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DEPARTMENT OF THE AIR FORCE

SUPPORTING DATA FOR FY 1991 BUDGET ESTIMATES

SUBMITTED TO CONGRESS JANUARY 1990

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DESCRIPTIVE SUMMARIES

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

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DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF
THE DEPARTMENT OF THE AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM
FY 1991 BUDGET ESTIMATES
JANUARY 1990

INTRODUCTION AND EXPLANATION OF CONTENTS

1. (U) General. This document has been prepared to provide information on the United States Air Force (USAF) Research, Development, Test and Evaluation (RDT&E) Program to Congressional Committees during the Fiscal Year 1991 hearings. This information is in addition to the testimony given by DOD witnesses.

(U) The Descriptive Summaries provide narrative information to all RDT&E program elements and projects, except those listed in paragraph 4b, within the USAF FY 1991 RDT&E Program. The formats and contents of this document are in accordance with the guidelines and requirements of the Congressional Committees insofar as possible.

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

(U) Pages 773-780 are presented in response to the Senate Appropriations Committee requirement contained on page 78 of the Senate Appropriations Committee report (98-292, 1 November 1983).

(U) The section of the Fiscal Year 1991 Descriptive Summaries entitled "Facilities Exhibits" (pages 789-805) contains information on major improvements to, and construction of, government owned facilities funded by RDT&E.

2. (U) Comparison of Fiscal Years 1989, 1990, and 1991 Data. A direct comparison of Fiscal Years 1989, 1990, and 1991 data shown in this document with corresponding data in the Descriptive Summaries dated January 1989 will reveal differences. Many of the differences are attributable to the following factors:

a. (U) Fiscal Year 1990 funding changes as a result of Congressional action on the appropriation and/or proposed RDT&E Reprogramming Actions.

b. (U) Fiscal Year 1989 funding changes between 1 October 1988 and 30 September 1989 due to RDT&E Reprogramming Actions.

c. (U) Reclassification of Fiscal Year 1988 and Fiscal Year 1989 data to achieve comparability with the program structure for Fiscal Years 1990/91.

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3. (U) Relationship of Fiscal Years 1990/91 Budget Structure to the Fiscal Year 1989 Budget Approved by the Congress.

PROGRAM ELEMENT	REMARKS
0101815F Advanced Strategic Programs	New program element proposed for 1991.
0207130F F-15A/B/C/D	Combined into 0207134F F-15E Squadrons
0207168F F-111 Self Protection System	Program element combined into PE 0604270, EW Development
0207319F SLAM	Program element deleted.
0305137F National Air Space (NAS) System	New program element proposed for 1991.
0303154F WIS Joint Program Office	Program element deleted.
0305158F Constant Source	New program element proposed for 1991.
0305185F Calvary	New program element proposed for 1991.
0601103F University Research Initiatives	Program element deleted.
0604246F Close Air Support (CAS)	Program element deleted.
0604315F ASRAAM	Program element deleted.
0604727F JSOW	Program element deleted.
0605712F Initial Operational Testing & Evaluation (IOT&E)	New program element proposed for 1990/ 1991.
b1011F SOF Force Enhancements - Active	Program element terminated - moved to Defense Agency.

4. (U) Classification.

a. (U) Classified pages bear the appropriate security classification. Classified data is identified by use of brackets [ ].



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STATEMENT "A" per Diana Arnold
Secretary of the Air Force/AQX
The Pentagon, Washington, DC 20
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FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0101120F Project Number: N/A
PE Title: Advanced Cruise Missile Budget Activity: #3 Strategic Programs

Project Title: Advanced Cruise Missile



(U) POPULAR NAME: ACM

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestone	Dual Source MM 1	DAB IIIB		PMRT
Engineering Milestones				
T&E Milestones		B-52 DT&E Complete	FOT&E	
Contract Milestones	LOT III Award	LOT IV Option Exer		Competition Contract
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	47,587	20,941	36,958	882,729 (2,500)
Support Contract	9,658	1,955	499	446,061 (0)
In-House Support	8,138	8,649	7,966	84,843 (4,197)
GFE/ Other	31,004	6,258	6,900	132,577 (0)
Total	96,950	42,998	52,307	1,546,210

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Program Element: #0101120F Project Number: N/A
PE Title: Advanced Cruise Missile Budget Activity: #3 Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

The ACM is a low-observable air launched strategic cruise missile with significant improvements in range, accuracy and survivability over the ALCM-B. Armed with

The ACM is designed for external carriage on the B-52H and internal/external carriage on the B-1B.

C. ( ) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments
   - (U) Physical Configuration Audit Completed
   - (U) Second Source Technology Transfer Completed
   - (U) Second Source Qualification Begun
   - (U) First Production Missile Delivered
   - (U)] Risk Reduction Initiated
   - (U) [ ] Variant Operational Demonstration Flight

2. (U) FY 1990 Planned Program
   - (U) Complete B-52 Qualification
   - (U) Second Source Qualification Complete
   - (U) Begin FOT&E

3. (U) FY 1991 Planned Program
   - (U) Required Asset Available/Initial Operational Capability
   - (U) First Second Source Production Missile Delivery
   - (U) [ ] Variant Phase I Completed
   - (U) Begin [ ] Variant Full-Scale Development

4. (U) Program Plan To Completion
   - (U) Variant Flight Test
   - (U) PMRT (IOC + 2 Years)
   - (U) Final Missile Delivery (FY 1996)

D. (U) WORK PERFORMED BY:

General Dynamics Corporation/Convair was selected as the prime contractor in mid-April 1983. Williams International (engines), Boeing-Wichita (B-52 integration), Rockwell and Boeing-Seattle (B-1B integration), and Boeing Wichita (missile launcher - CSRL) are associate contractors in the ACM program. The Air Force instituted and Congress mandated a second source (McDonnell Douglas Missile Systems).

Program Element: #0101120F Project Number: N/A
PE Title: Advanced Cruise Missile Budget Activity: #3 Strategic Programs

The ACM is undergoing a combined Developmental and Operational Test and Evaluation program in order to acelerate operational fielding. The 31st Test & Evaluation Squadron (SAC) in conjunction with the 6510th Test Wing (AFFTC) is the responsible test agency. AFOTEC monitors all test to insure compliance with applicable directives.

The Systems Program Office (ASD/VC) will provide management and supply support until time as AFLC is able to accept complete management responsibility. AFLC depot item manager for the ACM system is the Oklahoma City Air Logisitic Center (OC-ALC).

E. (U) COMPARISON WITH FY1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Due FY 1990 Congressional actions, ACM [ ] Variant development and procurement has been delayed one year.
3. (U) COST CHANGES: [ ] Funding being restructured for FY 1990 Congressional reduction and repriced with current requirements.

F. (U) PROGRAM DOCUMENTATION:

TYPE	OF DOCUMENT	DATE
(U)	SAC statement of Need	Aug 82
(U)	Program Baseline	May 89
(U)	LRIP (Sufficiency Review)	Jul 86
(U)	[ ] Statement of Need	Mar 87
(U)	ACM ILSP	Oct 87
(U)	ACM TEMP	Nov 89

G. (U) RELATED ACTIVITIES:

(U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

			FY89	FY90	FY91	TO Complete
(U)	3010	A/C Procurement	1,132	561	1,487	2,045
(U)	3020	Missile Procurement	0	315,202	473,269	2,452,360

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: NONE.

Program Element: #0101120F Project Number: N/A
PE Title: Advanced Cruise Missile Budget Activity: #3 Strategic Programs

J. (U) TEST AND EVALUATION DATA:

(U) T&E ACTIVITY (PAST 36 MONTHS)

(U) EVENT	Date	Results
(U) B-52 Free Flights	Ongoing	
(U) B-52 Captive Carries	Ongoing	
(U) [ ] Drop Test Demo	Jan 89	
(U) [ ] Demo	Jul 89	
(U) Missile Environmental Testing	Ongoing	
(U) Functional Ground Testing	Ongoing	

(U) T&E ACTIVITY (TO COMPLETION)

(U) EVENT	Date	Remarks
(U) B-52 Free Flights	Ongoing	
(U) B-52 Captive Carries	Ongoing	
(U) Functional Ground Testing	Ongoing	
(U) Second Source Qualification Test	3Q/FY90-1Q/FY91	
(U) B-1B Free Flights [ ]	TBD	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0101142F Budget Activity: #3 - Strategic Programs
PE Title: KC-135 Squadrons

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2214 Improved Aerial Refueling System (IARS) (U)	3111	2189	3573	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The IARS program is designed to fund several research and development projects that will improve the aerial refueling system of the KC-135 fleet. This requirement was established by SAC SON 001-87 which identified several deficiencies in the KC-135 refueling capability. The IARS program is phased to investigate changes to system deficiencies and improve the overall refueling capability of the aircraft, inter-and intra-service and NATO aerial refueling procedures.

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

(U) Project 2214, Improved Aerial Refueling System (IARS)
Provides R&D to improve the aerial refueling capability of the KC-135 fleet.

(U) FY 1989 ACCOMPLISHMENTS:
- (U) Developed KC-135 Performance Interface Document.
- (U) Conducted KC-135R Low Altitude Air Refueling (LAAR) test.
- (U) Development of a Master Plan for the KC-135R Avionics Modernization Program (AMP).

(U) FY 1990 Planned Program:
- (U) Continue KC-135 Performance Interface Document.
- (U) Continue Avionics Modernization Program (AMP) Master Plan
- (U) Develop AMP Integration for KC-135

(U) FY 1991 Planned Program:
- (U) Continuation of FY 1990 developments to include the AMP program.
- (U) Conduct Improved Aerial Refueling System Study.

Program Element: #0101142F Budget Activity: #3 - Strategic Programs
PE Title: KC-135 Squadrons

(U) Work Performed By: Work has been performed by the J.C. Carter Co., Costa Mesa, CA. Sergant Fletcher El Monte, CA. XAR Industries, City of Industries, CA. Data Products New England, Inc. Wallingford, CN. Aeronautical System Division, 4950th Test Wing, and 6150 Test Wing.

(U) Related Activities:
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0101213F
PE Title: Minuteman Squadrons
Project Number: 133B
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title Rapid Execution and Combat Targeting

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Minuteman Squadrons (Including REACT)	33,392	60,000	87,442	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Numerous communications and weapon system modifications to Minuteman Launch Control Centers (LCCs), coupled with engineering compromises and space limitations, over time, have task-saturated crew members. Concurrently, weapon system mission requirements increased in complexity and the command and monitoring functions became more time constrained. The resultant environment severely taxes crew abilities to effectively process National Command Authority execution directives in a timely fashion, especially during critical phases immediately preceding a missile launch. Additionally, some LCC components have become increasingly difficult and costly to support. The Rapid Execution and Combat Targeting (REACT) Program was created to address common concerns with warfighting responsiveness, combat capabilities, EWO effectiveness, message processing flexibility, and weapon system operability and supportability in the future. The program will modify the 100 Minuteman and Peacekeeper Launch Control Centers (LCCs) and their associated trainers, correct operability and supportability problems, improve combat crew responsiveness to launch directives, and provide rapid combat retargeting capability. The Rapid Message Processing modification significantly reduces crew reaction time, while increased rapid retargeting capability dramatically reduces the weapon system's response time to enhance our capabilities against mobile targets. A new Weapon System Controller (WSC) provides significantly increased system capacity and eliminates supportability diffuculties presented by the current aging WSC. The new console with dual workstations meets the Congressional requirement for console commonality between Minuteman and all other LCCs. In addition to REACT, the Program Element contains funds for Minuteman sustaining engineering and research support. Minuteman is projected to maintain its deterrent role until well into the next century and these funds are used to ensure that it remains current and viable.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Began process of REACT initial hardware and software development for LCC integration, rapid message processing, and rapid retargeting of ICBMs.
   - (U) Awarded the REACT full-scale development contract and began designs leading to the Systems Design Review.

2. (U) FY 1990 Planned Program:
   - (U) Continue REACT hardware and software development through the various subcomponent preliminary design reviews.

Program Element: # 0101213F
PE Title: Minuteman Squadrons
Project Number: 133B
Budget Activity: #3 - Strategic Programs

- (U) Begin specific design of REACT hardware and software for the first Minuteman configuration (AM/PCKR).

3. (U) FY 1991 Planned Program:
   - (U) Begin certification of first REACT Minuteman configurations at the Critical Design Review.
   - (U) BSD will conduct source selection and award contract and ESD will exercise their first option for production of the first configuration.

4. (U) Program to Completion:
   - (U) Achieve Operational Capability in 3rd Quarter FY 93.
   - (U) Achieve Full Operational Capability in 3rd Quarter FY 95.

D. (U) WORK PERFORMED BY: Ford Aerospace was awarded the WSC element of the REACT contract overseen by Ballistic Systems Division (BSD) and GTE was awarded the REACT communications element overseen by Electronic Systems Division. The responsible Air Force agency for the overall project is BSD.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC SON 6-85, ICBM Rapid Message Processing and Reargeting, 22 Aug 86.
- (U) SAC SON 14-86, ICBM Launch Control Center Integration, 8 Nov 87.
- (U) SAC ROC 2-75, Ground Wave Emergency Network
- (U) SAC ROC 6-70, Milstar

G. (U) RELATED ACTIVITIES:
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. (U) Missile Procurement (BA 4):					
Funds	0	0	78,214	142,752	220,966
2. (U) Other Procurement (3080):					
Funds	0	1,338	0	Cont	TBD

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

J. (U) MILESTONE SCHEDULE:

1. (U) FSD Contract award	Apr 1989
2. (U) Preliminary Design Review	Feb 1990
3. (U) Critical Design Review	Feb 1991
4. (U) Production Initiation	Jun 1991
5. (U) Initial Operational Capability	Apr 1993
6. (U) Full Operational Capability	Jan 1995

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0101312F Budget Activity: #3 - Strategic Programs
PE Title: Post Attack Command and Control System

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Post Attack Command and Control System	1185	1186	1278	Cont	TBD
TOTAL	1185	1186	1278	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: To provide a survivable command and control capability for the Single Integrated Operational Plan Commanders in Chief to support the National Command Authority during all phases of a limited or general war. Supports electromagnetic pulse (EMP) vulnerability surveillance of all aircraft of the Worldwide Airborne Command Post (WWABNCP) fleet, including those assigned to Commanders in Chief of the Strategic Air Command, European Command, Atlantic Command and Pacific Command, and the National Emergency Airborne Command Post.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY 1991: The WWABNCP System Program Office conducts, on a continuing basis, an EMP engineering surveillance program for the EC-135 and E-4B aircraft. This effort establishes and analyzes EMP design specifications for new systems, supports subsystem, component, and system testing, investigates new techniques to achieve improved EMP protection, and provides a continuing analysis of the EMP survivability of the WWABNCP.

(U) Project: WWABNCP EMP Surveillance Program

(U) FY 1989 Accomplishments:
- (U) Continued planning activities, acquired long lead items for FY 1990 system test
- (U) Conducted hardness maintenance/hardness surveillance
- (U) Continued survivability/vulnerability analysis of acquisition and modification programs

(U) FY 1990 Planned Program:
- (U) Conduct major systems test
- (U) Conduct hardness maintenance/hardness surveillance
- (U) Continued survivability/vulnerability analysis of acquisition and modification programs

(U) FY 1991 Planned Program:
- (U) Analyze FY 1990 test data, initiate corrective actions
- (U) Conduct hardness maintenance/hardness surveillance
- (U) Continued survivability/vulnerability analysis of acquisition and modification programs

(U) Work Performed By: The WWABNCP System Program Office has responsibility for the program. This is an Air Force

Program Element: #0101312F Budget Activity: #3 - Strategic Programs
PE Title: Post Attack Command and Control System

Logistics Command organization located at Tinker Air Force Base, Oklahoma. The prime contractor is TRW. The EMP tests are conducted by the Air Force Weapons Lab, Kirtland Air Force Base, New Mexico.

(U) Related Activities:

- (U) Program Element #0101316F Strategic Air Command Communications
- (U) Program Element #0303601F Air Force Satellite Communications
- (U) Program Element #0302015F National Emergency Airborne Command Post
- (U) Program Element #0303131F Air Force Support to the Minimum Essential Emergency Communications Network
- (U) Program Element #0303603F, Milstar
- (U) Program Element #0102433F, Nuclear Detonation Detection
- (U) Program Element #0604711F, System Survivability
- (U) Program Element #0604747F, Electromagnetic Radiation Test Facilities
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.
(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0101313F Budget Activity: #3 - Strategic Program
PE Title: War Planning ADP - SAC

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
N/A Strategic Mission Data Preparation System (SMDPS)	18,636	13,811	4,764	Cont	TBD
Total	18,636	13,811	4,764	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Strategic War Planning Automated Data Processing (ADP) effort for Strategic Air Command (SAC) supports maintenance and modernization of ADP equipment, software and communications links used in planning and executing the strategic bomber, intercontinental ballistic missile and sea launched ballistic missile components of the nuclear TRIAD. Requirements to optimize force application dictates an ADP capability which can effectively integrate numerous nuclear delivery vehicle sorties while rapidly reacting to changes in enemy force deployment and composition.

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

1. (U) xxx1, Strategic Mission Data Preparation System: Project complements ongoing upgrades to force level war planning ADP. It ensures automated mission planning support equipment for strategic bombers and their weapons are fully integrated in new hardware and software architecture of the Strategic War Planning ADP. This effort consolidates several independent mission planning actions within ongoing strategic bomber/weapon acquisition programs (B-52, B-1, B-2, Air Launched Cruise Missile, Advanced Cruise Missile, Short Range Attack Missile). The overall objective is to ensure programs will be compatible with SAC's War Planning ADP. Using common automated hardware and software architecture will facilitate interoperability and decrease total acquisition costs for future weapon systems.

(U) FY 1989 Accomplishments:
- (U) SMDPS Phase II Tape 7 delivery, incorporating ACM and B-1B defensive system updates. Effort included software coding, merging of individual modules, integration testing and recoding/retesting that culminates in a final end-to-end software verification test.
- (U) SMDPS Phase II Tape 8 development began supporting SRAM II flight testing.
- (U) SMDPS Phase III Nuclear Mission Planning and Production System (NMPPS) integration began to rehost existing Phase II software onto new hardware and developed the interface control documents to integrate new weapon systems (SRAM II, B-2 and other programs).
- (U) SMDPS Phase III Conventional Mission Planning and Production System (CMPPS) delivered first Integrated Conventional Stores Management System (ICSMS) tape to support conventional systems (Tacit Rainbow, etc.).

Program Element: #0101313F Budget Activity: #3 - Strategic Program
PE Title: War Planning ADP - SAC

(U) FY 1990 Planned Program:
- (U) Complete SMDPS Phase II Tape 8 development incorporating B-1B defensive avionics updates.
- (U) Continue SMDPS Phase III NMPPS integration to new mission planning architecture with Tape 1 development.
- (U) SMDPS Phase III CMPPS test tape delivery supporting integration/testing of additional conventional weapons.

(U) FY 1991 Planned Program:
- (U) Complete SMDPS Phase II effort with Tape 8 delivery.
- (U) Continue SMDPS Phase III NMPPS integration efforts with Tape 1 delivery and testing.
- (U) Transition SMDPS Phase III CMPPS efforts toward a common architecture compatible with tactical Mission Support Systems (MSS II & III) to support an Air Force Automated Mission Planning System (AFAMPS).

(U) Work Performed By: Mission Planning System's development program is being managed by the Directorate for Battle Management Systems, Electronic Systems Division, Hanscom AFB, MA. SMDPS Phase II/III integration contractor is Boeing Military Airplane of Wichita, KS.

(U) Related Activities:
- (U) This project consolidates automated war planning support in numerous strategic weapons programs. These include, but are not limited to; PE 0101113F, B-52 Squadrons; PE 0604226F, B-1B; PE 0604240F, B-2; PE 0101120F, Advanced Cruise Missile; PE 0604244F, Short Range Attack Missile II; PE 0207316F, Tacit Rainbow; and other programs.
- (U) PE 0208006F, Mission Planning System (MPS)
- (U) PE 0207128F, MSS II
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

Other Procurement (PE 0101313F):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	7,772	27,036	24,308	Cont	TBD

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F
PE Title: Cheyenne Mountain Upgrade - (CMU) - Integrated TW/AA
Budget Activity: #3 -Strategic Programs

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
3880	CMU				
	* 117,423	110,914	100,737	Cont	TBD
3881	Integrated TW/AA				
	** 2,481	2,706	4,162	Cont	TBD
TOTAL	119,904	113,620	104,899	Cont	TBD

* 25,935 of FY89 funds in PE 0102436F, Command Center Processing and Display System and 23,032 of FY89 funds in PE 0102311F, NCMC Space Defense System

** In PE 0102313F, Ballistic Missile TW/AA Systems

B. (U) BRIEF DESCRIPTION OF ELEMENT: As directed by FY 89 Appropriations Conference Language, the Defense Acquisition Board met on 12 Sep 89 and consolidated the individual computer upgrades at Cheyenne Mountain Complex (CMC) (previously in four different PE's) into a single integrated program. PE 0102310F has been renamed "CMU - Integrated TW/AA". It funds the replacement systems for the Tactical Warning/Attack Assessment (TW/AA) command, control, and communications (C3) system centralized within CMC. This replacement program is designed to incrementally upgrade and replace the current operational systems and facilities. This Integrated TW/AA architecture responds to a flexible, coordinated, (missile, air, and space) threat. The program is divided into two projects; the six CMU acquisitions comprise the project titled "CMU", and the "Integrated TW/AA" project, which provides the management framework through which the Air Force applies coordinated oversight of the acquisition and interface of the CMU into the Integrated TW/AA system. These projects will provide the Commander-in-Chiefs, United States Space Command (USCINCSPACE) and NORAD the National Command Authorities, the Joint Chiefs of Staff and other commanders with timely and reliable C3 systems which are capable of meeting the TW/AA needs of the United States into the next century.

Program Element: #0102310F
PE Title: Cheyenne Mountain Upgrade - (CMU) - Integrated TW/AA
Budget Activity: #3 - Strategic Programs

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10 MILLION IN FY91:

1. (U) Project #3881, Integrated TW/AA:
This project provides the management framework through which the Air Force will apply coordinated oversight of the acquisition and interface of CMU upgrades into the Integrated TW/AA systems. Integration will be ensured through the development of technical standards and implementation of protocols for communications interfaces and by development of detailed plans for command center processing and display of Integrated TW/AA data. Management of the TW/AA assets as an integrated system is necessary to ensure accurate, timely and unambiguous warning and assessment information to support force survivability actions and national decision making.

(U) FY 1989 Accomplishments:
- (U) Developed the Intgrated C3 program baseline for CMC programs
- (U) Developed Acquisition Transition Plan

(U) FY 1990 Planned Program:
- (U) System engineering efforts to ensure on-going acquisitions are meeting defined system requirements
- (U) Monitor overall system baseline performance
- (U) ITW/AA system end-to-end analysis and CMU analysis

(U) FY 1991 Planned Program:
- (U) Update analyses and models created in prior years to to contiuously improve performance predictions and interface compatibility between ITW&AA Systems
- (U) Provide system engineering and integration support to the CSSR program and the SCIS program to ensure these new programs are integrated into the CMC

(U) WORKED PERFORMED BY: Air Force System's Command Electronic Systems Division, Hanscom AFB, MA, Acquisition Integration Office, Technical support provided by MITRE, Bedford, MA.

(U) RELATED ACTIVITIES:
- (U) PE 0102432F, Ballistic Missile Early Warning System
- (U) PE 0102432F, Sea Launched Ballistic Missile Early Warning System
- (U) PE 0102424F SPACETRACK
- (U) PE 0604406F, Antisatellite
- (U) There is no unecessary duplication of effort within the Air Force or the Department of Defense

(U) Other Appropriation Funds: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

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

Project Title: CMU Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
CMU	* 117,423	110,914	100,737	Cont	TBD

* 25,935 of FY89 funds in PE 0102436F, Command Center Processing and Display System and 23,032 of FY89 funds in PE 0102311F, NCMC Space Defense System

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The CMU acquisitions respond to the requirement to provide the national decision makers with accurate, timely, reliable and unambiguous Integrated TW/AA information. The upgrades will provide 1) survivable communications; 2) integrated warning of ballistic missile, atmospheric and space threats; 3) standard user processing and displays; 4) a fully mission capable early/trans attack correlation center. The modernization achieved through these upgrades will also provide capability to address the enhanced threat that has evolved since system implementation while simultaneously taking advantage of the great strides in technology that have occurred over the same period.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) Held CMU DAB on 12 Sept 89
- (U) Completed Critical Design Review (CDR) for CCPDS-R (Common subsystem) and CSSR
- (U) Declared Initial Operational Capability (IOC) for Granite Sentry Air Defense Operations Center (ADOC) and SPADOC 4A
- (U) Completed SCIS surveys

(U) FY 1990 Planned Program:
- (U) Conduct CDR for CCPDS-R (Processing and Display System (PDS) subsystem)
- (U) Begin installation and checkout (I&CO) in the Space and Warning Systems Center (SWSC)
- (U) CSSR Subsystem Integration Tests
- (U) CSSR Installation and Checkout Red Tech Control CMC
- (U) Test Readiness Review Granite Sentry NORAD Command Center (NCC)
- (U) DT&E/IOT&E NCC
- (U) Declare IOC for Granite Sentry NORAD Command Center (NCC) (missile warning) upgrade
- (U) PDR NCC Space data for NCC
- (U) Hardware CDR for Space data in NCC
- (U) Software CDR for Space data in NCC

Program Element: #0102310F
PE Title: Cheyenne Mountain Upgrade (CMU) - Integrated TW/AA
Budget Activity: #3 - Stategic Programs

- (U) System Requirements Review Granite Sentry CSSR Interface
- (U) System Design Review CSSR Interface
- (U) Complete SCIS in-plant testing
- (U) Conduct SPADOC 4B Functional Qualification Test (FQT)
- (U) Conduct SPADOC 4B DT&E tests in CMC

(U) FY 1991 Planned Program:

- (U) Conduct CMU Program Review for DAB
- (U) Conduct Preliminary Design Review (PDR) for CCPDS-R (SAC Unique subsystem)
- (U) Install CSSR Mission Processing Distribution Subsystem in CMC
- (U) Complete CSSR System testing in SWSC
- (U) Conduct System tests in CMC
- (U) Conduct IOT&E in CMC
- (U) Complete SPADOC 4B DT&E system testing in CMC
- (U) Conduct SPADOC 4B IOT&E in CMC
- (U) Test Readiness Review for Granite Sentry NCC Space data
- (U) Conduct DT&E/IOT&E for NCC Space data
- (U) Conduct Hardware CDR for Granite Sentry CSSR Interface
- (U) Conduct Software CDR for Granite Sentry CSSR Interface
- (U) Declare IOC for CSSR, Granite Sentry NCC (space/correlation) upgrade, and SPADOC 4B
- (U) Award SPADOC 4C contract
- (U) Conduct SCIS Developmental Test and Evaluation (DT&E)/Initial Operational T&E (IOT&E) at 15 sites worldwide

(U) Program to Completion:

- (U) Conduct CDR for CCPDS-R (SAC Unique subsystem) and conduct PDR for SPADOC 4C
- (U) Initiate I&CO of CSSR Black Tech Control in CMAFB
- (U) Complete Granite Sentry CSSR Interface
- (U) Complete SCIS installation
- (U) Declare IOC for OPCC Missile Warning in FY 1995 and declare IOC for OPCC Air Warning/Command Center Processor (CCP) in FY 1996
- (U) System of Systems IOT&E, CMU Final Operational Capability (FOC), and a Program Review to the DAB in FY 1996

D. (U) WORK PERFORMED BY: The CMU program is managed by Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA. Prime contractors are: CCPDS-R - TRW, Redondo Beach, CA; CSSR - GTE, Needham, MA; GRANITE SENTRY - (developmental hardware) DEC, Colorado Springs, CO and (software assistance) Martin Marietta, Englewood, CO; SCIS - E Systems, Inc., St. Petersburg, FL; and SPADOC - Ford Aerospace Communications Corp., Colorado Springs, CO and (hardware) IBM, Houston, TX. AFSPACECOM is developing applications software for the Granite Sentry acquisition. Technical support is provided by MITRE, Bedford, MA. OPCC will be a government integration effort of hardware and software delivered on the other CMU acquisition contracts.

Program Element: #0102310F
Project Number: 3880
PE Title: Cheyenne Mountain Upgrade (CMU) - Integrated TW/AA
Budget Activity: #3 - Strategic Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: Required interfaces for interoperability have been added to individual acquisitions.

2. SCHEDULE CHANGES: Some of the acquisition milestones have been replanned to accommodate additional work required to execute the Air Force's new integrated CMU program baseline. The following milestones have been changed: CCPDS-R Common subsystem IOC delayed 12 mths and PDS/OPCC/SAC Unique subsystems IOC delayed from 3rd QTR FY93 until FY95; CSSR FOC FY92 changed to CSSR P3I 4th QTR FY94; and SCIS IOC delayed from FY91 until 2nd QTR 92 and SCIS New Media delayed 12 mths. OPCC milestones have been incorporated into the new baseline, they can be found in section J, Milestones.

3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) CMU SORD (draft), dated 25 Oct 89
- (U) CMU TEMP, SAE approved
- (U) CMU APB, dated 27 Nov 89

NOTE: CMU program documentation is currently being developed, as it is finalized/approved it will be annotated in future descriptive summaries

G. (U) RELATED ACTIVITIES:
- (U) Ballistic Missile Early Warning System (PE 0102423F).
- (U) Sea Launched Ballistic Missile Early Warning System - PAVE PAWS (PE 0102432F).
- (U) SPACETRACK (PE 0102424F)
- (U) Antisatellite (PE 0604406F)
- (U) Consolidated Space Operations Center (PE 0305130F)

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
Other Procurement: (BA 63)	17,020	30,312	6,887	TBD
Initial Spares	973	8806	2759	
Replen Spares	53	43	0	
Total	18,046	39,161	9,646	

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

Program Element: #0102310F Project Number: 3880
Cheyenne Mountain Upgrade (CMU) - Integrated TW/AA Budget Activity: #3 - Strategic Programs

J. (U) MILESTONE SCHEDULE:

- (U)	Granite Sentry ADOC IOC	Feb 89
- (U)	SPADOC 4A IOC	Apr 89
- (U)	Granite Sentry NCC (missile warning) IOC	Mar 90
- (U)	Granite Sentry NCC (space/correlation) IOC	Mar 91
- (U)	SPADOC 4B IOC	Apr 91
- (U)	CSSR IOC	Apr 91
- (U)	Granite Sentry CSSR Interface complete	2nd Qtr 92
- (U)	SCIS IOC	2nd Qtr 92
- (U)	CCPDS-R (Common subsystem) IOC	4th Qtr 93
- (U)	Granite Sentry CCPDS-R and SPADOC 4C Interfaces complete	4th Qtr 93
- (U)	Granite Sentry Weather and Battle Staff IOC	2nd Qtr 94
- (U)	CSSR P3I	4th Qtr 94
- (U)	OPCC Missile Warning IOC	FY 95
- (U)	SCIS New Media	FY 95
- (U)	CCPDS-R (PDS/SAC Unique/OPCC subsystems) IOC	FY 95
- (U)	Granite Sentry P3I	FY 95
- (U)	SPADOC 4C IOC	FY 95
- (U)	OPCC Air Warning/CCP IOC	FY 96
- (U)	CMU FOC	FY 96

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102325F
PE Title: Joint Surveillance System (JSS)
Budget Activity: 3
Strategic Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2976 Atmospheric Tactical Warning Connectivity	816	774	808	Cont	TBD
2996 FAA/AF Radar Replacement	846	840	870	Cont	TBD
TOTAL	1,662	1,614	1,678	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Joint Surveillance System (JSS) provides for air surveillance and command and control of air defense forces for airspace sovereignty.

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

1. (U) Project 2976, Atmospheric Tactical Warning Connectivity: The Atmospheric Tactical Warning Connectivity (ATWC) program will integrate the Over-the-Horizon Backscatter (OTH-B) radar system, North Warning System (NWS), and the Navy's Relocatable Over-the-Horizon Radar (ROTHR) into the JSS Region and Sector Operations Control Centers (ROCCs/SOCCs).

(U) Fiscal Year 1989 Accomplishments:
- (U) Completed initial ROCC/SOCC computer upgrades/integration (computer memory and port expansion).
- (U) Continued OTH-B and ROTHR ops center integration/evaluation.
- (U) Completed prototyping of OTH-B/ROTHR interface control unit for the ROCCs/SOCCs.
- (U) Prepared procurement documentation and specifications.

(U) Fiscal Year 1990 Planned Program:
- (U) Initiate competitive procurement of ROCC/SOCC integration hardware and software for OTH-B and ROTHR.
- (U) Begin installation of integration hardware and software.

(U) Fiscal Year 1991 Planned Program:
- (U) Continue installation and check-out of ROCC/SOCC integration hardware and software.

(U) Work Performed By: Air Force program management for the JSS Region and Sector Operations Control Centers is by Air Force Logistics Command, Wright-Patterson AFB, OH. The prime contractor for the JSS ROCCs/SOCCs is Hughes Aircraft Corporation, Fullerton, CA. Management of the Atmospheric Tactical Warning Connectivity is by the Electronic Systems Division of Air Force Systems Command, Hanscom AFB, MA.

Program Element: #0102325F
PE Title: Joint Surveillance System (JSS)
Budget Activity: 3 - Strategic Programs

(U) Related Activities:
- (U) Connectivity with OTH-B (0102417F), NWS (0102412F), ROTHR (0604725N), AWACS (0207417F).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTHER PROCUREMENT: (BA 63)	0	5,808	832	Cont	TBD

(U) International Cooperative Agreements: The ATWC program upgrades to the JSS ROCCs/SOCCs are shared with Canada on a reimbursable basis as part of the North American Air Defense Modernization Memorandum of Understanding signed in 1985 by the US Secretary of Defense and the Canadian Minister of Defense. This allows Canada to implement cost-effective and operationally consistent changes to their JSS ROCCs.

2. (U) Project 2996, FAA/AF Radar Replacement (FARR): The FAA/AF Radar Replacement (FARR) program will replace forty (40) existing JSS search, beacon, and height-finding radars with solid-state, three-dimensional radars to improve mission performance and reduce operation and maintenance costs. Saves Air Force over $48 million/year in support costs and over 1,000 critical manpower authorizations.

(U) Fiscal Year 1989 Accomplishments:
- (U) Continued post-award engineering support to the Joint Program Office (JPO).
- (U) Provided engineering support to resolve site-specific implementation issues.

(U) Fiscal Year 1990 Planned Program:
- (U) Continue technical engineering support for FARR JPO.
- (U) Support technical radar site surveys.

(U) Fiscal Year 1991 Planned Program:
- (U) Continue engineering support in preparation for system installation, test, and check-out.
- (U) Continue resolution of site-specific engineering issues.

(U) Work Performed By: The Federal Aviation Agency is the lead acquisition agency for the FAA/AF Radar Replacement Program in accordance with a 19 November 1984 sub-agreement (as amended by Amendment #1, dated 1 September 1988) to FAA/AF National Agreement (NAT) 711. The FAA and the Air Force have established a Joint Program Office at HQ FAA, Washington, D.C., for this procurement.

Program Element: #0102325F
PE Title: Joint Surveillance System (JSS)

Budget Activity: 3 - Strategic Programs

(U) Related Activities:
- (U) FAA/Air Force National Agreement 614 pertains.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTHER PROCUREMENT: (BA 63)	50,323	66,340	54,807	Cont	TBD

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element#0102411F Budget Activity: 3 - Strategic Programs
PE Title: Surveillance Radar Stations/Sites

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2980 North Atlantic Defense Sys (NADS)	790	5,010	7,202	Cont	TBD
3159 Caribbean Basin Radar Net (CBRN)	769	1,280	1,002	Cont	TBD
TOTAL	1,559	6,290	8,204	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element funds strategic air defense improvements in the North Atlantic and the Caribbean, and funds the operation and support of existing as well as new air defense systems in both regions.

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

1. (U) Project Number and Title: 2980 North Atlantic Defense System: Provides improvements to command, control and communications (C^3) and surveillance equipment in the North Atlantic required to correct air defense deficiencies and provide for defense of critical[ ] Supports US Commander-in-Chief Atlantic (USCINCLANT) and the North Atlantic Treaty Organization (NATO) Supreme Allied Commander Atlantic (SACLANT).

(U) FY 1989 Accomplishments:
- (U) NATO NADS software development continued.

(U) FY 1990 Planned Program:
- (U) NATO NADS Control and Reporting Center/Communications contract will be awarded using NATO Infrastructure Funds

(U) FY 1991 Planned Program:
- (U) First NATO Radar delivered and installed
- (U) CRC/Comm development continues

(U) Program to Completion:
- (U) All NATO Radars installed and operational
- (U) NATO IADS Full Operational Capability (FOC) achieved when CRC declared operational in[ ]
- (U) This is a continuing program

Program Element: #0102411F Budget Activity: 3-Strategic Systems
PE Title: Surveillance Radar Stations/Sites

(U) WORK PERFORMED BY: Efforts are managed by the Electronic Systems Division, Hanscom AFB, MA. Technical support is provided by MITRE Corporation, Burlington, MA; Rome Air Development Center, Griffiss AFB, NY; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. General Electric Radar Systems Division, Syracuse, NY, is the contractor for the NADS NATO Radar Subsystem. The contractor for the CRC/Comm subsystem has not been selected.

(U) RELATED ACTIVITIES:
- (U) Program Element #0102412F, DEW Radar Stations
- (U) Program Element #0102417F, Over-the-Horizon Backscatter (OTH-B) Radar
- (U) Program Element #0102325F, Joint Surveillance System,
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: NADS is a NATO Infrastructure Program funded primarily with NATO funds

2. (U) Project Number and Title: 3159 Carribbean Basin Radar Network
Provides ground-based radar systems and upgraded C^3 capability in the Caribbean. These ground radars will support attack warning, threat assessment, control of air defense/tactical forces, air traffic management, and drug and arms interdiction. This project supports the US Commander-in-Chief Southern Command (USSOUTHCOM) and USCINCLANT.

(U) FY 1989 Accomplishments:
- (U) RDT&E funds provided systems engineering support

(U) FY 1990 Planned Program:
- (U) RDT&E funds provide systems engineering support

(U) FY 1991 Planned Program:
- (U) RDT&E funds provide systems engineering support

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

(U) WORK PERFORMED BY: Efforts are managed by the Electronic Systems Division, Hanscom AFB, MA. Technical support is provided by MITRE Corporation, Burlington, MA; Rome Air Development Center, Griffiss AFB, NY; Electromagnetic Compatibility Analysis Center, Annapolis, MD. Westinghouse Corp, Baltimore MD is the CBRN Contractor.

Program Element: #0102411F Budget Activity: 3-Strategic Systems
PE Title: Surveillance Radar Stations/Sites

(U) RELATED ACTIVITIES:
- (U) Program Element #0102412F, DEW Radar Stations
- (U) Program Element #0102417F, Over-the-Horizon Backscatter (OTH-B) Radar
- (U) Program Element #0102325F, Joint Surveillance System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ in Thousands)

Other Procurement (BA63)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	42,654	1,952	3,256	Continuing	TBD

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Host Nation Agreements being pursued in connection with each planned CBRN site

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0102412 Budget Activity: 3 - Strategic Programs
PE Title: DEW Radar Stations

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2710 North Warning System	0	0	1,047	9,464	141,951
Total	0	0	1,047	9,464	141,951

B. (U) BRIEF DESCRIPTION OF ELEMENT: This PE supports the operation of 20 remaining DEW Line radar stations and funds the North Warning System (NWS) (DEW Line replacement program). The DEW Line provides tactical warning of bomber or cruise missile attack against the North American Continent through a radar line extending from Alaska to Greenland. The warning provides the National Command Authorities with time for decision making and survival actions, permits the launch of strategic retaliatory and command and control aircraft for survival, and alerts air defense fighters to intercept attacking aircraft. The DEW Line can be underflown by threat bombers because of numerous gaps at low altitude and marginal radar performance. Because of its age (1957 initial deployment), the DEW Line system is increasingly difficult and costly to operate and maintain. NWS program objectives are to eliminate low-altitude coverage gaps, improve radar performance, and reduce operation and maintenance costs.

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

(U) Project Number and Title: 2710 North Warning System (NWS):
A combination of minimally-attended, long-range radars (LRR) and short-range unattended radars (UAR) will be deployed as gapfillers. The NWS will be capable of detecting modern Soviet threat aircraft and cruise missiles

[redacted]

NWS investment costs will be amortized by reducing operations and support costs compared to the DEW Line and phasing out the U.S. contribution to operation of the CADIN-Pinetree radar system in Canada.

(U) FY 1989 Accomplishments:
- (U) No RDT&E Funds were requested
- (U) Initial Operational Test & Evaluation was conducted March through September 1989 (funded with remaining FY 1988 funds)
- (U) All remaining LRRs were installed at newly constructed Canadian sites in Labrador

(U) FY 1990 Planned Program:
- (U) No RDT&E Funds are requested
- (U) A Production Decision on the UAR will be made
- (U) A contract will be awarded for all 37 UARs in January 1990

Program Element: # 0102412F Budget Activity: 3 - Strategic Programs
PE Title: DEW Radar Stations

(U) FY 1991 Planned Program:
- (U) Three prototype UARs refurbished to production configuration
- (U) Small-target detection capability improvements will be identified for the LRR

(U) Work Performed By: This effort is managed by the Electronic Systems Division, Hanscom AFB, MA. MITRE Corporation, Burlington MA; Rome Air Development Center, Griffiss AFB, NY; Analytical Systems Engineering Corporation, Burlington MA; Earth Technology Corporation, Seattle WA; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD are providing technical support. AN/FPS-117 long-range radars were procured from General Electric Company, Syracuse NY, in FY 1984 and FY 1985. UNISYS Corporation (formerly Sperry), Great Neck, NY, was selected in FY 1984 as the Full Scale Development contractor for the UAR, overall systems engineering, and development of a communications architecture for the Alaskan part of the NWS. Canadian NWS efforts are managed by a Canadian program office located in Ottawa.

(U) Related Activities:
- (U) Program Element #0102411F, Surveillance Radar Stations/Sites
- (U) Program Element #0102325F, Joint Surveillance System
- (U) Program Element #0102417F, Over-the-Horizon Backscatter (OTH-B) Radar
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTHER PROCUREMENT:					
Funds (BA63)	198,897	196,010	6,561	0	516,519
Quantities					
SRR Controllers	1	2	0	0	3
Short Range Radar	17	20	0	0	37

(U) International Cooperative Agreements: The North Warning Program is the key element of North American Air Defense Modernization established by the March 1985 Memorandum of Understanding between the United States and Canada, signed by Secretary of Defense Weinberger and Canadian Minister of Defense Nielson.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102417F
PE Title: Over-the-Horizon Backscatter (OTH-B) Radar
Project Number: N/A
Budget Activity: #3-Strategic Programs

A. (U) RDT&E RESOURCES ($ in Thousands)

Project Title OTH-B

Popular Name	FY 1989 ACTUAL	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTH-B	18,389	20,215	12,851	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program develops an Over-the-Horizon Backscatter (OTH-B) radar to satisfy requirements for tactical early warning of an attack on North America by bombers and air-to-surface missiles. The OTH-B will detect and track airborne vehicles at all altitudes to ranges between 500 and 1800 nautical miles. The radar system will provide surveillance coverage of the east, west, and southern approaches to North America.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Begin DT&E on the integrated ECRS
   - (U) Awarded contract for Third Party Financed power plant for ARS

2. (U) FY 1990 Planned Program:
   - (U) Complete DT&E on the ECRS
   - (U) Conduct IOT&E on the ECRS
   - (U) Award contract for Alaskan Radar System (ARS), 1st sector

3. (U) FY 1991 Planned Program:
   - (U) Achieve [redacted]
   - (U) Begin procurement of the Central Radar System

4. (U) Program to Completion:
   - (U) Complete procurement of the Central Radar System
   - (U) This is a continuing program

D. (U) WORK PERFORMED BY: The development of the OTH-B radar system and supporting OTH technical efforts are managed by the Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA. The radar prime contractor is the General Electric Co., Syracuse, NY. Major subcontractors include General Telephone and Electronics Corp, Waltham, MA; General Electric Co., Huntsville, AL; Continental Electronics, Dallas, TX; and TRW, Redondo Beach, CA. Continuing OTH technical efforts, analysis, engineering studies and support are provided by: Rome Air Development Center, Griffiss AFB, NY; SRI International Remote Measurement Laboratory, Menlo Park, CA; Naval Research Laboratory, Washington, D.C.; MITRE Corporation, Bedford, MA; and the Air Force Geophysics Laboratory, Hanscom AFB, MA.

Program Element: #0102417F Project Number: N/A
PE Title: Over-the-Horizon Backscatter (OTH-B) Radar Budget Activity: #3-Strategic Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: Program restructured to 54 month program for the Alaskan Radar System vice previously planned 42 month schedule, reflecting a better understanding of the construction requirements in the Arctic.
3. (U) COST CHANGES: Construction costs in Alaska drive cost of ARS up to approximately $525 million

F. (U) PROGRAM DOCUMENTATION:
- (U) ASAF Decision Memorandum - Action Memorandum, Jan 82
- (U) ASAF Action Memorandum, Jan 84
- (U) TAC SOC, April 87
- (U) DCP #49, Rev 2, Jan 82
- (U) PMP, July 81
- (U) DOD Directive #5141.2, April 84
- (U) TEMP, Nov 82
- (U) Acquisition Plan, May 81
- (U) ADC ROC 10-71, Change 4, Dec 73
- (U) AD Master Plan, Jan 82
- (U) AAC SON 01-80, Sept 80
- (U) TAF SORD (10-71) 7 Aug 89

G. (U) RELATED ACTIVITIES:
- (U) OTH-B will be compatible with related programs such as the North Warning System (PE0102412F) and the Joint Surveillance System (PE0102325F).
- (U) OTH-B will send track information to the Regional and Sector Operations Control Centers of the Joint Surveillance System and to the North American Aerospace Defense Command (NORAD) Cheyenne Mountain Complex.
- (U) Communications will be provided under OTH Radar Systems Communications (PE0102444F).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. (U) OTHER PROCUREMENT: Funds (BA63)	169,239	204,577	0	Cont	TBD
Quantity (60 deg sector)	1	1	1	1	9
2. (U) MILCON	17,500	0	11,000	0	71,800

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

Program Element: #0102417F
PE Title: Over-the-Horizon Backscatter (OTH-B) Radar
Project Number: N/A
Budget Activity: #3-Strategic Programs

J. (U) MILESTONE SCHEDULE:

- (U)	System Definition Complete	November 1973
- (U)	Prototype Contract Award	March 1975
- (U)	Initiate Program Restructuring	December 1976
- (U)	Conclude Technical Feasibility Test	February 1981
- (U)	Conclude Limited Initial Operational Test and Evaluation	June 1981
- (U)	Air Force System Acquisition Review Council (AFSARC) Review	November 1981
- (U)	Development Decision	January 1982
- (U)	Development Contract Award	June 1982
- (U)	Development Test & Evaluation Complete	February 1990
- (U)	Contract Award - Alaskan Radar System	September 1990
- (U)	Initial Operational Test & Evaluation Complete	November 1990
- (U)	Initial Operational Capability (IOC)-East	
- (U)	IOC - West	
- (U)	IOC Alaskan Radar System	
- (U)	Full Operational Capability (FOC) Central Radar System	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0102423F
PE Title: Ballistic Missile Early Warning System
Project Number: N/A
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
BMEWS	23,558	16,314	22,329	Cont	TBD
Total	23,558	16,314	22,329	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The mission of BMEWS is to detect and provide warning of a ballistic missile attack on the United States, Canada, the United Kingdom, and Europe. Built in the late 1950s and early 1960s, the system was originally designed to detect and track Soviet threats consisting of a relatively small number of single warhead missiles. The system is designed to predict missile impact points by tracking the large, easy to detect rocket booster. BMEWS consists of three sites at Thule, Greenland; Clear, Alaska; and Fylingdales, England. The Thule site has been upgraded with a modern phased array radar and computer resources to improve its capability and maintainability. The Fylingdales site is now being upgraded. Current capabilities are:

	Thule	Clear/Fylingdales
Range/Warning Time	[redacted]	
Traffic Handling		
Launch Location (CEP)		
Impact Location (CEP)		

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Conducted major design reviews and began in-plant testing for hardware at the component level for the Fylingdales upgrade.
   - (U) Completed structural design efforts and started the UK-funded facility construction by a UK firm under subcontract to the US prime contractor.
   - (U) Began software coding.

2. (U) FY 1990 Planned Program:
   - (U) Continue software coding and begin initial development software testing.
   - (U) Continue hardware testing and begin in-plant testing at the system level.
   - (U) Continue facility construction.

Program Element: #0102423F Project Number: N/A
PE Title: Ballistic Missile Early Warning System Budget Activity: #3 - Strategic Programs

3. (U) FY 1991 Planned Program:
   - (U) Complete in-plant development testing at the system level.
   - (U) Complete facility construction.
   - (U) Accomplish computer and radar installation on-site.
   - (U) Initiate integration testing of on-site equipment and facilities.

4. (U) Program to Completion:
   - (U) This is a continuing program. The Fylingdales site will attain IOC in FY 1992. Additional upgrade efforts will be implemented as necessary to accommodate Tactical Warning/ Attack Assessment requirements.

D. (U) WORK PERFORMED BY: The prime contractor is Raytheon Corporation in Wayland, MA. Major subcontractors are Control Data Corporation, Minneapolis, MN (computers), and TRW, Redondo Beach, CA (software). The program office is located at Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA. General system engineering is performed by the MITRE Corporation, Bedford, MA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
   - (U) ADCOM ROC 3-75, BMEWS Modernization (S), 17 Oct 75.
   - (U) The USAF Master Plan for Ballistic Missile Tactical Warning and Attack Assessment (Sensors only) (FY 81-90) (S), 31 Mar 81.
   - (U) Ballistic Missile TW/AA System Architecture (S-FRD), 31 Dec 83.
   - (U) JCSM, 2308/804 Tactical Warning and Attack Assessment Requirements in support of Presidential Retaliatory Execution of the SIOP (TS), 26 Jun 78.
   - (U) OSD Master Plan for Ballistic Missile Tactical Warning and Attack Assessment (S), 31 Mar 80.
   - (U) Joint RAF/USAF Operations Plan, BMEWS Site III, RAF Fylingdales, Oct 83 (S).
   - (U) AFSPACECOM SON 002-87, BMEWS Modernization (S).

G. (U) RELATED ACTIVITIES:
   - (U) Program Element #0102431F, Defense Support Program
   - (U) Program Element #0102432F, Sea Launched Ballistic Missile Radar Warning Systems
   - (U) Program Element #0102424F, SPACETRACK
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: # 0102423F Project Number: N/A
PE Title: Ballistic Missile Early Warning System Budget Activity: #3 - Strategic Programs

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT:

Other Procurement Funds (BA 63):	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
	2,413	6,169	250	TBD

2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: MOU between the United States and United Kingdom concerning the Modernization of the Ballistic Missile Early Warning Station, Royal Air Force Fylingdales, Yorkshire, United Kingdom, 13 Oct 86 (U). Letter of Offer and Acceptance between the United States Department of Defense and the Government of the United Kingdom, Defense Procurement Office, 8 May 88 (U).

J. (U) MILESTONE SCHEDULE:

1. (U) Thule Initial Operational Capability (IOC)	June 1987
2. (U) Fylingdales Radar Upgrade Contract Award	June 1988
3. (U) Fylingdales Radar IOC	FY 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102424F Budget Activity: #3 - Strategic Programs
PE Title: SPACETRACK

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2295 Ground-Based Electro-Optical Deep Space Surveillance System	1,400	1,100	1,100	1,100	
2296 Space Surveillance Network Improvement Program	4,695	4,726	407	Cont	TBD
3202 Air Force Maui Optical Station	3,200	3,800	4,015	Cont	TBD
3887 Space Control Support	0	6,000	10,005	Cont	TBD
3793 Project HAVE GAZE	3,000	0	0	0	
Total	12,295	15,626	15,527	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT:

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

1. (U) Project 2295 Ground-based Electro-Optical Deep Space Surveillance System: This program provides a global network of five sites to optically detect, track and identify satellites in earth orbit from 2,000 to 22,000 nautical miles. Four sites have been deployed with the fifth site in country to country negotiations.

   (U) FY 1989 Accomplishments:
   - (U) Continued minimal essential SPO support for deployment of site 5.
   - (U) Continued negotiations with the Portuguese government on the technical and facility agreements for the 5th site.

Program Element: #0102424F Budget Activity:#3 - Strategic Programs
PE Title: SPACETRACK

- (U) Continued "caretaker-only" status of the GEODSS Test Site (GTS) which houses the equipment to be delivered to the 5th site once the facility is built and environmentally capable of handling the operational equipment.

(U) FY 1990 Planned Program:
- (U) Continues minimal essential SPO support for deployment of site 5.
- (U) Continues negotiations with the Portuguese government on the technical and facility agreements for the 5th site.
- (U) Continues "caretaker-only" status of the GEODSS Test Site (GTS).
- (U) Continues minimal operational support of the GEODSS Experimental Test Station (ETS) which provides a technology test bed where potential improvements can be developed and operationally configured before deployment

(U) FY 1991 Planned Program:
- (U) Continues minimum essential SPO support for deployment of site 5.
- (U) Implements agreements with the Portuguese government for installation of site 5.
- (U) Continues "caretaker-only" status of the GTS for deployment of site 5 equipment.
- (U) Continues minimal operation of GEODSS ETS.

(U) Work Performed By: Prime civilian contractor is TRW, Redondo Beach, CA. Civilian subcontractors are ITEK (cameras), Lexington, MA; Contraves Georz (telescopes), Pittsburgh, PA; and Kentron (operations and maintenance), Honolulu, HI.

(U) Related Activities:
- (U) Program Element #0102310F, Cheyenne Mountain Complex Tactical Warning/ Attack Assessment System
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

Other Procurement (BA 63):

FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
598	10,836	230	Cont	TBD

(U) International Agreements: None

2. (U) Project 2296 Space Surveillance Network Improvement Program: Provides the architecture, technology, integration and implementation programs for pre-planned improvements to the dedicated, collateral and contributing sensors in the SSN as well as the associated command, control, communication and mission operations segments that are required to support the overall Space Control mission.

Program Element: #0102424F Budget Activity:#3 - Strategic Programs
PE Title: SPACETRACK

(U) FY 1989 Accomplishments:
- (U) Began installation of the PACBAR III equipment into the Saipan facility.
- (U) Began preliminary testing and check-out of the Saipan Radar System.
- (U) Completed the installation and check-out of the Haystack PACS.
- (U) Continued low level technology development on INTACS.
- (U) Began INTACS subsystem prototype installation for initial test and evaluation.

(U) FY 1990 Planned Program:
- (U) Completes DT&E and IOT&E for the Saipan Radar.
- (U) Continues minimum essential technology development on INTACS.
- (U) Continues INTACS subsystem prototype installation into CMC.
- (U) Begins work to integrate data from space-based visible sensors into surveillance system data processing flow

(U) FY 1991 Planned Program:
- (U) Evaluates INTACS operation in CMC.
- (U) Tasks required but not funded - will be held as unfunded requirements.

(U) Work Performed By: Saipan Radar deployment contracted through ESMC & WSMC. Haystack PACS performed by MIT/LL. INTACS Technology/Prototype Development performed by MIT/LL. Space based visible sensor work is performed by MIT/LL. General systems engineering and technical support is provided by Aerospace Corporation, Los Angeles, CA.

(U) Related Activities:
- (U) Program Element #0603438F, Satellite System Survivability
- (U) Program Element #0102310F, Cheyenne Mountain Complex Tactical Warning/Attack Assessment System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

Other Procurement: Not applicable.

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 3202 Air Force Maui Optical Station: The Air Force Maui Optical Station (AMOS) is a unique national resource R&D

Program Element: #0102424F Budget Activity: #3 - Strategic Programs
PE Title: SPACETRACK

facility that supports operational space surveillance requirements, provides measurement support to government and scientific communities, and serves as a test bed for electro-optics technology. The basic operations and maintenance support is provided through SPACETRACK RDT&E funding. Outside user support is provided through other development, measurement and experimental programs from various outside users (i.e. SDI, Intel, etc.). This site provides critical operational data to Space Command with IR signature data and compensated imaging data used for space object identification and mission/payload assessment (SIO/MPA) and ASAT support.

(U) FY 1989 Accomplishments:
- (U) Provided minimum essential core funding for basic operations.

(U) FY 1990 Planned Program:
- (U) Provides basic core funding for minimum site operations.
- (U) Provides some deferred maintenance.

(U) FY 1991 Planned Program:
- (U) Provides basic core funding for minimum site operations.
- (U) Provides some deferred maintenance.

(U) Work Performed By: Avco Everett Research Laboratories, Everett, MA, operates the Maui Optical Tracking and Identification Facility and conducts research and development at the Air Force Maui Optical Site. General systems engineering and technical support is provided by Lincoln Laboratory, Lexington, MA and Mitre Corporation, Bedford, MA.

(U) Related Activities:
- (U) Program Element #0603438F, Satellite System Survivability
- (U) Program Element #0102311F, Cheyenne Mountain Complex Tactical Warning/Attack Assessment System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

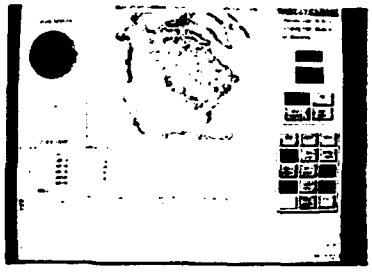
Other Procurement: Not applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0102424F
PE Title: SPACETRACK
Project: #3887
Budget Activity: #3 - Strategic Programs

Project Title: Space Control Support



Popular Name: Not Applicable

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY1991	To Complete
Program Milestones	MS 0 Jan 89	MS I Jan 90	N/A	MS II 3Q FY 92 MS III 2Q FY 95
Engineering Milestones	N/A	N/A	N/A	PDR 1Q FY 93 CDR 1Q FY 94 IOC 4Q FY 96
T&E Milestones	N/A	N/A	N/A	DT&E 4Q FY 94 IOT&E 2Q FY 95 Sys End-to-end Test TBD
Contract Milestones	N/A	N/A	Release RFP Aug 91	Contract Award 1Q FY 92
BUDGET ($000)	FY 1989	FY 1990	FY 1991	TO COMPLETE
Major Contract	0	0	0	(FY 92-97) 135,900
Support Contract	0	5,200	8,800	(FY 92-97) 64,200
In-House Support	0	800	1,205	(FY 92-97) 10,200
GFE/ Other	0	0	0	(FY 92-97) 0
Total	0	6,000	10,005	210,300

Program Element: # 0102424F Project: #3887
PE Title: SPACETRACK Budget Activity: #3 - Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
Soviet space systems represent a growing threat to US land, naval, and aerospace forces, enabling over-the-horizon targeting of these forces. This, combined with the operational capability of the Soviet coorbital ASAT, which can attack all US space systems in low earth orbit (LEO), allows Soviet space forces to serve as an unacceptable multiplier for Soviet terrestrial forces. Without a comparable capability, the US would be in an inferior position in any confrontation throughout the spectrum of conflict. This situation could force the US to accept the control of space by the enemy and provide them the margin of capability needed to defeat US forces. To prevent this, the planned US ASAT system will deploy both kinetic energy and directed energy weapons under the cotrol of a single comprehensive surveillance and battle management/command, control, and communication (BM/C3) system. This project develops the necessary surveillance and BM/C3 capabilities to provide a highly responsive and flexible control system for all ASAT weapons. The program will improve the Space Surveillance Network (SSN), develop and install BM/C3 systems in Cheyenne Mountain, and integrate the various ASAT weapons with USCINCSPACE's other space control capabilites.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments: Not applicable.

2. (U) FY 1990 Planned Program:
   - (U) Begin prototyping effort on BM/C3 acquisition
   - (U) Initiate simulation laboratory at AFSPACECOM
   - (U) Prepare source selection documentation
   - (U) Perform engineering analyses to support system specification
   - (U) Initiate space surveillance upgrade definition contract
   - (U) Begin Hypervelocity Breakup Modelling study to analyze ASAT debris hazard

3. (U) FY 1991 Planned Program:
   - (U) Release ASAT BM/C3 contract RFP
   - (U) Continue debris, simulation, prototyping, and surveillance work
   - (U) Begin system engineering contract for overall ASAT system

4. (U) Program to Completion:
   - (U) Installation of ASAT BM/C3 system in Cheyenne Mountain (FY 1997)
   - (U) Improvements to SSN to handle ASAT generated debris (FY 1997)
   - (U) Improvements in SSN to support weapon targetting and strike assessemnt (FY 1997)

D. (U) WORK PERFORMED BY: No contracts have been awarded to date. Government support is currently provided by MITRE Corp, Lexington, MA. Responsbile agency is Headquarters Electronic Systems Division, Advanced Technology Systems Office.

Program Element: # 0102424F Project: #3887
PE Title: SPACETRACK Budget Activity: #3 - Strategic Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: Debris study work replaces Uncorrelated Target Processor (UCTP) and Integrated Network Tasking and Control System (INTACS) work, since UCT and INTACS capabilities planned for SPADOC 4C should be sufficient to support ASAT if debris does not overwhelm processing capacity of network. Target signature work now funded by kinetic energy ASAT weapon program (Army effort). System engineering work for overall ASAT system added to ensure integrated program.

2. (U) SCHEDULE CHANGES: No change.

3. (U) COST CHANGES: No change.

F. (U) PROGRAM DOCUMENTATION:
- (U) Mission Need Statement (MNS) for Space Control Antisatellite Capability, 19 May 1988, SECRET
- (U) Acquisition Decision Memorandum (ADM), Antisatellite (ASAT) Systems, 6 Mar 89, SECRET
- (U) AFSPACECOM Statement of Operational Need (SON) 003-89, ASAT Battle Management/Command, Control, and Communication (BM/C3) System (draft), 9 May 1989, SECRET
- (U) AFSPACECOM SON 004-89, ASAT Weapons Systems (draft), 9 May 89, SECRET
- (U) USSPACECOM Antisatellite (ASAT) Concept of Operations (CONOPS), 12 Oct 89, SECRET
- (U) AFSPACECOM System Operational Requirement Document (SORD) 003-89-1, ASAT BM/C3 and Surveillance System (draft), 22 Nov 89, SECRET.
- (U) Test and Evaluation Master Plan (TEMP) for the Kinetic energy ASAT Weapon System, 2 Oct 89, SECRET
- (U) Requirements for an ASAT Program, MJCS 201-86, Joint Chiefs of Staff, 22 Sep 88, SECRET
- (U) USSPACECOM Multicommand Required Operational Capability (MROC) 03-87 for a Space Control ASAT Capability, Joint Chiefs of Staff, SM-77-88, 5 Feb 88, SECRET

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0102311F, Cheyenne Mountain Complex Tactical Warning/Attack Assessment System.
- (U) There is no unnecessary duplication of effort within the Air Force or the 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: None.

Program Element: # 0102424F Project: #3887
PE Title: SPACETRACK Budget Activity: #3 - Strategic Programs

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
None.		

T&E ACTIVITY (TO COMPLETION)

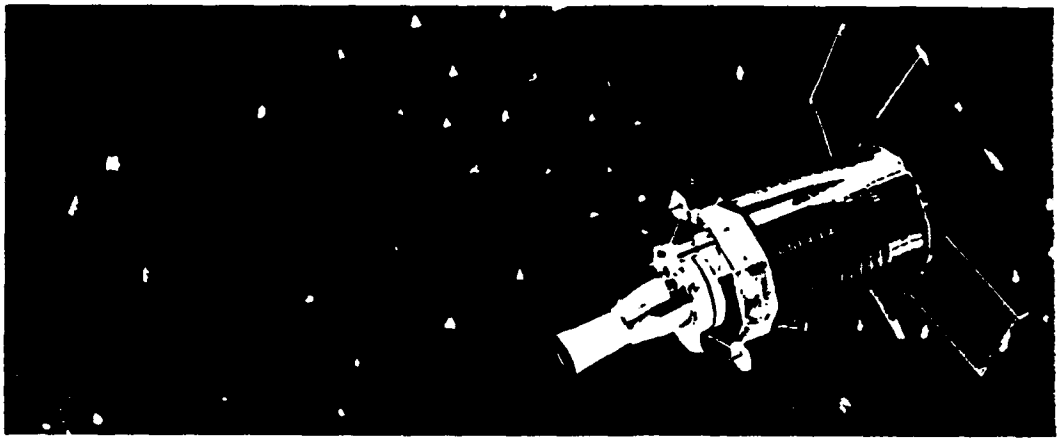
Event	Planned Date	Remarks
DT&E	4Q FY94	None
IOT&E	3Q FY95	None
SYS END-TO-END TEST	TBD	Demonstrates integrated system (surveillance/BM/C3/ weapon) performance

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102431F
PE Title: DEFENSE SUPPORT PROGRAM

Project: # 3624
Budget Activity: #3 - Strategic Programs

Project Title: DEFENSE SUPPORT PROGRAM



POPULAR NAME: DSP

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones				Transition to BSTS
Engineering Milestones	First DSP-1 Flight	Sat.Readout Sta.Upgrade	Sat.Readout Sta.Upgrade	Continuing
T&E Milestones		MGT-14 DT&E/OT&E		
Contract Milestones	Sat 14-15 Delivery		Sat 16-19 Delivery	Sat 20-25 Delivery

BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	81892	54474	49456	TBD
Support Contract	8037	15116	12015	TBD
In-House Support	2856	3088	3052	TBD
GFE/ Other	7570	7293	5467	TBD
Total	100355	79971	69990	TBD

Program Element: #0102431F
PE Title: DEFENSE SUPPORT PROGRAM
Project: # 3624
Budget Activity: #3 - Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The DSP system is intended to satisfy the operational requirement for a highly available, survivable, reliable satellite borne surveillance system to detect and report missile and space launches and nuclear detonations in near real time [ ] The DSP system consists of [ ] in geostationary orbits, fixed and mobile ground processing stations, one multi-purpose facility, and a ground communications network (GCN). DSP's primary mission is to provide tactical warning and limited attack assesment of a ballistic missile attack. [

[DSP also detects and reports [ ] /nuclear events

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U)
   - (U) Continued Mobile Ground System (MGS) hardware and software upgrades to enhance survivability and ensure DSP-I compatibility.
   - (U) Continued redesign of fixed ground station software architecture to complement DSP-1 capabilities.
   - (U) Demonstrated the ability to process data from two satellites simultaneously to achieve a "stereo viewing" capability.
   - (U) Began the development to replace unsupportable satellite readout equipment at the fixed ground stations.

3. (U) FY 1990 Planned Program:
   - (U) [ ]
   - (U) Continue redesign of fixed ground station software architecture to complement DSP-1 capabilities (e.g., laser crosslink data processing, processing new sensor data, Ada-based language), and redesign software maintenance and support programs.
   - (U) Continue Mobile Ground System (MGS) hardware and software upgrades to enhance survivability and ensure DSP-I compatibility.
   - (U) Continue the development to replace unsupportable satellite readout equipment at the fixed ground stations.

Program Element: #0102431F
PE Title: DEFENSE SUPPORT PROGRAM
Project: # 3624
Budget Activity: #3 - Strategic Programs

4. (U) FY 1991 Planned Program:
   - (U)
   - (U) Continue redesign of fixed ground station software architecture to complement DSP-1 capabilities (e.g., laser crosslink data processing, processing new sensor data, Ada-based language), and redesign software maintenance and support programs.
   - (U) Continue Mobile Ground System (MGS) hardware and software upgrades to enhance survivability and ensure DSP-I compatibility.
   - (U) Continue the development to replace unsupportable satellite readout equipment at the fixed ground stations.
   - (U) Begin the development to replace overloaded computers at the fixed ground stations.

5. (U) Program to Completion:
   - (U) Continuing Program
   - (U) Emphasis directed toward eliminating/minimizing operational deficiencies and vulnerabilities, insuring launch capability by either Titan IV or Space Shuttle, insuring a survivable DSP through fixed and mobile ground system upgrades, and insuring ground station supportability.
   - (U) Plan and execute the transition to the follow-on program, the Boost Surveillance and Tracking System (BSTS) which is being developed jointly by the Air Force and Strategic Defense Initiative Office.

D. (U) WORK PERFORMED BY: The major contractors are TRW, Redondo Beach, CA; Aerojet ElectroSystems Company, Azusa, CA; IBM, Boulder, CO; Aerospace Corp., El Segundo, CA; Sandia National Laboratories, Albuquerque, NM; and Los Alamos National Laboratories, Los Alamos, NM. AFSC/Space Systems Division is responsible for system development and acquisition.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) ENGINEERING CHANGES: None.
   2. (U) SCHEDULE CHANGES: None.
   3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) Update sheet for the DSP Development Concept Paper No. 58, 1 Sep 72 (S).
   - (U) DepSecDef memo for SAF (S), Subject: DSARC I for Advanced Warning Systems, 15 Feb 80; and SAF/AL memo for USAF/CV (S), Subject: DSP DSARC I Implementation, 3 Mar 80.
   - (U) ADCOM ROCs 6-73, 3-77, 4-77, WWMCS OR/ROC DSP-01-72, and 13-77 (S).
   - (U) MENS for Improved Missile Warning and Attack Assessment, SecDef memo to SAF(S), 19 Mar 80.
   - (U) SON 201-82, Survivable and Enduring Missile Warning System (S).

Program Element: #0102431F
PE Title: DEFENSE SUPPORT PROGRAM
Project: # 3624
Budget Activity: #3 - Strategic Programs

G. (U) RELATED ACTIVITIES:
- (U) P.E. 0303110F and 0303605F (Defense Satellite Communications System)
- (U) P.E. 0305119F (Space Boosters)
- (U) P.E. 0305171F (Space Launch Support Program)
- (U) P.E. 0603735F (WWMCCS Architecture)
- (U) P.E. 0603220C (Surveillance, Acquisition, Tracking, and Kill Assessment). This SDIO-managed PE provides advanced technical development to support DSP follow-on design.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
Missile Procurement Funds (BA 45)	432,389	346,631	326,247	TBD
Quantity (satellites)	2	1	1	
Other Procurement Funds (BA 63)	5,151	72,221	78,193	TBD

2. (U) MILITARY CONSTRUCTION: N/A

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Flight 13 on-orbit DT&E/OT&E	FY88	Completed
Flight 14 on-orbit DT&E/OT&E	FY89	Completed
Ground system upgrades for DSP-1 satellites DT&E/OT&E	FY88-89	Completed

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Satellite on-orbit DT&E/OT&E	FY90-98	Satellites 15-25
MGT-14 Upgrade DT&E/OT&E	FY89-92	six mobile term.
System 1 Software DT&E/OT&E	FY89-92	three gnd. sta.
Satellite Readout Station Upgrade (SRSU) DT&E/OT&E	FY90-93	three gnd. sta.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102432F Budget Activity: #3 - Strategic Programs
PE Title: Sea Launched Ballistic Missile (SLBM) Radar Warning Systems

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2887 PAVE PAWS	9,815	3,599	2,294	3,030	35,600
Total	9,815	3,599	2,294	3,030	35,600

B. (U) BRIEF DESCRIPTION OF ELEMENT: [

The SLBM Radar Warning System consists of PAVE PAWS sites at Cape Cod AFS, MA; Beale AFB, CA, Robins AFB, GA; and Eldorado AFS, TX; and the Perimeter Acquisition Radar Attack Characterization System (PARCS) in North Dakota. [

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

(U) Project 2887, PAVE PAWS: PAVE PAWS is being upgraded to [

The Northeast (NE) and Northwest (NW) sites will undergo a computer upgrade to provide commonality with the new Southeast (SE) and Southwest (SW) sites, and [ ] Current capabilities are:

	PAVE PAWS	PARCS
Range/Warning Time	[	]
Traffic Handling		
Launch Location (CEP)		
Impact Location (CEP)		

(U) FY 1989 Accomplishments:
- (U) Continued system engineering software development, and in-plant testing for the ADP upgrades (NE and NW sites).

(U) FY 1990 Planned Program:
- (U) Continue system engineering software development and in-plant testing for the ADP upgrades (NE and NW sites).
- (U) Initiate installation and on-site testing at NE site.

Program Element: #0102432F Budget Activity: #3 - Strategic Programs
PE Title: Sea Launched Ballistic Missile (SLBM) Radar Warning Systems

(U) FY 1991 Planned Program:
- (U) Complete system engineering and software development for ADP upgrades (NE and NW sites).
- (U) Complete on-site installation and testing at the NE site.
- (U) Initiate installation and on-site testing at the NW site.

(U) Work Performed By:
- Prime contractor: Raytheon Corporation, Wayland, MA.
- Major subcontractors: Control Data Corporation, Minneapolis, MN (Hardware) and TRW, Redondo Beach, CA (software).
- Program management: Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA, with North American Aerospace Defense Command (NORAD), Space Command, and Air Force Communications Command.
- General system engineering: MITRE Corporation, Bedford, MA.

(U) Related Activities:
- (U) Program Element #0102431F, Defense Support Program
- (U) Program Element #0102423F, Ballistic Missile Early Warning System
- (U) Program Element #0102424F, SPACETRACK
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (BA 63):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	1,769	746	0	0	71,915

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: N/A

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102433F Project Number: # N/A
PE Title: NUDET Detection System (NDS) Budget Activity: 3-Strategic Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY1991 Estimate	To Complete	Total Program
0001 NUDET Detection System	10,794	6,735	5,125	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT:
The National Military Command System and Unified and Specified Commands require a highly survivable capability to detect, locate, and report any nuclear detonation (NUDET) on a global basis in near real time. NUDET information supports post-impact selection of appropriate retaliatory options in response to a nuclear attack against North America, as well as strike confirmation, and damage assessment. The NUDET Detection System consists of sensors integrated on the operational Navstar Global Positioning System (GPS) satellites plus a user segment consisting of Ground/Airborne Integrated Terminals (G/AIT). The sensors will provide location of nuclear bursts worldwide [redacted] This program element complements PE 0301357F which provides for the integration of these NDS sensors on GPS spacecraft.

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

1. (U) Project 0001, NUDET Detection System:
This project develops the EMP sensor for the GPS satellites and develops the Ground/Airborne Integrated Terminal (G/AIT) to provide authorized users direct receipt of NDS nuclear detonation data.

(U) FY 1989 Accomplishments
- (U) Began engineering development and requalification of the NDS payload for the GPS replenishment satellites.
- (U) Completed G/AIT software qualification testing.
- (U) Continued production planning and preparation activities.

(U) FY 1990 Planned Program:
- (U) Conclude basic G/AIT development.
- (U) Upgrade G/AIT processing capabilities.
- (U) Begin integration/testing of FSD G/AITs.
- (U) Continue engineering development and requalification of NDS sensors to install into GPS Block IIR satellites.

Program Element: #0102433F Project Number: # N/A
PE Title: NUDET Detection System (NDS) Budget Activity: 3-Strategic Programs

(U) FY 1991 Planned Program
- (U) Continue integration and field testing of FSD G/AITs.
- (U) Continue engineering development and requalification of NDS sensors to install into GPS Block IIR satellites.
- (U) Continue upgrade of G/AIT processing capabilities.

(U) WORK PERFORMED BY: System development and procurement is accomplished by Air Force Systems Command's Space Systems Division, Los Angeles AFB, CA with the [redacted] Rockwell International, Seal Beach, CA, integrates the NDS sensors on Block II GPS satellites and produces the EMP sensor for Block II satellites. General Electric, East Windsor, NJ will integrate NDS sensors on Block II replenishment satellites. Science Applications International Corporation, Manhattan Beach, CA, and the Aerospace Corporation, El Segundo, CA, provide systems engineering support. Sandia National Laboratories, Albuquerque, NM, and Los Alamos National Laboratory, Los Alamos, NM, are under contract to the Department of Energy to produce the X-ray and optical nublear detonation sensors. Texas Instruments, Dallas, TX, is developing the G/AIT.

(U) RELATED ACTIVITIES:
- (U) PE 0305165F, Navstar Global Positioning System (GPS) Space Segment.
- (U) [redacted]
- (U) PE 0301357F, NUDET Detection System (NDS)
- (U) PE 0305999F, Data Analysis.
- (U) PE 0302015F, NEACP/E-4B Class V
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ in Thousands)

Missile Procurement (BA 27)

	FY 1989 Actual	FY 1990 Estimate	FY1991 Estimate	To Complete	Total Program
Cost	0	0	17,977	Continuing	TBD
Quantity	0	0	0	Continuing	TBD

Other Procurement (BA 83)

Cost	0	5,487	17,625	Continuing	TBD
Quantity	0	0	1	Continuing	TBD

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207129F Budget Activity: #4 - Tactical Programs
PE Title: F-111 Squadrons

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2962 F-111 Avionics Modernization Program (AMP)	3,960	5,876	5,329	3,526	130,856
3079 F-111 Digital Flight Control System (DFCS)	17,001	16,493	5,988	1,251	63,441
3925 F-111D Permissive Action Link (PAL)	0	10,000	0	0	10,000
Total	20,961	32,369	11,317	4,777	204,297

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides funds for development activities associated with the F-111 aircraft. The F/FB-111 AMP (Project 2962) is a reliability/maintainability improvement to the bomb/navigation system required to reduce maintenance and support costs associated with high failure, high cost, and technologically outdated components. The funding in FY 89-91 will allow development of Test Program Sets (TPSs) for both intermediate and depot level repair of LRUs/SRUs. The TPS development/procurement is critical to lessen dependence on interim contractor support (ICS) for the F-111 AMP-modified systems. Project 3079, the DFCS, is a development effort to replace the analog flight control system with a digital system to eliminate safety deficiencies (uncommanded flight maneuvers) and improve reliability and maintainability. Project 3925, PAL, is a development effort to replace the existing Aircraft Monitor and Control function to meet nuclear weapon use control requirements and compatibility with new technology nuclear weapons.

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

1. (U) Project 2962, Avionics Modernization Program (AMP): The F/FB-111 AMP is a low risk reliability/maintainability upgrade to the bomb navigation system of the FB-111, F-111 A/D/E/F, and EF-111A. This modification involves the substitution, modification and repackaging of 16 Line Replaceable Units in the following subsystems: Inertial Navigation System, Terrain Following Radar, Attack Radar, Doppler Radar, Controls and Displays and Data Transfer Unit. The AMP modification also raises the mean time

Program Element: #0207129F Budget Activity: #4 - Tactical Programs
PE Title: F-111 Squadrons

between failure of the overall system from the current 5 hours to approximately 20 hours and will ensure system supportability into the 1990s. The current phase of development deals with the design of Test Program Sets (TPSs) needed to achieve an organic repair capability at intermediate and depot levels. In early 1988, an agreement was reached between Air Force Systems Command (AFSC) and Air Force Logistics Command (AFLC) specifying that Warner-Robins Air Logistics Center (ALC) would develop the TPSs in-house. This agreement was based on anticipated savings in development costs and an earlier projected fielding date (as compared to contracting the effort with private industry) for the AMP TPSs.

(U) FY 1989 Accomplishments:
- (U) Continued SRU TPS development.
- (U) Began development of TPSs for Line Replaceable Units (LRUs).

(U) FY 1990 Planned Program:
- (U) Continue SRU and LRU TPS development.
- (U) Hold Preliminary Design Review and Critical Design Review for LRU TPS development effort.

(U) FY 1991 Planned Program:
- (U) Complete SRU TPS development.
- (U) Continue LRU TPS development and begin Independent Validation and Verification (IV&V).

(U) WORK PERFORMED BY: The F-111 AMP contractors are General Dynamics Corporation, Ft. Worth, TX for the FB-111 aircraft; and Grumman Aerospace Corporation, Bethpage, NY for the F-111 A/E and EF-111 aircraft. Development of the TPSs is being performed in-house by Warner-Robins ALC, GA.

(U) RELATED ACTIVITIES: There is no unnnecessary duplication of effort within the Air Force of the Department of Defense.

(U) OTHER APPROPRIATION FUNDS

AIRCRAFT PROCUREMENT (3010) FUNDS ($ in Thousands):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	87,426	32,576	6,668	8,269	953,200

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: #0207129F Budget Activity: #4 - Tactical Programs
PE Title: F-111 Squadrons

2. (U) Project 3079, Digital Flight Control System (DFCS): The DFCS is a Class IV-A safety modification that replaces the electronic portion of the F/FB/EF-111 flight control system with a modern state-of-the-art digital computer and sensors. This project will also improve the critical interfaces of the flight control system by incorporating the on-board autopilot and low altitude monitor, and monitoring the terrain following radar systems. As a by-product of this safety modification, the reliability of the flight control system will be improved from the current 60 hours to 1750 hours.

(U) FY 1989 Accomplishments:
- (U) Continued durability testing, reliability growth testing and combined DT&E/IOT&E on the FB-111A.
- (U) Finalized production design.

(U) FY 1990 Planned Program:
- (U) Complete DT&E/IOT&E on the FB-111A (SAC configuration).
- (U) Award the Low Rate Initial Production (LRIP) option.

(U) FY 1991 Planned Program:
- (U) Deliver six LRIP units for kit-proofing on the six models of F-111 aircraft.
- (U) Complete development of the Maintenance Training Set
- (U) Complete development of Test Program Sets.
- (U) Begin modification and testing on the EF-111A.

(U) WORK PERFORMED BY: The DFCS contractor is General Dynamics, Ft Worth, TX. The major subcontractor is Lear Astronics, Santa Monica, CA. The F-111 System Manager is located at Sacramento Air Logistics Center, McClellan AFB, CA. The DFCS development effort is managed at Aeronautical Systems Division, Wright-Patterson AFB, OH.

(U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS:

AIRCRAFT PROCUREMENT (3010) FUNDS ($ in Thousands):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	3,600	25,400	37,600	66,600

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: #0207129F Budget Activity: #4 - Tactical Programs
PE Title: F-111 Squadrons

3. (U) Project 3925, Permissive Action Link (PAL): The F-111 PAL is a low risk reliability/maintainability upgrade to the Aircraft Monitor and Control (AMAC) function on the F-111D aircraft. This modification involves the upgrade of AMAC units that currently exist on the F-111E which are no longer supportable nor available for integration on the F-111D. The improved AMAC will be backward compatible with the existing F-111E AMAC units.

(U) FY 1989 Accomplishments:
- Not Applicable

(U) FY 1990 Planned Program:
- (U) Develop and test breadboard and brassboard versions of new controller.
- (U) Conduct preliminary and critical design reviews.
- (U) Complete data package.

(U) FY 1991 Planned Program:
- (U) Project complete.

(U) WORK PERFORMED BY: Design and development by Sandia National Laboratory; integration is being performed by General Dynamics Corporation, Ft. Worth, TX.

(U) RELATED ACTIVITIES: There is no unnecessary duplication of within the Air Force or the Department of Defense.

(U) OTHER APROPRIATION FUNDS:

AIRCRAFT PROCUREMENT (3010) FUNDS ($ in Thousands):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	3,800	3,536	1,900	3,667	12,903

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207131F
PE Title: A-10 Squadrons

Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
A-10 Squadrons	-0-	6,000	1,983	-0-	7,983

B. (U) BRIEF DESCRIPTION OF ELEMENT: The development efforts are designed to continue the viability of A-10 aircraft through modification of existing assets. The program supports the AF position that some A-10 should be modified with improved avionics for cost effective operations in lower threat CAS environments and evaluates night enhancements for A-10s in both CAS and Forward Air Controller (FAC) roles.

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

1. (U) A-10 Squadrons (No Project Number): The development funds provided support two separate, but related parallel efforts. First is the development of a Class V modification for the installation of the updated Automatic Target Handoff System (ATHS) II Improved Data Modem (IDM). This kit will be retrofitted to 225 A-10's which will already be equipped with the Low Altitude Safety and Targeting Enhancement (LASTE) system. The ATHS II will improve capabilities for the A-10 in the Close Air Support (CAS) and the OA-10 in Forward Air Control (FAC) missions. The second is the A/OA-10 Technology Demonstrator Program (TDP) which will integrate/demonstrate avionics technology and different Forward Looking Infrared (FLIR) systems for both the CAS and FAC missions. The results of the TDP will assist Tactical Air Command in identifying requirements which may lead to future modifications of the A-10 and/ or the OA-10.

(U) FY 1989 Accomplishments:
- (U) TDP preliminary planning phase completed (March-May).
- (U) TDP Program Management Direction (PMD) issued (May).
- (U) TDP Prelimmary Design Review (Sep).
- (U) TDP demonstration flight planning initiated.

(U) FY 1991 Planned Program:
- (U) Provide Class V reprocurement package to AFLC.
- (U) Assist Air Force Logistics Command and TAC with Qualification Test and Evaluation and Qualification Operational Test and Evaluation.
- (U) Provide prototype kit to AFLC for kitproofing.

(U) Work Performed By: A/OA-10 TDP is on contract with Grumman Aerospace, Bethpage NY and managed by Aeronautical Systems Division, Wright-Patterson AFB OH. No contract decisions have been made concerning ATHS integration on the 225 aircraft.

(U) Related Activities:
- (U) PE 0604249/3920, Night/Precision Attack Program.

Program Element: #0207131F
PE Title: A-10 Squadrons

Project Number: N/A
Budget Activity: # 4 - Tactical Programs

- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, (BA 5)					
Cost*	--	--	--	TBD	TBD

* Funds are budgeted beginning in FY 92 to support the A-10 ATHS and are a portion of the total BP1100 (Class V modification) monies allocated to the A-10 under Budget Activity #5 (Modification of in-service aircraft).

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0207133F
PE Title: F-16 Squadrons
Project Number: # 2671
Budget Activity: # 4 - Tactical Programs

Project Title: F-16 Squadrons



POPULAR NAME: F-16 Falcon

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N / A	CAS/BAI MS IV	N / A	N / A
Engineering Milestones	Ongoing Integration	Block 40/50/MLU Integration	Block 40/50/MLU Integration	Block 40/50/ML CAS Ongoing Integration
T&E Milestones	EW suite Integration Testing	IPE Flight Test	Block 50 Integration Testing	Ongoing Integration Testing
Contract Milestones	Authorize MSIP Follow-on Contract	Initiate F-16 CAS/MLU Kit FSD	Continuing Effort	Continuing Effort
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	1,506	11,000	58,600	1,251,087 (233,222)
Support Contract	2,700	540	0	232,501 (0)
In-House Support	7,638	10,500	8,400	189,258 (55,600)
GFE/ Other	11,268	2,960	3,056	105,546 (25,422)
	23,112	25,000	70,056	1,778,392 (314,244)

Program Element: #0207133F
PE Title: F-16 Squadrons
Project Number: #2671
Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
There is a continuing need for modernization of the USAF and allied tactical fighter forces. Through the turn of the century, a multimission fighter is required to counter quantitative deficiencies in the tactical fighter force and modernize and supplement existing forces. The F-16C/D is intended to fulfill these requirements. The F-16 is a single-engine, single-seat, multirole tactical fighter with full air-to-air and air-to-surface combat capabilities. It will be employed in a complementary role to the F-15 in counter-air missions and as a primary aircraft in the surface attack role. It will replace aging F-4s and modernize the Air Reserve Forces. This project includes tasks to develop, integrate and qualify systems to enhance the overall performance of the F-16 in the accomplishment of its missions. These improvements are grouped into a comprehensive, cost-effective Multinational Staged Improvement Program (MSIP). They include expanded air combat identification capability, updated electronic warfare suite, and incorporation of improved communication/identification equipment. In addition, this project develops enhanced night, under the weather attack capability in the air-to-ground role. Improvements include a higher maximum takeoff weight, improved air-to-air gun sight algorithms, digital flight controls, and improved pilot interface. Combat capability and versatility will be increased by integration of an Increased Performance Engine (IPE), and enhanced with the addition of advanced air-to-surface and air-to-air missiles and munitions. It develops enhanced air-to-ground capabilities including a Digital Terrain System (DTS), Pave Penny, Dry Bay Fire Extinguisher, 30mm gun pod, and an Automatic Targeting Hand-off System (ATHS) for retrofit into a planned quantity of 146 Block 30 F-16C/D aircraft for Close Air Support (CAS). To continue to meet the increased threat of the 1990's, a Mid-Life Upgrade (MLU) of the F-16A/B aircraft avionics will be conducted in concert with our European partners. Future plans include studies to upgrade F-16C/D avionics and computer system.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed F-16 Agile Falcon Predevelopment.
   - (U) Continued FSD of Pressure Breathing anti-G System (Combat Edge).
   - (U) Completed initial service release of both versions of Improved Performance Engine (IPE).
   - (U) Completed FSD testing of the LANTIRN navigation and targeting pods.
   - (U) Established detailed design for the Block 50 multirole upgrades including full HARM/Shrike capability, advanced management of expendables, and integrated ECM.
   - (U) Completed launches of FSD AMRAAM system.
   - (U) Continued development and testing of improvements initiated in FY 88 and prior.

Program Element: #0207133F
PE Title: F-16 Squadrons

Project Number: #2671
Budget Activity: #4 - Tactical Programs

2. (U) FY 1990 Planned Program:
   - (U) "Transition to FSD" phase of the Mid-Life Update (MLU).
   - (U) Complete FSD on Pressure Breathing anti-G System (Combat Edge).
   - (U) Initiate development of improved data modem for the Automatic Target Hand-off System.
   - (U) Initiate development testing of the Block 50 upgrades.
   - (U) Develop software upgrades to enhance LANTIRN targeting pod operations.

3. (U) FY 1991 Planned Program:
   - (U) Continue CAS retrofit development tasks.
   - (U) Begin MLU FSD.
   - (U) Initiate development flight testing of integrated HARM/Shrike capability.
   - (U) Develop selected hardening features to reduce vulnerability and increase survivability.
   - (U) Initiate development of a digital terrain system for covert autonomous navigation and ground collision avoidance.

4. (U) Program to Completion:
   - (U) Develop and test ATHS parameters for Suppression of Enemy Air Defense (SEAD) mission.
   - (U) Complete FSD of the F-16 MLU kit.
   - (U) Complete FSD of the CAS retrofit kit.

D. (U) WORK PERFORMED BY: The F-16 System Program Office of the Aeronautical Systems Division (ASD), Wright-Patterson Air Force Base, OH, has management responsibility for the F-16C/D program, F-16 Derivative program, as well as residual development tasks identified for the F-16A/B program. The F-16 System Program Management Division of the Ogden Air Logistics Center, Materiel Management Directorate, Hill AFB, UT, has management responsibility for the F-16A/B program, with the exception of residual tasks retained by ASD under the Program Management Responsibility Transfer agreement. The major contractors are General Dynamics, Fort Worth, TX (airframe); Pratt & Whitney, East Hartford, CT and General Electric, Evandale, OH (engine); and Westinghouse, Baltimore, MD (radar). Major European manufacturers include Fabrique Nationale, Belgium (engine); SABCA/SONACA, Belgium (aft fuselage, wings and assembly); FOKKER, The Netherlands (center fuselage and assembly); DAF, the Netherlands (landing gear); Per Udsen, Denmark (pylons and vertical fin); Kongsberg Vapenfabrikk, Norway (inertial navigation set and fan drive module); and General Electric Corporation, England (head-up display).

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: Adds requirement for CAS retrofit kit development (+$39.3M) and F-16A/B MLU retrofit kit development (+$14.4M). Deletes requirement for F-16 derivative development (-$161.0M).
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Above changes and other adjustments including revised inflation rates total -$10.[illegible]M for FY 1991.

Program Element: #0207133F
PE Title: F-16 Squadrons
Project Number: #2671
Budget Activity: #4 - Tactical Programs

F. (U) PROGRAM DOCUMENTATION:
- (U) DCP #120, LWF Prototype, 1 Nov 72.
- (U) TAC ROC 303-76, F-16 Air Combat Fighter, 28 Dec 76.
- (U) DCP #143, Multipurpose Fighter (F-16), 8 May 78.
- (S) F-16C/D Block 40 SORD (draft), 9 May 89
- (S) F-16C/D Block 50 SORD (draft), 19 May 89
- (U) F-16C/D TEMP, 2 Aug 89

G. (U) RELATED ACTIVITIES:
- (U) Night, under-the-weather attack capability is being developed for use on the F-16 and other aircraft under PE 0603249F, Night Attack Program and PE 0604249F, Night/Precision Attack (Low Altitude Navigation and Targeting Infrared System for Night).
- (U) Advanced identification systems for the F-16 are being developed under PE 0604725F, Aircraft Identification Systems, and PE 0603742F, Combat Identification Technology.
- (U) Alternate and Improved performance engines are being developed for the F-16 (and the F-15) under PE 0604218F, Engine Model Derivative Program; PE 0604223F, Alternate Fighter Engine Program; and PE 0604268F, Aircraft Engine Component Improvement Program.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS ($ in thousands)

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement (BA 01F16X, P-1 Line Items 6&7):					
Funds	2877.7	2984.2	2794.5	18,067.6	48,956.5
Quantity	180	150	150	900	3059

2. (U) MILITARY CONSTRUCTION: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The Air Force was directed in July 1987 by the Secretary of Defense to conduct a study of F-16 derivatives which would be suitable for a mid-1990s complement to the ATF and would be attractive to the European Participating Governments (EPG) in the F-16 program. We established the framework for the F-16 Derivative program with the EPG as a three-phase cooperative program consisting of predevelopment, development, and production. DOD funding for the predevelopment phase was provided from the NATO R&D appropriation (Nunn Amendment) which provided $8.0M of the FY 1988 RDT&E appropriation. The EPG concluded they do not have a near term requirement for a new aircraft. However, they do need a mid-life update (MLU) for their existing F-16s. Thus, to reach agreement with the EPG, it was necessary to include MLU in the program. During preparation of the FY 1990/1991 amended President's budget, the F-16 derivative aircraft (Agile Falcon) portion of the program was cancelled, leaving only the MLU. Current plans are to proceed with the MLU program with the EPG in FY 1990 under the provisions of Section 22 of the Arms Export Control Act.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0207134F
PE Title: F-15E Squadrons
Project Number: 0131
Budget Activity: # 4 - Tactical Programs

Project Title: F-15 Squadrons



POPULAR NAME: F-15 Eagle

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N / A	N / A	N / A	N / A
Engineering Milestones	Ongoing Integ	Ongoing Integ	Ongoing Integ	Ongoing Upgrades
T&E Milestones	MSIP /AMRAAM Flt Test	IPE Flight Test	Nuclear Cert Flight test	Follow on Weapons Integ Flt Test
Contract Milestones	Complete F-15E Contract	First Annual OFP Update	F-15E IPE Integr Complete	VHSIC Comp, ALQ-135 Band 1.5
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	47,205	38,933	55,200	2,628,274 (44,400)
Support Contract	0	0	0	0
In-House Support	34,075	47,400	33,900	452,690 (81,700)
GFE/ Other	3,500	0	0	349,149 (0)
Total	84,780 *	86,333 **	89,110	3,430,113 (126,100)

* FY 1989 reported under PE 0207130F (including Proj 0132).
** FY 1990 Includes $2.749M from PE 0207130F

Program Element: # 0207134F
PE Title: F-15E Squadrons
Project Number: 0131
Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The F-15 is the most capable fighter in the world today. As such, it is the cornerstone to the accomplishment of all other tactical missions. With conformal fuel tanks, the F-15 can deploy worldwide with minimal tanker support and arrive in a combat ready configuration. The F-15E retains the basic air-to-air capability and adds systems necessary to meet the requirement for all weather, deep penetration and night/ under the weather air-to-surface attack. However, the Soviet threat is making qualitative advances with their new generation of aircraft possessing all-weather detection and kill capabilities. To maintain the F-15's superiority against the threat through the 1990s, avionics, armament, airframe, and engine improvements are required. Avionics changes which exploit proven technological advances are being incorporated into the F-15 to provide expanded capability and support an updated and fully integrated electronic warfare suite. Further, this project develops enhanced capability for the air-to-ground role. In addition, overall combat capability will be increased by integration of an Increased Performance Engine (IPE), and a Very High Speed Integrated Circuit (VHSIC) central computer (CC) into the aircraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued development and testing of the improvements initiated in FY 1988 and prior.
   - (U) Continued design, test and checkout of all Multi-Staged Improvement Program (MSIP) changes and peculiar support equipment to ensure system compatibility, continued IPE integration, RF compatibility efforts, and continued ECCM enhancements. The upgraded systems serve as a baseline for the F-15E aircraft.
   - (U) Continued VHSIC Central Computer full scale development.

2. (U) FY 1990 Planned Program:
   - (U) Continued development and testing of the improvements initiated in FY 1989 and prior.
   - (U) Continued design, test and checkout of all MSIP changes and peculiar support equipment to ensure system compatibility. Continued IPE integration, RF compatibility efforts, VHSIC Central Computer full scale development and ECCM enhancements.
   - (U) Production of first annual operational flight program update.
   - (U) Field Mission Support System II software.

3. (U) FY 1991 Planned Program:
   - (U) Continue development and testing of the improvements initiated in FY 1990 and prior.
   - (U) Continue flight test and RDT&E tasks associated with SEEK EAGLE, Tactical Electronic Warfare System (TEWS) integration, Increased Performance Engine (IPE) integration, VHSIC CC development, RF compatibility, advanced algorithm ECCM, combat identification improvements, Mission Support System, Ground Collision Warning System, Standard Crash Survivable Flight Data Recorder, Vertical Tail Redesign, and LANTIRN integration.

Program Element: # 0207134F
PE Title: F-15E Squadrons

Project Number: 0131
Budget Activity: # 4 - Tactical Programs

- (U) Produce second Operational Flight Program update.
- (U) Incorporate Data Transfer Module write capability.
- (U) Incorporate JTIDS capability.

4. (U) Program to Completion:
   - (U) Completion of tasks including radar improvements, ECCM improvements, VHSIC CC, combat identification, Global Positioning System, added capability for electronic warfare test equipment, and flight testing for safety and operational deficiencies.

D. (U) WORK PERFORMED BY: The F-15 development program is being managed by the F-15 Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base OH. McDonnell-Douglas Corporation, St. Louis MO, is the prime contractor for development and production of the F-15 aircraft. Pratt & Whitney division of the United Technology Corporation, West Palm Beach FL, is the engine contractor. Hughes Aircraft Company, Culver City CA, is the radar subcontractor to McDonnell-Douglas Corporation. Northrop Corporation, Rolling Meadows IL, is responsible for the ALQ-135 Internal Countermeasures System. Loral Corporation, Yonkers NY, is responsible for the ALR-56C Radar Warning Receiver.

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

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: SRAM-T RDT&E efforts have been transferred to the SRAM-T program element.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAC ROC 9-68, February 1968
- (U) DCP #19, Rev C, May 1977 as amended February 1980
- (U) TAF SON 321-82, January 1984
- (U) F-15E TEMP, April 1989

G. (U) RELATED ACTIVITIES:
- (U) The Tactical Electronic Warfare System for F-15 application is being developed in PE 0604241F (Consolidated EW Programs).
- (U) The Joint Tactical Information Distribution System (JTIDS) is being developed for use on multiple aircraft including the F-15 under PE 0604754F (JTIDS).
- (U) The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) is being developed for the F-15E under PE 0604249F (Night/Precision Attack).
- (U) The Increased Performance Engine (IPE) is being developed under PE 0604223F (Alternate Fighter Engine).
- (U) The F-15 Ring Laser Gyro inertial navigation unit is being developed for F-15E production and subsequent F-15A-D retrofit under PE 0604201F (Aircraft Avionics Equipment Development).
- (U) The Short Range Attack Missile - Tactical (SRAM-T) is being developed for the F-15 under PE 0603364F and PE 0604245F (Short Range Attack Missile - Tactical).

Program Element: # 0207134F
PE Title: F-15E Squadrons
Project Number: 0131
Budget Activity: # 4 - Tactical Programs

- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, (BA 01)					
Funds	1,377,850	1,337,132	1,699,771	406,232	26,708,000
Quantity	36	36	36	0	1074

2. (U) MILITARY CONSTRUCTION: Not Applicable.

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

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0207136F Budget Activity: # 4 - Tactical Programs
PE Title: F-4G Wild Weasel Squadrons

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
327B F-4G WW Sqs	4,487	2,000	* 0	0	59,226
3779 F-WW	0	1,149	* 0	Cont	TBD
Total	4,487	3,149	* 0	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This element provides funds for the development and support of the Air Force's manned lethal defense suppression weapon system(s). The F-4G Wild Weasel is the sole operational, destructive, defensive suppression weapon system currently in the Air Force inventory. It provides man-in-the-loop capability to detect, identify, locate, and destroy the radars supporting hostile surface-to-air missile (SAM) systems. F-4G armaments consist of anti-radiation missiles, standoff guided munitions, and conventional F-4 weapons. F-4G Initial Operational Capability (IOC) was achieved on 1 April 1979. The requirement for a Follow-on Wild Weasel (F-WW) weapon system, TAF Statement of Operational Need 305-86, was validated on 4 November 1987. The basis of this requirement is the need to maintain a supportable, flexible and effective destructive capability against enemy SAM system radars throughout and beyond the 1990s.

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

1. (U) Project: 327B, F-4G Wild Weasel Squadrons:
The APR-38 Radar Warning and Attack System is the backbone of the F-4G Wild Weasel. As signal complexity and density increased due to the fielding of new threat systems, the need to improve the F-4G Wild Weasel weapon system was evident. The APR-38 Performance Update Program (PUP) and F-4G/F-16 Targeting Modem for the hunter/killer scenario respond to this requirement. The R&D effort is to update the capabilities of the F-4G so it can contend with the exotic threat radars of the SAM systems being deployed now and through the 1990's.

(U) FY 1989 Accomplishments:
- (U) Completed production delivery of WASP computers FY 4/89.
- (U) Completed tasks resulting from PUP Phase II termination.
- (U) WASP program management transferred - FY 2/89.
- (U) APR-38 redesignated APR-47 due to WASP installation.

Program Element: # 0207136F Budget Activity: # 4 - Tactical Programs
Title: F-4G Wild Weasel Squadrons

(U) FY 1990 Planned Program:
- (U) Full operational capability of APR-47/WASP - FY 1/90
- (U) Initiate APR-47 frequency extension improvement.
- (U) Trial installation of F-4G/F-16 Targeting Modem into F-4G.
- (U) Develop technical data package for F-4G airframe integration.
- (U) Initial purchase of F-4G/F-16 Targeting Modem.
- (U) Identify support equipment for Targeting Modem.

(U) FY 1991 Planned Program:
- (U) Initial test and evaluation of F-4G/F-16 Targeting Modem.
- (U) Complete development of improved support equipment for the APR-47/F-4G.
- (U) Complete APR-47 frequency extension development - FY 3/91.
- (U) APR-47 frequency extension, trial installation - FY 4/91.

(U) WORK PERFORMED BY: McDonnell Douglas, St Louis MO, is the primary contractor for the F-4G Wild Weasel Performance Upgrade Program (PUP). Sperry Univac, Minneapolis MN, is producing the PUP Phase I, WASP computer. Air Force Systems Command is responsible for development. Odgen Air Logistics Center UT is responsible for management and installation of the subsystems into the F-4G aircraft.

(U) RELATED ACTIVITIES:
- (U) PE 0604270F (Electronic Warfare Development).
- (U) PE 0207313F (Imaging Infrared Maverick)
- (U) PE 0207126F (High Speed Anti-Radiation Missile).
- (U) PE 0207133F (F-16 Squadrons).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands): None.

Program Element: # 0207136F Budget Activity: # 4 - Tactical Programs
PE Title: F-4G Wild Weasel Squadrons

2. (U) Project: 3779, Follow On Wild Weasel:
OUSD(A) mission area #224, Defense Suppression, highlights the responsibility of the Tactical Air Forces (TAF) to develop and maintain the Electronic Combat (EC) mix required to contain friendly air attrition rate to less than [ ] and less than [ ] for the duration of a conflict. A key element of the current Defense Suppression mix is the F-4G Wild Weasel aircraft which provides a manned lethal defense suppression capability. The F-4G Wild Weasel aircraft has a dedicated mission of real time attack against mobile/fixed, land and sea based, enemy radar-guided SAM systems. The F-4G weapon system's service life is due to end in the 1998-2004 time frame which will cause a shortfall in the Air Force's lethal defense suppression capability. A Weapon System must be developed and fielded in time to offset this shortfall.

Threat base for lethal defense suppression includes the existing [

(U) FY 1989 Accomplishments:
- (U) Establish a program office.
- (U) Define and initiate studies to examine/evaluate system concepts for accomplishing lethal Defense Suppression in 1995-2005 time frame.
- (U) Perform force mix studies to evaluate roles and missions and the cost effectiveness of manned/unmanned platforms.

(U) FY 1990 Planned Program:
- (U) Continue system concept studies/evaluation.
- (U) Continue program Phase 0 documentation requirements.

(U) FY 1991 Planned Program:
- (U) Continue program Milestone 0 documentation requirements.
- (U) Update system concept, acquisition strategy and other program documents.

Program Element: # 0207136F Budget Activity: # 4 - Tactical Programs
PE Title: F-4G Wild Weasel Squadrons

(U) WORK PERFORMED BY: Air Force Systems Command's Aeronautical Systems Division, Dayton OH, is the developing activity. Air Force Studies and Analysis, Washington DC, and Air Force Electronic Warfare Center, San Antonio TX, are performing operational assessments of various system concepts and force mixes. Ball Systems Inc., San Diego CA, is performing system concept evaluation studies.

(U) PROGRAM DOCUMENTATION:
- (U) Defense Guidance section III subsection I, Force Modernization paragraph 3b.
- (U) OUSD(A) Mission Area #224, Defense Suppression.
- (U) TAF SON 305-86, 4 Nov 87.
- (U) Program Decision Memorandum, 14 Jul 88.
- (U) TAF SORD 305-86-I-A, 13 Aug 89.
- (U) AF/CC 301855Z Jan 90 Msg (S); Subj: Lethal Defense Suppression (U).

(U) RELATED ACTIVITIES:
- (U) PE 0207316F, Tacit Rainbow.
- (U) PE 0604242F, Advanced Tactical Aircraft.
- (U) PE 0603109F, INEWS/ICNIA.
- (U) PE 0207162F, High Speed Anti-Radiation Missile.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands): None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207162F Budget Activity: #4 - Tactical Programs
PE Title: Tactical Air-to-Ground Missiles

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2330 High Speed Antiradiation Missile	3,881	2,485	509	-0-	44,019

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element supports two upgrades to the High Speed Antiradiation Missile (HARM) guidance section: Block III and Block IV. The Block III upgrade, baseline for HARM C (Block IV and Lower Cost Seeker (LCS)), will correct system deficiencies, refine guidance, and provide increased capabilities against current threats. HARM Block IV will address antenna, receiver, and video processor hardware and software changes to the HARM guidance section improving HARM's performance against the increased sophistication, concentration, and lethality of enemy ground based guided missile and antiaircraft artillery systems that threaten the ability of tactical aviation to accomplish its mission and survive. Block IV and LCS are interchangeable, and are in direct competition for HARM C production contracts beyond fiscal year 1992.

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

1. (U) Project 2330, HARM:

(U) FY 1989 Accomplishments:
- (U) Completed Block IV Contractor Test and Evaluation (31 captives, 5 firings).
- (U) Started Block IV Development Test (DT).
- (U) Continued Block III DT/IOT&E.

(U) FY 1990 Planned Program:
- (U) Block III - complete combined DT/IOT&E testing (163 captive flights and 9 firings).
- (U) Block IV - complete DT (151 captives, 8 firings). Complete delivery of pre-production missile (PPM) seekers. Start IOT&E (8 firings).
- (U) Develop and test support equipment hardware and software updates.

Program Element: #0207162F Budget Activity: #4 - Tactical Programs
PE Title: Tactical Air-to-Ground Missiles

(U) FY 1990 Planned Program:
- (U) Block IV - Complete DT-IIIB testing (151 captives, 8 firings). Start OT-III(IOT&E) (8 firings)

(U) FY 1991 Planned Program:
- (U) Block III - Conduct OT-IIIB testing (12 captive flights, 6 firings).
- (U) Block IV - Develop support equipment updates. Complete OT-III(IOT&E).

(U) Work Performed By: The Air Force program management is provided by the Munitions Systems Division, Eglin AFB FL. Government facilities used include the following: Aeronautical Systems Division, Wright-Patterson AFB OH; Naval Weapons Center, China Lake CA; Pacific Missile Test Center, Pt Mugu CA; and the Air Force Flight Test Center, Edwards AFB CA. Air Force participation in joint operational testing will be conducted by the Air Force Operational Test and Evaluation Center, Kirtland AFB NM. The prime contractor for this effort is Texas Instruments, Incorporated, Dallas TX.

(U) Related Activities:
- (U) Program Element #0603320F, Lower Cost Antiradiation Seekers
- (U) Program Element #0207317F, HARM Improved Seeker
- (U) Program Element #0207136F, F-4G Wild Weasel Squadrons.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Missile Procurement (BA 4, P-1 Line Item N/A)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	221,945	67,902	0	*1,070,249	3,088,500
Quantity	893	326	0	4820	9622

*AF Procurement of Block IV begins in FY92.

(U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207163F Project Number: 3777
PE Title: Advanced Medium Range Air-to-Air Missile Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: AMRAAM Pre-Planned Product Improvement (P3I)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
AMRAAM P3I	0	14,929	25,516	155,167	195,612

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The current Air Force/Navy developed AMRAAM responded to an urgent need of the US and NATO Tactical Air Forces which required a high performance missile to help compensate for the numerical advantage of Warsaw Pact fighter/interceptor aircraft. The AMRAAM Pre-Planned Product Improvement (P3I) program provides for a research and development program which enhances the missile's capability and operational flexibility against new projected threats, maximizes its compatibility with advanced fighters, incorporates high payoff technology developments, and investigates new variants and/or alternate missions that can utilize many of the current AMRAAM attributes.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments: Not applicable.

2. (U) FY 1990 Planned Program:
   - (U) Initiate ATF compatibility improvements for compressed carriage.
   - (U) Initiate Electronic Counter-Countermeasure (ECCM) upgrade to counter emerging threat countermeasures improvements.
   - (U) Initiate a variable flow ducted rocket system engineering study to address advanced propulsion requirements.

3. (U) FY 1991 Planned Program:
   - (U) Continue development of improvements started in FY 1990.
   - (U) Provide for proof of manufacture (POM) and qualification hardware for subsystem testing, missile integration, and system level testing.
   - (U) Continue study and analysis work to prepare other P3I projects for FSD start as appropriate.

4. (U) Program to Completion:
   - (U) Complete missile upgrade projects begun in FY 1990.
   - (U) Define and pursue additional changes in areas such as propulsion, ordnance, guidance, and ECCM required to enable the missile to counter the evolving threat.

Program Element: #0207163F | Project Number: 3777
PE Title: Advanced Medium Range Air-to-Air Missile | Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY: This project is managed by the AMRAAM Joint System Program Office at the Munitions Systems Division, Eglin AFB FL. Hughes Aircraft Company, Canoga Park CA was the FSD contractor. Production contracts have been awarded to Hughes Aircraft Company, Tucson AZ and Raytheon Company, Bedford MA. Hughes and Raytheon have formed a team to perform the AMRAAM P3I FSD effort. A contract will be awarded to Hughes with Raytheon as subcontractor (project associate). Production competition will be retained.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: No change.
2. (U) SCHEDULE CHANGES:
   (A) (U) Initial Operational Capability (IOC) — April 1990
   Change explanation: Missile deliveries have been delayed due to manufacturing delays and to incorporate fixes resulting from the flight test porgram. The F-15 radar computer program was also updated to incorporate fixes identified through the AMRAAM test program.
   (B) (U) Milestone IIIB (Full Rate Production Decision) — May 1990
   Change explanation: The date for DAB IIIB has been changed to complete the Stage 3 Captive Carriage Reliability Program and demonstrate at least a 200 hour Mean Time Between Maintenance (MTBM) reliability.
   (D) (U) P3I Missile Free Flight Test Initiated — 2nd Qtr 1993
   Change explanation: More detailed schedule estimate caused a slip of the planned date for the first free flight test.
   (E) (U) P3I First Production Delivery (Lot VIII Block Change) — 2nd Qtr 1995
   Change explanation: Change due to change in acquisition strategy to Block incorporations, an expansion of flight testing, and a re-assessment of production leadtimes.
3. (U) COST CHANGES: Total RDT&E program cost increase for AMRAAM P3I program (+ $6.9 million) is due to incorporation of revised economic escalation rates.

F. (U) PROGRAM DOCUMENTATION:

- (U)	JSOR (USAF ROC 9-76)	Sep 78
- (U)	MENS	Nov 78
- (U)	SOC	Jul 86
- (U)	DCP	Apr 87
- (U)	STAR	Feb 89
- (U)	TEMP	Mar 89

G. (U) RELATED ACTIVITIES:
- (U) AMRAAM integration with the following programs:
  PE #0207130F, F-15
  PE #0207133F, F-16
  PE #0603230F, #0604239F, Advanced Tactical Fighter
  PE #0205667N, F-14

Program Element: #0207163F Project Number: 3777
PE Title: Advanced Medium Range Air-to-Air Missile Budget Activity: #4 - Tactical Programs

PE #0204136N, F/A-18
PE #0604314N, AMRAAM (Navy RDT&E)
PE #0204162N, AMRAAM (Navy Proc)
PE #0205138M, AMRAAM (Navy Proc)

- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990* Estimate	FY 1991 Estimate	To Complete	Total Program
Missile Procurement (BA 4, P-1 Line Item 17):					
Cost	801,117	698,612	915,487	6,008,827	9,955,576
Quantity	874	815	1,250	13,589	17,108

* Includes $4.667 million and 12 missiles funded in PE 0207590F, SEEK EAGLE

2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: No cooperative agreements with Foreign Nationals exist at this time for a P3I version of the AMRAAM Missile System. However, under PE 0604314F (AMRAAM FSD), the governments of the Federal Republic of Germany (GE), the United Kingdom (UK), and the United States (US) signed a Memorandum of Understanding (MOU) during August 1980 concerning the research, development and production of a Family of Advanced Air-to-Air Missile Systems. Under the MOU, the US would develop and produce the Advanced Medium Range Air-to-Air Missile (AMRAAM) system, and Europe would develop and produce the Advanced Short Range Air-to-Air Missile (ASRAAM) system. Under the MOU, GE and UK may establish their own production line, coassemble the missile, or buy through Foreign Military Sales (FMS) to acquire the AMRAAM. The Federal Republic of Germany has formally withdrawn from the MOU; however, the aircraft integration work and FMS purchases of inventory weapons are underway.

J. (U) MILESTONE SCHEDULE:

1. (U)	Awarded Full Scale Development contract	December 1981
2. (U)	Milestone IIIA (Low Rate Initial Production)	June 1987
3. (U)	Initial Operational Capability	April 1990
4. (U)	Milestone IIIB (Full Rate Production)	May 1990
5. (U)	Award Initial AMRAAM P3I Contracts	2nd Qtr 1990
6. (U)	P3I Missile Free Flight Test Initiated	2nd Qtr 1993
7. (U)	P3I First Production Delivery (Lot VIII Block change)	2nd Qtr 1995
8. (U)	Final Production Deliveries (Lot XII)	3rd Qtr 2000

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207215F
PE Title: TR-1 Squadrons
Project Number: 3314
Budget Activity: #4 - Tactical Programs

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

Project Title TR-1

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
TR-1	99,115	110,710	54,764	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The TR-1 Tactical Reconnaissance System provides the United States and allied forces in the NATO Central Region with near-real-time battlefield surveillance using [ ] the Advanced Synthetic Aperture Radar System (ASARS-2) imaging radar carried aboard the TR-1 aircraft. The resulting intelligence gives tactical commanders the ability to attack or otherwise react to enemy activities [ ] deep inside enemy territory. TR-1 sensor data will be processed and exploited in the TR-1 Ground Station (TRIGS) located in a hardened bunker [ ] and in a northern ground station [ ] TRIGS and the northern ground station will replace the [ ] above ground prototype station [ ] The TR-1 program develops TRIGS and northern ground station segments and integrates them into a warfighting capability. These segments provide mission planning and control, communications, and imagery processing and exploitation. The two ground stations will also coordinate various sensor exploitation segments to form an integrated battlefield reconnaissance system.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Construction began on the NATO-funded TRIGS bunker.
   - (U) Major hardware procurement and assembly continued.
   - (U) The ASARS Processing Segment finished acceptance tests and began integration at the prime contractor's facility.
   - (U) The program restructure contract was awarded to resynchronize the hardware and bunker deliveries, and to ensure the hardware is adequately tested in CONUS before shipment to the FRG.
   - (U) A study to investigate using Enhanced Moving Target Indication in TRIGS was initiated.

2. (U) FY 1990 Planned Program:
   - (U) TRIGS bunker construction will continue.
   - (U) System level TRIGS integration will start at the contractor's facility with delivery of the communications, imagery exploitation, [ ]
   - (U) CONUS flight testing of all TRIGS operational segments will begin at the contractor's facility.

3. (U) FY 1991 Planned Program:
   - (U) TRIGS bunker construction will finish.
   - (U) CONUS flight tests will finish, and the system will be shipped overseas.
   - (U) TRIGS system installation in the bunker will commence.
   - (U) Hardware procurement will start for the northern ground station.

4. (U) Program to completion:
   - (U) The first TRIGS will achieve initial operational capability in [redacted]
   - (U) The northern ground station will achieve initial operational capability by [redacted] Currently, options are being explored to allow limited operations in [redacted]
   - (U) AFOTEC will conduct TRIGS operational testing after TRIGS initial operational capability, and deficiencies will be corrected in the out-years.

D. (U) WORK PERFORMED BY: The program office is the Air Force Aeronautical Systems Division, Wright-Patterson AFB OH. The TRIGS prime contractor is Ford Aerospace Corp., San Jose CA. The ASARS-2 contractor is Hughes Radar Systems Group, Culver City, CA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) TAF ROC 315-75, All Weather Target Acquisition System, 9 April 1975, revised 3 May 1977 (S).
   - (U) Mission Element Need Statement for Continuous Battlefield Standoff Surveillance 6 August 1979 (S/NOFORN).

G. (U) RELATED ACTIVITIES:
   - (U) Side-Looking Airborne Radar (SLAR), Program Element 0604756F. Funds the airborne radar system and ground processing equipment.
   - (U) [redacted]
   - (U) US Army Tactical Radar Correlator (TRAC), Program Element 0604740D662, procurement line BA0329. May procure (with Air Force-provided funds) the ASARS-2 ground processor. The Air Force and the Army are studying the merits of this procurement strategy.
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
1. (U) Aircraft Procurement BA04				
- (U) BP11 and BP16 Funds	21,135	22,751	35,148	Continuing
- (U) BP19 Funds	0	10,431	8,255	Continuing
- (U) Total	21,135	33,182	43,403	Continuing
- (U) Quantity	0	0	0	23
(All aircraft already delivered, funds are for modifications)				
(U) Other Procurement BA04				
- (U) Funds	0	11,655	0	Continuing
- (U) Quantity	0	0	0	2
2. (U) Military Construction BA04				
- (U) Funds	4,432	3,900	0	46,796

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The US Air Force signed a memorandum of understanding[ ] to ensure the TR-1 system is interoperable with related[ ] systems.

J. (U) MILESTONE SCHEDULE:

1. (U) First TR-1 Contract	November 1979
2. (U) Prototype Ground Station Contract Award	July 1981
3. (U) First TR-1 Delivered	September 1981
4. (U) ASARS-2 Operational Evaluation	November 1982
5. (U) ASARS-2 Production Award	September 1983
6. (U) Prototype Ground Station Delivery to Germany	August 1985
7. (U) TRIGS Initial Operational Capability	[redacted]
8. (U) TR-1 Northern Ground Station Initial Operational Capability (may be accelerated)	[redacted]

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207217F Budget Activity: #4 - Tactical Programs
PE Title: Follow-on Tactical Reconnaissance System

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3201 Tactical Air Reconnaissance System	45,867	45,650	33,948	Cont	TBD
3364 Joint Services Imagery Processing System	13,930	19,200	13,300	Cont	TBD
Total	56,797	64,850	47,248	Cont	TBD

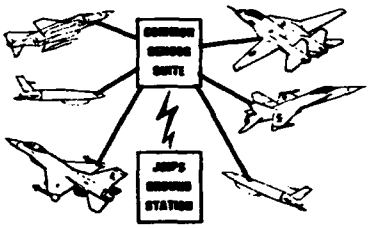
B. (U) BRIEF DESCRIPTION OF ELEMENT: The Follow-on Tactical Reconnaissance System (FOTRS) is an umbrella concept made up of an airborne portion called the Advanced Tactical Air Reconnaissance System (ATARS) and a ground portion called the Joint Services Imagery Processing System (JSIPS). The program's primary objective is the upgrade of USAF, USN, and USMC tactical penetrating reconnaissance systems. The USAF portion of ATARS consists of Project 3201, Tactical Air Reconnaissance System (TARS). The JSIPS portion is known as Project 3364. TARS focuses on full-scale development of a family of common electro-optical (EO) sensor suites (sensors, data-link, recorders, and management system) for upgrade of USAF, USMC, and USN manned and unmanned reconnaissance systems. TARS equipment will be used as the reconnaissance payload for the USAF, USN, USMC Medium-Range Unmanned Aerial Vehicle (UAV-MR). The Navy will upgrade the USMC F/A-18D and USN F/A-18C with TARS. JSIPS focuses on the development of an all-Service ground exploitation system capable of receipt, processing, and exploitation of multi-sensor tactical imagery (EO/IR/radar). The ground station will have commonality with Air Force, Navy, and Marine Corps manned and unmanned systems.

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FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207217F
PE Title: Follow-on Tactical Reconnaissance System
Project Number: 3201
Budget Activity: #4 - Tactical Programs

Project Title: Tactical Air Reconnaissance System



POPULAR NAME: TARS

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 19898	FY 1990	FY 1991	To Complete
Program Milestones	N/A	N/A	Production Decision	Field System
Engineering Milestones	PDR and CDR	Engineer. Model Deliv	Qualif. Testing	N/A
T&E Milestones	N/A	N/A	DT&E Start/ Complete	IOT&E Start/ Complete FY 92
Contract Milestones	N/A	N/A	N/A	Complete FSD
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	43,919	37,300	29,749	Continuing (TBD)
Support Contract	264	2,470	1,280	Continuing (TBD)
In-House Support	389	1,800	1,500	Continuing (TBD)
GFE/ Other	1,295	4,080	1,419	Continuing (TBD)
Total	45,867	45,650	33,948	(TBD)

Program Element: #0207217F Project Number: 3201
PE Title: Follow-on Tactical Reconnaissance System Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The Tactical Air Reconnaissance System (TARS) is a full-scale development (FSD) project which meets the needs of tactical commanders for responsive and timely location and classification of tactical targets. This project focuses on the development of a family of common electro-optical (EO) sensor suites (sensors, data link, recorders and reconnaissance management system) to upgrade USAF, USMC, and USN manned and unmanned reconnaissance systems. The Air Force will integrate TARS sensor suites into the Medium-Range Unmanned Aerial Reconnaissance Vehicle (UAV-MR). The RF-4C will be used as a test vehicle for TARS sensor validation tests.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Preliminary Design Review completed in Oct 88.
   - (U) Prime contractor initiates fabrication and assembly efforts
   - for engineering models.
   - (U) Contractor initiated development of support equipment.
   - (U) Critical Design Review began in Sept 89.

2. (U) FY 1990 Planned Program:
   - (U) Critical Design Review action items closed out 1 Feb 90.
   - (U) Nine engineering models to be delivered.
   - (U) Integration into platform begins.

3. (U) FY 1991 Planned Program:
   - (U) Flight test begins.
   - (U) Production decision.
   - (U) Start/Complete DT&E.

4. (U) Program to Completion:
   - (U) Enter into production.
   - (U) System fielded.

D. (U) WORK PERFORMED BY: The contractor for EO sensor suite development is Control Data Corporation, Minneapolis MN. The Sub-contractor for data link development is Unisys Corp., Salt Lake City UT. The Aeronautical Systems Division, Wright-Patterson AFB OH, has in-house management responsibility for system development.

Program Element: #0207217F | Project Number: 3201
PE Title: Follow-on Tactical Reconnaissance System | Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH AMENDED FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON, 7 Aug 79
- (U) MENS, May 81
- (U) JMENS, Mar 82
- (U) SDDM, 30 Mar 87
- (U) TEMP, 20 Nov 87
- (U) TAF SON, 18 Dec 87
- (U) PDM, 14 Jul 88

G. (U) RELATED ACTIVITIES:
- (U) USAF/USN Memorandum of Agreement on unmanned air reconnaissance vehicle.
- (U) Joint Program Office for Unmanned Air Vehicles. DOD Joint Unmanned Air Vehicle Program, PE 030514D.
- (U) PE 0204136N, F/A-18.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Federal Republic of Germany Foreign Military Sales for study and subsequent integration of Tactical Air Reconnaissance System (TARS) sensors into FRG RF-4cs.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
N/A	N/A	N/A

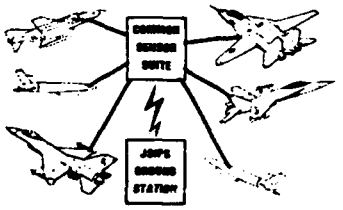
T&E ACTIVITY (TO COMPLETION)

Event	Date	Remarks
DT&E	Start/Complete FY 1991	None
IOT&E	Start/Complete FY 1992	None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207217F
PE Title: Follow-on Tactical Reconnaissance System
Project Number: 3364
Budget Activity: #4 - Tactical Programs

Project Title: Joint Services Imagery Processing System



POPULAR NAME: JSIPS

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	N/A	Prod Decision Sept 91	Field System
Engineering Milestones	Crit Des Review	Qualif Testing	N/A	N/A
T&E Milestones	Test Ready Review-DT&E Initiated	Complete DT&E	Start IOT&E	Complete IOT&E
Contract Milestones	N/A	N/A	Complete FSD	Production Options
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	11,630	12,500	7,500	Continuing (TBD)
Support Contract	2,000	4,100	4,100	Continuing (TBD)
In-House Support	300	2,600	1,700	Continuing (TBD)
GFE/ Other	0	0	0	Continuing (TBD)
Total	13,930	19,200	13,300	(TBD)

Program Element: #0207217F Project Number: 3364
PE Title: Follow-on Tactical Reconnaissance System Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: JSIPS provides a transportable tactical capability to receive, process, and exploit, in softcopy or hardcopy, [ ] JSIPS will provide the Tactical Air Reconnaissance System (TARS) project with a ground station using modular, exportable technology. Designed to meet the Tactical commander's need for timely and responsive imagery for the detection, location and classification of tactical targets, JSIPS will replace the present photo processing and interpretation facilities associated with the RF-4C. JSIPS will support TARS sensor-equipped manned platforms and the Medium-Range Unmanned Air Vehicle (UAV-MR). [| As part of a multi-Service program, JSIPS also supports the USMC All Source Imagery Processor and the Army Imagery Processing and Dissemination Processing System requirements.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Critical Design Reviews (CDR) of various segments.
   - (U) Began JSIPS integration.
   - (U) Began joint testing of the Air Force, Army and Marine Corps Engineering Models.

2. (U) FY 1990 Planned Program:
   - (U) Critical Design Review of final segment and begin system CDR.
   - (U) Continue testing.
   - (U) Complete DT&E

3. (U) FY 1991 Planned Program:
   - (S) Production decision [ ]
   - (U) Continue testing [ ]
   - (U) Start IOT&E

4. (U) Program to Completion:
   - (U) Complete testing [ ]
   - (U) Begin fielding JSIPS.

D. (U) WORK PERFORMED BY: The contractor for full-scale development of JSIPS is E-Systems, Garland TX. Electronic Systems Division, Hanscom AFB MA, has responsibility for in-house management.

Program Element: #0207217F | Project Number: 3364
PE Title: Follow-on Tactical Reconnaissance System | Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: Program restructured to compensate for FY 89 funding shortfall.
2. (U) SCHEDULE CHANGES: Restructure of program caused slip in production decision from Jan 90 to Sep 91.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) SOC, Jan 87
- (U) Temp, Nov 87
- (U) Son, USAF 002-85, Feb 88

G. (U) RELATED ACTIVITIES:
- (U) MOA with USA and USMC on JSIPS. PE 060373A and PE 0604718M.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
N/A	N/A	N/A

T&E ACTIVITY (TO COMPLETION)

Event	Date	Remarks
DT&E	Complete FY 1991	None
IOT&E	Start FY 1991/Complete FY 1992	None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0207247F Budget Activity: #4 - Tactical Programs
PE Title: Air Force TENCAP

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0001 TENCAP	4822	335	346	Cont	TBD
Total	4822	335	346	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program responds to 1977 Congressional direction. The main objective is to develop procedures, tactics and interface equipment/software to demonstrate the tactical use of [ ] within an operational combat framework and to influence the design and operation of [ ] capabilities to improve tactical support.

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

1. (U) Project 0001, TENCAP: Efforts include participating in tactical exercises, prototyping software/hardware for interfacing with existing C3I and combat support systems, conducting conceptual studies, and preparing Tactical Impact Statements for [

(U) FY 1989 Accomplishments:

- (U) Deployed prototype single channel CONSTANT SOURCE systems (a small ruggedized transportable UHF receive and exploitation system to provide [ ]
- (U) Continued prototype development of an airborne qualified CONSTANT SOURCE system nomenclated the Multi-mission Advanced Tactical Terminal (MATT).
- (U) Continued study of methods to locate relocatable targets.
- (U) Identified requirements for use of multi-spectral imagery.
- (U) For Special Project Quiet Sunset, developed software and interface connectivity to evaluate the application of [

Program Element: # 0207247F Budget Activity: #4 - Tactical Programs
PE Title: Air Force TENCAP

(U) FY 1990 Planned Program:
- (U) Continue prototype development and testing of the MATT.
- (U) Refine software integration of multiple [products for [
- (U) For BRIGHT STAR exercise, develop a prototype CONSTANT SOURCE terminal capable of [
- (U) Participate in Joint Army/USAF exercise to evaluate the application of [

(U) FY 1991 Planned Program:
- (U) [
- (U) Participate in JCS Special Project (a joint TENCAP exercise with location and specific objectives TBD).
- (U) Investigate/evaluate the utility of integrating
- (U) Develop Tactical Impact Statements/assessments on new and/or upgraded [

(U) Work Performed By: Air Force management of this effort is under the Air Force Deputy Chief of Staff for Plans and Operations, Headquarters USAF, Washington, DC.

(U) Related Activities:
- (U) Program Element #0305159I, Defense Reconnaissance Support Program
- (U) Program Element #0305158F, CONSTANT SOURCE
- (U) Program Element #0304111F, Special Activities
- (U) Program Element #0301313F, Defense Dissemination System
- (U) TENCAP formally interfaces with numerous national programs/agencies, the Major Commands and their components, the Air Staff, Office of the Secretary of Defense, Secretary of the Air Force, and the other Services in order to effectively influence the designs and concepts of the [
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

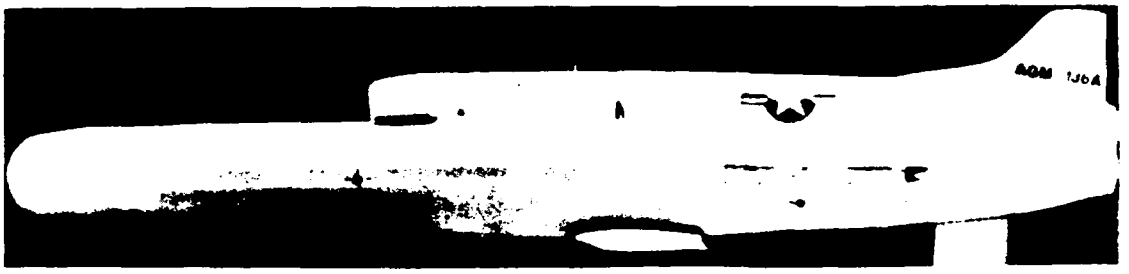
(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207316F
PE Title: Tacit Rainbow
Project: N/A
Budget Activity: #4 - Tactical Programs

Project Title: Tacit Rainbow



POPULAR NAME: Tacit Rainbow

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	PPV award Mar 90	DAB IIIA Nov 90	DAB IIIB 3Q FY 93
Enginerng Milestones	N/A	N/A	N/A	N/A
T&E Milestones	DT&E/IOT&E start Mar 89	DT&E/IOT&E ends Sep 90	N/A	FOT&E starts 3Q FY 92
Contract Milestones	Ongoing	FSD ends Sep 90	Lot I award Mar 91	1st PPV deliv 2Q FY 92
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total* (To Complete)
Major Contract	25,651	14,725	4,449	116,722* (0)
Support Contract	5,172	831	700	8,387* (0)
In-House Support	1,738	2,300	1,747	14,632* (905)
GFE/ Other	6,563	3,141	2,863	16,782* (0)
Total	39,124	20,997	9,759	156,523* (905)

*Does not include FY 1987 and prior funding from a classified Program Element

Program Element: #0207316F
PE Title: Tacit Rainbow

Project: N/A
Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Services have an urgent need for a low-cost, programmable, loitering missile system that can search out and attack emitting enemy radars and jammers. The Tacit Rainbow (TR) missile will meet this requirement and provide commanders with a weapon that can defeat/suppress the enemy's ability to acquire and attack friendly forces and jam friendly emitters. Both air and ground launch variants will be developed; maximum commonality of components between the variants is required. The system must interface with existing and planned command, control, communications, and intelligence (C^3I) elements to be compatible with individual and Joint Service employment concepts. Air launch TR vehicles will be launched from Air Force B-52 aircraft. The Army will launch the ground launch variant from the Multiple Launch Rocket System (MLRS). Using simplified seeker and guidance techniques and state-of-the-art technology, this autonomous loitering weapon system is designed to produce a viable emitter attack capability at a cost significantly less than other anti-radiation attack weapon systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued FSD and began the Air Force and Navy combined DT&E/IOT&E test program using the B-52G and A-6E.
   - (U) Continued development of the mission planning software which will reside on the Strategic Air Command's Conventional Mission Planning and Production System (CMPPS).

2. (U) FY 1990 Planned Program:
   - (U) Continue development and begin testing of the mission planning system.
   - (U) Integrate TR with a new version of the B-52G flight management software.
   - (U) Start a pre-production verification effort to build test assets for FY 1992 testing and proof the production line.

3. (U) FY 1991 Planned Program:
   - (U) Continue testing of the mission planning system.
   - (U) Make the Milestone IIIA low rate initial production decision for the missile.
   - (U) Award the Lot 1 production contract.

4. (U) Program to Completion:
   - (U) Conduct Follow-on Test and Evaluation with the B-52G in FY 1992.
   - (U) The Milestone IIIB full rate production decision is planned for 3Q FY 1993.
   - (U) Develop seeker upgrades needed to meet an expanded target base.
   - (U) The Air Force plans to buy a total of [ ] air launch vehicles.

Program Element: #0207316F
PE Title: Tacit Rainbow
Project: N/A
Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY: Northrop Corporation, Ventura Unit, Thousand Oaks CA was selected as the prime contractor for Full Scale Development and initial production of the air launch vehicles. The production facility is located in Perry GA. Other major contractors are: Texas Instruments, Dallas TX for the seeker; Williams International, Walled Lake MI for the engine; and Delco Electronics, Goleta CA for the mission computer. The Raytheon/McDonnell Douglas/E-Systems team is the second source producer. The Tacit Rainbow development and acquisition program is being managed by the Joint Tactical Autonomous Weapons Program Office at the Aeronautical Systems Division, Wright-Patterson AFB, OH. Other government organizations participating in the development effort include Air Force Tactical Air Command, Langley AFB VA; Air Force Strategic Air Command, Offutt AFB NE; Air Force Logistics Command, Wright-Patterson AFB OH; Warner-Robins Air Logistics Center, Robins AFB GA; Naval Air Systems Command, Washington DC; Naval Weapons Center, China Lake CA; Army Materiel Command, Washington DC; Army Missile Systems, Redstone Arsenal AL; and Dugway Proving Ground UT.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Delay in DT&E/IOT&E testing slips planned delivery of 1st production missile by one year.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) TEMP, Jul 87 (S)
- (U) JSOR, Dec 88 (S)

G. (U) RELATED ACTIVITIES:
- (U) TR is a Tri-Service program with the Air Force as the Executive Service. Army and Navy personnel are integrated into the Joint System Program Office (JSPO). TR is DOD's weapon of choice to meet all three Services' requirements for a loitering anti-radiation missile. The Navy has cancelled plans to procure air launch TR missiles.
- (U) The air launch TR vehicle is compatible with Air Force and Navy aircraft suspension equipment and multiple carriage bomb racks.
- (U) Funding for Navy peculiar Full Scale Development (FSD) is in Program Element #0207316N.
- (U) Full Scale Development of ground launch TR is funded by the Army in Program Element #0207316A.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0207316F
PE Title: Tacit Rainbow

Project Number: N/A
Budget Activity: #4 - Tactical Programs

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. (U) PROCUREMENT:					
(U) Aircraft Procurement (launchers)					
(U) Funds	24,917	0	29,300	106,800	161,017
(U) Quantity	0	0	6	25	31
(U) Missile Procurement					
(U) Funds	70,490	0	231,300	3,388,810	3,690,600
(U) Quantity					
2. (U) MILITARY CONSTRUCTION:					
(U) Funds	5,600	0	1,460	0	7,060

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Contractor Development Testing	Mar 87 - Mar 89	2 out of 4 flights successful
DT&E/IOT&E	Mar 89 - Present	9 flights to date -- 5 successes, 4 partial successes

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Complete DT&E/IOT&E	Sep 90	Conduct remaining flights (25 flights total)
FOT&E (1)	3Q FY92 - 3Q FY93	FOT&E on B-52G in support of Milestone IIIB

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207411F Budget Activity: #4 - Tactical Programs
PE Title: Overseas Air Weapon Control System

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2704 EIFEL Follow-on	5,207	1,387	2,311	Cont	TBD
Total	8,912*	1,387	2,311	Cont	TBD

* Funds were reprogrammed into this Program Element in FY89 for the Warrior Prep Center in USAFE. These funds were not spent on EIFEL and were a one-time reprogramming ($3.705M).

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Elektronisches Information und Fuhrungsystem fur die Einsatzbereitschaft der Luftwaffe (EIFEL) system satisfies the requirement for an automated command and control system for the United States Air Force-operated Allied Tactical Operations Center (ATOC) at Sembach AB, GE. Under the EIFEL Follow-On (EFO) effort, the US Air Force will cooperate with the Federal Republic of Germany, Belgium, the Netherlands, and the United Kingdom in the joint development of a follow-on system to replace the current system (EIFEL I)fielded in the mid-1970s. In addition to replacing the EIFEL I system, improvements are being developed which will fully integrate the EFO system with other systems in the ATOC, leading to a more effective battle management capability for the 17AF Commander.

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

1. (U) Project 2704, EIFEL Follow-On:
Replacement of the EIFEL I system, full integration of command and control systems within the ATOC.

(U) FY 1989 Accomplishments:
- (U) Upgraded ATOC and EIFEL central processo
- (U) Continued software development.
- (U) Upgraded ATOC Local Area Net for better EIFEL compatibility.

(U) FY 1990 Planned Program:
- (U) Continue software development, integration and testing.
- (U) Install EIFEL I Lifetime Extension (EILE).
- (U) Interface EILE with the Force Level Advanced Planning System.

(U) FY 1991 Planned Program:
- (U) Install EFO, transition from EILE to EFO.
- (U) Interface EFO with FLAPS.
- (U) Develop an interface between EIFEL and the Wing Command and Control System (WCCS).
- (U) Develop computer aided instruction training packages.

Program Element: #0207411F Budget Activity: #4 - Tactical Programs
PE Title: Overseas Air Weapon Control System

(U) Work Performed By: The German Dornier Corporation and its subcontractor, Computer Sciences International, Deutschland, are developing the EIFEL system software.

(U) Related Activities:
- (U) Program Element #0207415F, USAFE Command and Control System is developing the Wing Command and Control System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: A Memorandum of Understanding (MOU) between the United States and the Federal Republic of Germany was signed in June 1986 for the cooperative software development and implementation of the EIFEL Follow-On system. Under this agreement, total US contribution will not exceed 50 million Deutsch Marks. The MOU was supplemented in June 1988 to include the United Kingdom, Belgium, and the Netherlands. The accompanying Financial Agreement defines each nation's liability as a percentage of the total contract cost within the cap set by the MOU.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207412F
PE Title: Tactical Air Control System Improvements
Project Number: N/A
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: TACS Improvements

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
TACSI	13,080	17,212	17,075	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Tactical Air Control System (TACS) provides the means through which the Air Component Commander exercises control of his forces to accomplish his assigned mission. This program provides for major improvements to the existing TACS which was designed in the 1960s and is nearing the end of its useful life. Some of the improvements include developing a new transportable modularized, software-intensive, automated air command and control system and two electronic countermeasure programs to enhance the survivability of the AN/TPS-43E surveillance radar. The TACSI RDT&E program consists of the Modular Control Equipment (MCE) Pre-Planned Product Improvement (P3I) program and the Anti-Radiation Missile (ARM) Decoy program. MCE P3I provides improvements to the baseline MCE to ensure the MCE is interoperable with new systems being fielded. Block 1 includes integration of JTIDS, an Automated Air Tasking Order capability (AATO), upgrade to the satellite/troposcatter radio interface, and secure anti-jam VHF radios. The ARM Decoy program is developing a set of decoys designed to lure ARMs from the TACS ground surveillance radars.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) ARM Decoy DT&E completed, solicitation of production contract accomplished.
   - (U) MCE P3I Block 1 development 40% complete; in-plant brassboard and preliminary software testing began.

2. (U) FY 1990 Planned Program:
   - (U) ARM Decoy production contract will be awarded.
   - (U) Hardware fabrication and integration testing of the first software release for MCE P3I will be 90% complete.

3. (U) FY 1991 Planned Program:
   - (U) In-plant development testing of MCE P3I begins.
   - (U) Advanced studies for Block 2 P3I will begin.

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

Program Element: #0207412F
PE Title: Tactical Air Control System Improvements
Project Number: N/A
Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY: ARM Decoy development contractors are ITT Corp., Van Nuys, CA; Aydin Corp., San Jose, CA; and LTV Corp., Buffalo, NY. The MCE P3I contractor is Litton Data Systems, Van Nuys, CA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: ARM Decoy production contract award has slipped from Dec 89 to Feb 90 due to longer than expected staffing at Electronic Systems Division.
3. (U) COST CHANGES: Cost for the MCE P3I program has not changed. Realignment of $5.0 million from FY91 to FY92 was due to poor execution. Money was transferred from FY91 to FY90 in the other procurement account to front end payment of nonrecurring costs.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 316-80, "Improved Tactical Air Surveillance/Improved Tactical Air Control System", dated 17 Nov 80 (S)
- (U) Amended TAF SON 316-80, 15 Jul 83.
- (U) DCP for Modular Control Equipment (MCE), 10 Feb 87 (S).
- (U) Joint TEMP, MCE, 1 Sep 89

G. (U) RELATED ACTIVITIES:
- (U) Modular Control Equipment (MCE) production is a joint USAF/USMC program (PE 0206626M). The MCE contract is administered by the Marines under a Memorandum of Agreement between the Navy and the Air Force. MCE P3I integrates the Joint Tactical Information Distribution System (JTIDS) terminals (PE 0604771D and 0604754F) and provide secure anti-jam VHF radios via the Single Channel Ground and Airborne Radio System (SINCGARS) (PE 0207423F).
- (U) The ARM Decoy interfaces with the Ultra Low Side-lobe Antenna (ULSA), an upgrade to the AN/TPS-43E radar. The ULSA upgrade, (PE 0207412F) will cause the TPS-43E to be renomenclatured as the AN/TPS-75.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. PROCUREMENT:	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Other Procurement:	0	13,322	20,184	Cont	TBD
Quantities:					
ARM Decoy	0	2	14	49	65
MCE P3I Retrofit Kits	0	0	0	139	139

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: #0207412F Project Number: N/A
PE Title: Tactical Air Control System Improvements Budget Activity: #4 - Tactical Programs

J. (U) MILESTONE SCHEDULE:

1.	(U) Award ARM Decoy production contract	Feb 1990
2.	(U) Begin P3I in-plant testing	May 1991
3.	(U) P3I IOT&E begins	Jun 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207417F
PE Title: Airborne Warning and Control System
Project: # N/A
Budget Activity: # 4-Tactical Programs
Project Title: Airborne Warning and Control System (AWACS)



POPULAR NAME: E-3 SENTRY

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	III HQ A-Nets RSIP AFSARC		HQ A-Nets IOC	III 30/35 Nov 91 III RSIP Jan 94
Engineering Milestones		RSIP SDR RSIP PDR HQ A-Nets FCA	RSIP CDR	
T&E Milestones	RSIP Breadbd Flt Tests	RSIP Brassbd Flt Tests	30/35 DT/OT RSIP Brassbd Tst	RSIP DT/OT
Contract Milestones	RSIP FSD Award HQ Prod Award	HQ A-Nets Follow-on Prod		30/35 FCA/PCA 92 RSIP FCA/PCA 94
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contracts	RSIP 25,134 30/35 44,197	53,780 26,100	87,290 24,108	Continuing Continuing (TBD)
Support Contract	10,780	12,420	10,450	Continuing (TBD)
In-House Support	15,498	14,459	11,205	Continuing (TBD)
GFE/ Other	21,415	8,141	757	Continuing (TBD)
Total	117,024	114,900	133,810	Continuing (TBD)

Program Element: 0207417F
PE Title: Airborne Warning and Control System
Project Number: N/A
Budget Activity: 4-Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This program develops and integrates system improvements which will enable the E-3 AWACS to remain an effective, survivable airborne surveillance system for command and control of tactical forces and for strategic defense of the United States. The E-3 overcomes ground-based surveillance system deficiencies through its unique ability to provide extended all altitude surveillance and to manage the air battle in real time. It can be employed at any level of conflict. Planned improvements will continue to exploit the AWACS' inherent capabilities and keep pace with the evolving threat. These improvements include Electronic Support Measures (ESM), central computer memory upgrade, and JTIDS Class 2H/TADIL J and NAVSTAR GPS terminal integrations (collectively known as Block 30/35); the Radar System Improvement Program (RSIP); and HAVE QUICK. RSIP will restore required E-3 surveillance capability against the evolving threats posed by low radar cross-section fighters and cruise missiles, and improve ECCM, reliability and maintainability. The E-3 AWACS contributes significantly to the effective use of U.S. forces supporting the North Atlantic Treaty Organization (NATO), the air defense of the United States, and worldwide commitments.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
- (U) Block 30/35 full scale development (FSD) continued; system Critical Design Review (CDR) successfully accomplished.
- (U) RSIP risk-reduction activities continue, and a breadboard of the radar modifications (less the processors) was built. RSIP FSD contracts awarded.
- (U) HAVE QUICK A-NETS development efforts were completed and the initial production contract was awarded.
- (U) Trainer External Simulation System (TESS) FSD continued, and the system underwent software testing.

2. (U) FY 1990 Planned Program:
- (U) Block 30/35 FSD continues; integration and checkout begins.
- (U) RSIP risk reduction is concluded; brassboard flight testing of radar waveform will be conducted.
- (U) RSIP FSD design activities will commence with system and preliminary design reviews scheduled.
- (U) TESS FSD will be completed.
- (U) RSIP Ada software top level design will be initiated by dual software teams and the initial software bench will be installed in the software development facility.
- (U) HAVE QUICK A-Nets follow-on production contract will be awarded.

Program Element: 0207417F
PE Title: Airborne Warning and Control System
Project Number: N/A
Budget Activity: 4-Tactical Programs

3. (U) FY 1991 Planned Program:
- (U) Block 30/35 FSD will continue, DT&E/IOT&E will be conducted on the modification kits, ESM integration and checkout will be completed, and US and NATO ESM flight testing will be accomplished. One Block 30 kit proof will be acquired for installation in an operational E-3 in 1993 to verify engineering data.
- (U) RSIP FSD will continue and CDR will be accomplished. Hardware fabrication and software coding will begin.
- (U) The second segment of brassboard flight testing will be conducted.

4. (U) Program to completion: This is a continuing program.

D. (U) WORK PERFORMED BY: The Electronic Systems Division (ESD) at Hanscom AFB, MA manages the US program. ESD and the NATO Airborne Early Warning and Control Program Management Agency (NAPMA), Brunssum, Netherlands, jointly manage the Electronic Support Measures (ESM) cooperative development program. The major contractors are the Boeing Aerospace Company, Seattle, WA (air vehicle and system integration & test); Westinghouse Electric Corporation, Baltimore, MD (radar); IBM, Owego, NY (Data Processor); Plessey, Little Falls, NJ (JTIDS); and UTL Corporation, Dallas, TX (ESM).

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: None.
2. SCHEDULE CHANGES: A 7 month slip in the overall Block 30/35 FSD schedule occurred because of ESM software problems and late hardware fabrication. Block 30/35 production start slipped from FY91 to FY92 and the kit proof acquisition slipped from FY90 to FY91.
The RSIP schedule is adjusted by one quarter to reflect the Sep 89 contract award versus the planned Jun 89 date.
3. COST CHANGES: FY90 budget request was reduced $20M by Congress. The FY91 budget request increased by $7M to reflect Block 30/35 target to ceiling cost increase of $25 million and realignment of funding (-$18 million) to defer approved ECPs.

F. (U) PROGRAM DOCUMENTATION:

- (U) ROC No: ADC/TAC-1-66 (S), 1 Sep 66
- (U) DCP No. 5, Rev 4, E3-A (AWACS) Program (S), 6 Mar 80
- (U) Block 30/35 Acquisition Plan 86-AP-019, 14 Nov 85, and J&A 86-J&A-019, 16 Sep 85.
- (U) USAF-NAPMO Cooperative R&D Agreement for E-3 ESM, 17 Nov 86
- (U) SORD for E-3 RSIP, TAF(TAC 001-66)-I,II,III-A, 26 Sep 89.
- (U) RSIP Acquisition Plan 89-AP-014, 7 May 89 and J&A 89-J&A-OA, 7 May 89

G. (U) RELATED ACTIVITIES:
- (U) Development of the JTIDS Class 2H terminal required for the TADIL J is funded in PE 0604771D, Common JTIDS.

Program Element: 0207417F | Project Number: N/A
PE Title: Airborne Warning and Control System | Budget Activity: 4-Tactical Programs

- (U) Development and integration of the Global Positioning System (GPS) user equipment is funded in PE 0305164F, Navstar GPS User Equipment.
- (U) HAVE QUICK improvements are funded in PE 0207423F, Advanced Communications Systems.
- (U) United Kingdom and France direct commercial E-3 purchases include, and are dependent upon, the USAF-developed E-3 integration of the JTIDS Class 2H/TADIL J terminal and central computer memory upgrade.
- (U) Discussions continue on US participation in the NATO AWACS Modernization Program, including NATO cooperative participation in RSIP. UK and French participation in a cooperative RSIP is also being discussed with those countries.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS ($ In Thousands)

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
Aircraft Procurement, BA 11-Modifications (Class V Mod kits & initial spares)	13,200	24,800	18,700	Continuing

2. (U) MILITARY CONSTRUCTION: Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The United States and the North Atlantic Treaty Organization (NATO) are jointly developing and integrating a common ESM package for US and NATO E-3 aircraft. Boeing Aerospace Company, Seattle, Wa is the prime contractor for ESM integration, and UTL Corporation, Dallas, TX, is the major US vendor for the ESM equipment. Total FSD cost is estimated at $150 million with NATO contributing a 35% share. NATO, the United Kingdom and France have indicated a desire to participate in the RSIP program and other US E-3 improvements. Discussions on participation are continuing and the USAF and OSD/ISA are working to develop a U.S. position. Anticipate negotiations with NATO, UK, and ROF on a cooperative RSIP could begin during FY90.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (Past 36 MONTHS)

Event	Date	Results
HAVE QUICK A-Nets IOT&E	Jan 1988	Successful

T&E ACTIVITY (TO COMPLETION)

Event	Date	Remarks
ESM IOT&E Complete	Aug 1991	
Block 30/35 IOT&E Complete	Aug 1991	
RSIP DT&E	1Q FY93-4Q FY93	
RSIP IOT&E	4Q FY93-1Q FY94	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0207423F Budget Activity: # 4 - Tactical Programs
PE Title: Advanced Communication Systems

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2614 HAVE SYNC	3,211	1,126	0	800	48,037
2982 HAVE QUICK II	7,017	10,102	6,385	6,406	92,907
Total	10,228	11,228	6,385	7,206	140,944

B. (U) BRIEF DESCRIPTION OF ELEMENT: Jam-resistant Ultra-High Frequency (UHF) and Very-High Frequency (VHF) voice communications meet a critical need of our combat forces - the need to effectively operate in a dense, sophisticated enemy jamming environment. The Air Force relies on UHF communications for primary command and control, while VHF communications are vital for interoperability and coordination between Air Force and Army units. The UHF HAVE QUICK II program is developing significant operational enhancements and performance improvements to the frequency hopping HAVE QUICK system which we began deploying in 1981. HAVE QUICK and HAVE QUICK II are standards for jam-resistant voice communications within NATO. HAVE QUICK IIA (a fast frequency hopping capability) is the effort currently in development to further enhance our anti-jam robustness against a variety of communications jamming threats. HAVE QUICK IIA has been accepted by NATO as the foundation for their long-term jam-resistant voice communications called Second-generation Anti-jam Tactical UHF Radio for NATO (SATURN). A NATO Standardization Agreement (STANAG) for SATURN is in coordination and the US Air Force will rename the HAVE QUICK IIA program SATURN when this STANAG is signed. The HAVE SYNC program is developing an Electronic Counter Countermeasure (ECCM) capable replacement for our existing airborne radio, the AN/ARC-186. The HAVE SYNC radio, primarily designated for installation in platforms requiring direct communications with Army ground forces to support Close Air Support, Special Operations and some Command & Control mission areas, is fully interoperable with the Army's ground SINCGARS radio. In order to equip our own ground forces (Tactical Air Control Parties, Combat Control Teams, etc.), the Air Force will procure ground SINCGARS radios from the Army.

Program Element: # 0207423F Budget Activity: # 4 - Tactical Programs
PE Title: Advanced Communication Systems

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

1. (U) Project: 2614, HAVE SYNC:
The AN/ARC-205 HAVE SYNC radio (formerly Air Force Airborne SINCGARS) is being developed for our tactical fighter and airlift forces who require direct voice communications with Army ground forces. The radio is designed to be a form, fit, and function replacement for the existing (non-ECCM) AN/ARC-186 VHF radio and is required to meet a fielded Mean Time Between Failure (MTBF) requirement of 2,000 hours. Due to contractor non-performance the HAVE SYNC development contract was terminated for default in October 1989. Meanwhile, the program is being restructured and plans will be incorporated into future budget requests.

(U) FY 1989 Accomplishments:
- (U) Conducted DT&E/IOT&E Program.
- (U) Terminated the FSD contractor for default.

(U) FY 1990 Planned Program:
- (U) Compare the alternatives to field an airborne SINCGARS capability and chose the most cost effective, operationally sound approach.
- (U) Restructure HAVE SYNC program.

(U) FY 1991 Planned Program:
- (U) Purchase ground SINCGARS radios from the Army's ground SINCGARS production contract.
- (U) Implement restructured HAVE SYNC program in FY 92.

(U) WORK PERFORMED BY: Air Force Systems Command, Electronic Systems Division (AFSC/ESD), Hanscom AFB, MA, has program management responsibility.

(U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: # 0207423F Budget Activity: # 4 - Tactical Programs
PE Title: Advanced Communication Systems

(U) OTHER APPROPRIATION FUNDS ($ In Thousands):

PROCUREMENT FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3010	0	3,750	0	200,049	210,800
3080 *	0	0	6,673	104,157	108,800

* The Air Force will use this appropriation to purchase ground SINCGARS radios using an existing, negotiated, Army production contract.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: # 0207423F Budget Activity: # 4 - Tactical Programs
PE Title: Advanced Communication Systems

2. (U) Project: 2982, HAVE QUICK II: HAVE QUICK is a slow frequency hopping Ultra High Frequency radio which is providing near-term anti-jam (AJ) voice communications. HAVE QUICK vulnerabilities were assessed, and a program named HAVE QUICK II was initiated to develop and implement operational enhancements and performance improvements required to meet the evolving threat. Improvements include an increase in the number of frequencies over which the system can hop, an increase in the modulation factor, expansion of time dissemination methods, an increase in the number of preset frequencies, provisions for multiple and automatic Word of Day entry (new control head) and the incorporation of new software to optimize cosite (multiple radios operating simultaneously on the same platform) performance. Other key improvements include raising the output power (to 20 watts) and increasing the hopping rate/providing for finer frequency resolution (HQIIA/SATURN), providing for HAVE QUICK/Global Positioning System time interfaces and the addition of electrical and mechanical provisions for later incorporation of an embedded communications security (COMSEC) capability. Development of a 100-watt high power amplifier (HPA) is being accomplished to increase jam resistance of select ground and airborne platforms.

(U) FY 1989 Accomplishments:
- (U) Continued development of the HQIIA airborne radio.
- (U) Completed development of the timing system upgrades.
- (U) Began development of HQIIA capable vehicular radio.

(U) FY 1990 Planned Program:
- (U) Begin production of the timing system upgrades.
- (U) Begin production of HQII capable ground radios.
- (U) Complete development of HQIIA capable airborne radio.
- (U) Complete development the 100-watt high power amplifier.
- (U) Continue development of the HQIIA capable ground radio.
- (U) Continue development of HQIIA vehicular radio.

(U) FY 1991 Planned Program:
- (U) Begin production of HQIIA capable airborne radio.
- (U) Initiate development of a software configuration management effort for HQIIA.
- (U) Continue development of HQIIA capable ground radio.
- (U) Continue development of HQIIA capable vehicular radio.
- (U) Continue studies for additional system AJ improvements.

Program Element: # 0207423F Budget Activity: # 4 - Tactical Programs
PE Title: Advanced Communication Systems

(U) WORK PERFORMED BY: AFSC/ESD, Hanscom AFB, MA, has program management responsibility; Magnavox Corp (Ft Wayne, IN), MACOM (Hauppage, NY), Motorolla (Phoenix, AZ), and Rockwell-Collins (Cedar Rapids, IA) are prime contractors.

(U) PROGRAM DOCUMENTATION:
- (U) "Jam-Resistant Secure Voice Communications (JRSVC) (U)" TAF ROC 321-75, (S) 15 Jul 1975
- (U) Program Management Directive 3094(7), 10 Mar 1987
- (U) Ground HAVE QUICK II/IIA Acquisition Plan, 2 Jun 1987
- (U) High Power Amplifier Acquisition Plan, 10 Oct 1986
- (U) VRC-XXX Acquisition Plan, 10 Apr 1986

(U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands):

PROCUREMENT FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3010	24,156	22,400	3,000	340,032	397,389
3080	4,409	6,685	0	59,711	113,679

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: The HAVE QUICK IIA waveform has been accepted by NATO as the basis for their long-term UHF anti-jam voice communications system (Second-Generation Anti-Jam Tactical UHF Radio for NATO, or SATURN). A Standardized NATO Agreement (STANAG) for this system was submitted for ratification in June 1988. The document remains unratified.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207431F Budget Activity: #4 - Tactical Programs
PE Title: Tactical Air Intelligence Systems (TAIS)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3009 Intra-Theater Intelligence Communications Network (IINCOMNET)					
	0	462	484	0	3,387
Total	0	462	484	0	3,387

B. (U) BRIEF DESCRIPTION OF ELEMENT: The tactical forces are faced with a critical deficiency in their capability to rapidly and accurately process and disseminate intelligence information from various sources to operational commands and command and control elements. The purpose of this system is to develop, acquire, and operate land-based processing exploitation and dissemination systems used by tactically deployed general purpose forces.

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

1. (U) Project Number: 3009, Intra-Theater Intelligence Communication Network (IINCOMNET)

The Air Force Intelligence Information Systems Committee has identified improvements in terrestrial intelligence communications as its number one priority.

The packet switching capability will be compatible with and integrated into the European segment of the Defense Data Network. Survivability will be achieved through this diverse multiple link access capability. IINCOMNET will link key United States Air Forces in Europe intelligence centers (Combat Operations Intelligence Center, Tactical Fusion Center) with operational tactical fighter/reconnaissance wings.

(U) FY 1989 Accomplishments:

- Completed initial functional testbed of multilevel secure release capability.
- Completed installation of hardware required for multilevel secure release capability.

Program Element: #0207431F Budget Activity: #4 - Tactical Programs
PE Title: Tactical Air Intelligence Systems (TAIS)

(U) FY 1990 Planned Program:
- Develop software to interactively communicate with multilevel secure release system.

(U) FY 1991 Planned Program:
- Complete development and installation of interactive software.

(U) Work Performed By: Air Force management is provided by HQ US Air Forces in Europe, Ramstein AB, GE and Rome Air Development Center, Griffiss AFB, NY. Logicon Operating Systems, San Diego, CA is responsible for IINCOMNET multilevel secure release software.

(U) Related Activities: IINCOMNET developed capabilities must be compatible with and integrated into the European segment of the Defense Data Network for common-user service, PE 0303126F, Long Haul Communications - Defense Communication System, as well as equipment developed under PE 0208010F, Joint Tactical Communications Program.

The Air Force established the Intelligence Information Systems Committee, with membership from major air command intelligence and communications and computer staffs and participation from the National Security Agency (NSA) and the Defense Communications Agency (DCA), to ensure fully coordinated intelligence communications and computer planning. Preliminary demonstration of the feasibility of the proposed dedicated portion of IINCOMNET, Project ENDRUN, is being conducted under PE 0305885G, with financial support from the INCA PO, which supports IINCOMNET objectives.

There is no unnecessary duplication within the Air Force or the Department of Defense.

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

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207590F
PE TITLE: SEEK EAGLE
Project Number: N/A
Budget Activity: #4 - Tactical Programs

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

Project Title: SEEK EAGLE

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SEEK EAGLE	0	16,497	14,549	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Air Force SEEK EAGLE program certifies the safe carriage and release of every weapon and store configuration on Air Force and Foreign Military Sales (FMS) aircraft. SEEK EAGLE also verifies the accuracy of the weapons ballistics portion of the aircraft Operational Flight Program (OFP). Certification, safe carriage and release, is determined by engineering analysis, wind tunnel testing, and flight testing for compatibility, structural integrity, jettison and normal release, and flutter. Ballistics accuracy verification requires analysis and flight testing to develop and verify data in the aircraft OFP for weapon delivery accuracy. SEEK EAGLE products include verified weapon delivery software for inclusion in the aircraft OFP and publications such as loading manuals, flight manuals, and delivery manuals--absolute essentials for operational use of aircraft and stores. SEEK EAGLE is a continuing program. New aircraft and stores are continually being developed, and new loading configurations and employment parameters arise due to changing operational requirements and tactics with weapons and aircraft already in the field. As of Jan 1990, there were 20 aircraft and 85 store types in work under SEEK EAGLE certification and/or accuracy verification. This, in turn, involved over 950 aircraft/store configurations in various stages of the process. Previously, SEEK EAGLE was funded through aircraft and store PEs. The inefficiencies and extended delays in getting SEEK EAGLE products to the field under this arrangement surfaced the need for better overall control and efficiency through centralized management and funding.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments: Funded through aircraft and store PEs.

2. (U) FY 1990 Planned Program:
   - (U) Conduct intensive ballistics accuracy verification of the MK 82/84, CBU-52/58/87/89, GBU-15, BDU-38, MC-1, and MK-20 stores on the F-15E, and F-15E certification of AGM-65 and AIM-7.
   - (U) Complete MK-11 and begin HAVE NAP and BSU-85 certifications on the B-52.

Program Element: #0207590F
PE Title: SEEK EAGLE

Project Number: N/A
Budget Activity: #4 - Tactical Programs

- (U) Accomplish certifications and/or accuracy verifications of the GBU-10/12, CBU-87/89, and AIM-120 on the F-16A/B/C/D and Harpoon on the F-16C/D. Begin SE certifications on the F-16C/D Block 40, and the AGM-65G on the F-16A/B/C/D, F-4D/E/G, A-10, and F-111F.
- (U) In addition to the above highlighted examples, work will be on going with other aircraft and stores on the hundreds of loading configurations in the SEEK EAGLE queue.

3. (U) FY 1991 Planned Program:
   - (U) Accomplish AIM-120 SEEK EAGLE certifications with LAU-106A and LAU-128 on the F-15E. Continue MK 82/84, GBU-10/12, MC-1, and CBU-89 efforts on the F-15E from FY90.
   - (U) Continue work on AIM-120 and air-to-ground stores on the F-16A/B/C/D, SE associated with Block 40 on the F-16C/D, and complete HAVE NAP and BSU-85 on the B-52. Begin SE for mixed loads of weapons and AIM-9 on the F-111A/D/E/F.
   - (U) As in FY 1990, accomplish work on the hundreds of other aircraft and store configurations in addition to these highlighted examples.
   - (U) Conduct a minimum effort on SE process technology application.

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

D. (U) WORK PERFORMED BY: SEEK EAGLE work is performed both under contract with prime airframe contractors and through Air Force in-house engineering and test organizations. The AF SEEK EAGLE program is centrally managed by the AF SEEK EAGLE Office at Eglin AFB FL. Two of the prime contractors are General Dynamics, Ft Worth TX in support of the F-16 and McDonnell Douglas, St Louis MO for the F-15E. Much of the work, however, is done in-house at such locations as the Munitions Systems Division, Eglin AFB FL; AF Flight Test Center, Edwards AFB CA; Ogden Air Logistics Center (ALC), Hill AFB UT; and AF Tactical Fighter Weapons Center, Nellis AFB NV.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: F-15E baseline store certification work accelerated from the out years into FY 1991. BLU-80 certifications on F-111, F-16, F-15E, and A-7 slipped from FY 1991 to FY 1992.
3. (U) COST CHANGES: RDT&E funds decreased by $3.25M in FY 1991 due to an overall reduction in the AF RDT&E budget and a realignment of priorities within that budget.

F. (U) PROGRAM DOCUMENTATION: Numerous certification requests from users such as SAC, TAC, MAC and the AF Directorate of International Programs (AF/PRI) for FMS aircraft.

Program Element: #0207590F
PE Title: SEEK EAGLE
Project Number: N/A
Budget Activity: #4 - Tactical Programs

G. (U) RELATED ACTIVITIES:

- (U) SEEK EAGLE relates to, and must be in step with, the following programs.

Program Element	Title
- (U) 0101113F	B-52 Squadrons
- (U) 0101126F	B-1B Squadrons
- (U) 0207129F	F-111 Squadrons
- (U) 0207130F	F-15A/B/C/D Squadrons
- (U) 0207131F	A-10 Squadrons
- (U) 0207133F	F-16 Squadrons
- (U) 0207134F	F-15E Squadrons
- (U) 0207136F	F-4G Squadrons
- (U) 0207163F	Advanced Medium Range Air-to-Air Missile
- (U) 0208030F	WRM Ammunition

- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Missile Procurement/(BA 4, AMRAAM)					
Funds	0	4,667	0	Cont.	TBD
Quantities	0	12*	0	Cont.	TBD
Other Procurement/(BA 1, BIGEYE)					
Funds	0	2,203	0	Cont.	TBD
Quantities	0	95*	0	Cont.	TBD

*The above quantities are incorporated in the program documents for the respective missile and munition programs, but are funded under SEEK EAGLE, PE 0207590F.

2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE: Each of the SEEK EAGLE Requests from the AF operational commands has a user need date. Key milestones such as engineering analysis, ground test, flight test, OFP update, and TO publication for the roughly 950 requested loading configurations are established for these but are too numerous to list here. One example is the MK 82 low-drag general purpose bomb on the F-15E. Separation effects tests were completed in Feb 1989; final OFP verification flights are scheduled for completion in May 1991; and TO publication in Aug 1991.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0208006F Budget Activity: # 4 - Tactical Programs
PE Title: Mission Planning System (MPS)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
N/A Mission Planning System	18,636*	16,296**	18,146	Cont	TBD
Total	18,636	16,296	18,146	Cont	TBD

* FY 1989 funds in PE 0101313F
** FY 1990 funds include $13.811M in PE 0101313F

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Mission Planning System (MPS) will support development and acquisition of Air Force automated mission planning systems for tactical, strategic, and airlift forces. This program was created to preclude unnecessary duplication of effort and consolidate ongoing, fragmented mission planning development efforts by individual weapon programs. MPS will provide automated mission planning, intelligence, weather, weapons, electronic combat and navigation information to aircraft and associated weapons systems. Automated interface with Theater, Command, and Joint data bases will be provided as well as the capability to load and read automated aircraft/weapon data systems cartridge units. It is planned to provide ground and aircraft support for all associated command and control systems. Present mission planning capabilities are deficient in speed, storage capacity, software application, processing capability, flexibility, graphics, and automated combat mission folder preparation. They also lack a near-real-time data input to provide current enemy threat information, and the capability to adequately process that data. The mobility, complexity, quantity and lethality of enemy threat systems dictate an automated data input. Present Strategic Mission Data Preparation System (SMDPS) and Tactical Air Forces Mission Support System efforts will be supported along with consolidating common development efforts to benefit all commands.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments: (PE 0101313F)
   - (U) (SMDPS) Phase II Tape 7 delivery, incorporating ACM and B-1B defensive system updates.
   - (U) Tape 8 development began supporting SRAM II flight test.
   - (U) SMDPS Phase III integration effort began to rehost existing Phase II software onto new hardware and develop the interface control documents to integrate new weapon systems (SRAM II, B-2, other programs).
   - (U) Conventional Mission Planning and Production System (CMPPS) delivered the first Integrated Conventional Stores Management System (ICSMS) tape and continued support of additional weapons (Tacit Rainbow and other).

Program Element: #0208006F Budget Activity: #4 - Tactical Programs
PE Title: Mission Planning System (MPS)

2. (U) FY 1990 Planned Program:
   - (U) Provide enhancements for Mission Support System II (MSS II). Provide a combat mission folder capability, integration of weaponeering software and F-4, F-111 and SRAM-T functionality.
   - (U) Complete Tape 8 development incorporating B-1B defensive avionics updates.
   - (U) CMPPS test tape delivery supporting integration and testing of additional conventional weapons.

3. (U) FY 1991 Planned Program:
   - (U) Resolution of design deficiencies identified during early use of fielded MSS II system. Continued development and testing of the improvements initiated in FY 1990 for the MSS II system.
   - (U) Award contract for Air Force Automated Mission Planning System (AFAMPS) development program to start competitively acquired mission planning software and associated hardware enhancements for tactical platforms and weapons. Primary emphasis will be on preliminary design and tradeoff analysis, with attention given to future planned enhancements to meet stated requirements as technology matures.
   - (U) CMPPS will deliver a tape incorporating Tacit Rainbow and other conventional weapons.

4. (U) Program to Completion:
   - (U) Resolution of design deficiencies identified during early use of fielded MSS II system. Continued development and testing of the improvements initiated in FY 1990 for the MSS II system.
   - (U) Continue prototype design of the AFAMPS system initiated in FY 1991. Begin hardware and software integration. Plan for future enhancements.

D. (U) Work Performed By: The Mission Planning System's development program is being managed by the Directorate for Battle Management Systems, Electronic Systems Division, Hanscom AFB MA. The Mission Support System II contractor is Fairchild Communications and Electronics Company, Germantown MD. SMDPS Phase III integration contractor is Boeing Military Airplane of Wichita KS.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: None.
   3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) SAC SON 13-87, SECRET, Feb 1988.
   - (U) TAF SON 312-87, May 1988.
   - (U) MAC SON 07-88, Jun 1989.

Program Element: #0208006F Budget Activity: #4 - Tactical Programs
PE Title: Mission Planning System (MPS)

G. (U) Related Activities:
- (U) The MSS I was developed in PE #0207133F, F-16 Squadrons.
- (U) The MSS II which will be used for F-4, F-15, and F-111 applications is being developed in PE #0207128F, F-4 Squadrons.
- (U) This project consolidates automated war planning support efforts within numerous strategic programs. They include, but are not limited to, B-52 (PE 0101113F), B-1B (PE 0604226F), B-2 (PE 0604240F), Air Launched Cruise Missile (PE 0604361F), Advanced Cruise Missile (PE 0101120F), Tacit Rainbow (PE 0207316F), Short Range Attack Missile II (PE 0604244F) and other programs.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Actual	FY 1990 Estimate	FY1991 Estimate	Total Program
Other Procurement PE 0101313F	7,772	27,036	24,308	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1. (U) SMDPS Phase III
   - (U) Deployable SMDPS First Asset Delivery (FAD) Jul 90
   - (U) CMPPS
     - (U) Tape 1 FAD Sep 90
     - (U) Tape 2 FAD (Tacit Rainbow) Apr 91
2. (U) MSS II IOC Jun 89
3. (U) AFAMPS RFP Jun 90
4. (U) MSS II Upgrade IOC Dec 90
5. (U) AFAMPS IOC Oct 93

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0208010F Budget Activity: #4 - Tactical Programs
PE Title: Joint Tactical Communications Program

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2270 Support and Integration	1,214	3,514	4,833	Cont	TBD
Total	1,214	3,514	4,833	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The TRI-TAC program develops digital communications equipment for tactical operations. The Air Force needs to replace the aging and outdated equipment now in use with a secure, anti-jam communications network. Developments include transmission, switching, and system control equipment, local distribution equipment, terminal devices, and interface equipment. Significant slips and program cancellations to TRI-TAC due to budgetary constraints have increased the need to integrate more TRI-TAC capabilities into older generation equipments and to resolve interoperability and compatibility problems with TRI-TAC among other systems.

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

1. (U) Project 2270, Support and Integration:
With cancellation of over $600M of TRI-TAC equipments, older systems which were to be replaced by TRI-TAC gear must now be made to become compatable with remaining TRI-TAC components. This project funds various development efforts to assure Air Force TRI-TAC communications components are compatible, interoperable and controllable when interfaced with other Air Force, fixed base and joint service systems.

(U) FY 1989 Accomplishments:
- (U) Planning initiated for a Tactical Communications Integration program, a long term effort to assure TRI-TAC systems interoperate with evolving tactical and fixed based command and control systems.
- (U) Establishmented joint software development with Army for mission planning software for the AN/TTC-39A circuit switch.
- (U) Planning initiated for resolving compatability problem between Air Force TRI-TAC and Army Mobile Subscriber Equipment systems.

Program Element: #0208010F Budget Activity: #4 - Tactical Programs
PE Title: Joint Tactical Communications Program

(U) FY 1990 Planned Program:
- (U) Prior integration activities will continue.
- (U) Detailed investigation of TRI-TAC integration into United States Air Force Europe/NATO systems.
- (U) Conduct demonstration of Ku Band troposcatter radio to assess feasibility of production lighweight troposcatter radio capability.
- (U) Conduct interoperability evaluations in support of Air Force participation with the Joint Tactical C^3 Agency.

(U) FY 1991 Planned Program:
- (U) Prior integration activities will continue.
- (U) Initiate detailed development planning to resolve data/message interoperability/incompatability problems caused by cancellation of the Modular Tactical Communications Center program.

(U) Work Performed By: The Air Force Systems Command manages the Air Force portion of the program through the Electronic Systems Division, Hanscom AFB, MA. Contractors include: Raytheon Corp, Sudbury, MA, Unisys Corporation, Salt Lake City, UT, Troposcatter Radio; Sonicraft Corporation, Chicago Il, TAC-1 Fiber Optics Interface Unit, Analytical Systems Engineering Corporation, Burlington, MA and Mitre Corporation, Bedford, MA, Systems Engineering Support.

(U) Related Activities:
(U) Work is conducted by all Services under overall direction of the Office of Assistant Secretary of Defense, Command, Control, and Communications and Intelligence, and the guidance of the Joint Tactical C^3 Agency, Ft Monmouth NJ.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

Other Procurement*

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	147,331	146,465	39,955	72,465	Continuing	TBD

* These funds are for the procurement of numerous items of TRI-TAC equipment not including spares, and are not identified by project, but apply to the entire program element.

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0208021F Budget Activity: 4 - Tactical Programs
PE Title: Electronic Combat Support

A. (U) RESOURCES ($ in thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
374 - C3 PROTECTION/MULTI-MISSION, TECHNOLOGY AND SUPPORT					
TOTAL	0*	2,490	2,770	Cont	TBD

* Funds contained in PE 0604270F in FY89. This is not a new start.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program accomplishes studies and develops systems to provide warning, self-protection and support to personnel and equipment against electronic combat systems employed by enemy forces. It identifies existing research and development efforts which can satisfy unfulfilled operational requirements identified by the Unified and Specified (U&S) Commands, and it makes maximum use of current service lab developments to avoid duplication and quickly bridge the gap between technology development and operational requirements. The Secretary of Defense identified the need for this capability in 1983, and in 1986, with unanimous approval of services and U&S commands, JCS made the Systems Engineering (SE) function a permanent part of Joint Electronic Warfare Center (JEWC) mission. The Air Force, as the executive agent, is responsible for the total funding.

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

1. (U) Project 374, C3 PROTECTION/MULTI-MISSION, TECHNOLOGY & SUPPORT: Develops engineering capabilities to match EW operational programs with quick, off-the-shelf existing technology.

(U) FY 1989 Accomplishments:
- (U)

- (U)

- (U)

Program Element: #0208021F Budget Activity: 4 - Tactical Programs
PE Title: Electronic Combat Support

- (U)

- (U)

- (U) Continued unfinished FY88 projects
  - -- (U) Developed EW/ESM modeling system for shipboard use--an EMCON training tool (Prototype EW Module)---initial at sea testing completed Oct 89, with follow-on testing scheduled for Mar 90
  - — (U) Developed synthetic jamming system for naval ECCM training of communications operators (NETJAM)---dock-side and at sea testing completed Nov 89, with final testing scheduled for 2nd Qtr FY90
  - — (U) Developed VHF/UHF hand held expendable jammers (HEXJAM); Loral prototype delivery scheduled Jun 90 and Northrop prototype delivery scheduled for Apr 90, with acceptance testing to follow each delivery
  - — (U) Developed VHF jammer for Army mini-drone (Smart V); field and antenna tests completed Nov 89, final report due Mar 90, and JPO for UAV briefed on test results
  - — (U) Marine Expeditionary Unit Special Operation Capable (MEUSOC) Jammer--develops highly mobile UHF jammer for on the move jamming capability, prototype delivery scheduled Oct 90, with acceptance testing to follow

(U) FY 1990 Planned Program:
- (U)

- (U) Development of a microcomputer based user friendly system for USCINSOC, Threat Intercept Prediction System (TIPS), capable of predicting threat intercept coverage in area of interest, which is less time-consuming than Prophet or Ireps--testing scheduled for 3rd Qtr FY90
- (U) Development of a training device for DA, Army Communications (ECM/ECCM) Training System (ACETS) capable of simulating threat utilization of the electromagnetic spectrum in order to train operators in ECM and ECCM techniques--follow-on project of NETJAM--contract negotiations on-going
- (U) Development of a ground-based, man-portable jammer, supports 25th ID EW operations in Low-Intensity Conflict (LIC)--follow on project of MEUSOC Jammer--tentative plan is to purchase additional jammer for testing in low intensity environment
- (U) Modify the TLQ-17A jammer employed at Corps level to change frequency from the VHF to the HF frequency band--under study
- (U) Continue unfinished FY89 projects

Program Element: #0208021F Budget Activity: 4 - Tactical Programs
PE Title: Electronic Combat Support

(U) FY 1991 Planned Programs:
- (U) Investigate technologies and develop prototypes to improve electronic warfare support measures (ESM)
- (U) Develop methods to facilitate processing and I.D. of new complex threat emissions
- (U) Develop advanced electronic countermeasures (ECM) for use against more sophisticated future threat systems
- (U)
- (U) Conduct operational testing of the MEUSOC jammer
- (U) Continue unfinished FY90 projects

(U) WORK PERFORMED BY: JEWC at Kelly AFB, Texas, performs independent studies and analysis leading to the development of engineering prototypes for field demonstrations/operations. When technology is available in service labs, JEWC arranges for the development of a prototype, and in conjunction with the developer, conducts testing and field demonstration. Service Laboratories the JEWC works with include the Pacific Missile Test Center, Point Mugu, California; the Naval Ocean System Center, San Diego, California; and Air Force Logistics Command, Wright-Patterson AFB, Ohio. Where required technologies are not available within DOD, JEWC manages contractual efforts to produce, test and demonstrate prototypes. JEWC currently has an engineering support contract with Northrop Defense Systems Division (NDSD) Department, Rolling Meadows, Il. Under JEWC management, NDSS performs engineering analysis, procures, fabricates, tests and demonstrates engineering models to satisfy CINC identified operational shortfalls.

(U) RELATED ACTIVITIES:
- (U) The JEWC SE program supports services and joint electronic combat (EC) programs
- (U) Builds upon technology demonstrated in PE 0604270F, EW Development, and other Service's related PEs
- (U) Technology development is related to that being developed in the following PEs
  - (U) PE 0603711A, Aircraft Survivability Equipment
  - (U) PE 0603718A, Vulnerability Susceptibility
  - (U) PE 0603755A, Tactical ECM Systems
  - (U) PE 0603214N, Tactical C3 Countermeasures

(U) Other Appropriation Funds ($ in thousands): N/A

(U) International Cooperative Agreements: N/A

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0301357F Project Number: # 0001
PE Title: NUDET Detection System (NDS) Budget Activity: 3-Strategic Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: NUDET Detection System

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
NDS					

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES

The Unified and Specified Commands require a highly survivable capability to detect, locate, and report any nuclear detonation (NUDET) on a global basis in near real time. NUDET information supports post-impact selection of appropriate retaliatory options in response to a nuclear attack against North America, as well as strike confirmation, and damage assessment. NUDET information is vital to the effective management of U.S. forces through the trans- and post-attack phases of a nuclear conflict. Reports to command centers of weapon effectiveness will be vital in managing strategic reserve forces and reestablishing a command structure. NDS data could be a major information component during negotiations to terminate a nuclear conflict. The NUDET Detection System consists of sensors integrated on the operational Navstar Global Positioning System (GPS) satellites plus a user segment consisting of Ground/Airborne Integrated Terminals (G/AIT). The NDS satellite payload consists of X-ray, optical and electromagnetic pulse (EMP) sensors. These sensors, when coupled with the extremely precise GPS timing capability, will provide location of nuclear bursts worldwide These data are crosslinked to other GPS/NDS satellites which act as relay points. This crosslinking of information, when used with at least 18 satellites, will allow a user on one side of the earth to receive NUDET data from the opposite side. A broad range of users (National Command Authorities, Strategic Air Command, US Space Command, Federal Emergency Management Agency) receive NUDET data, direct from the spacecraft, on the precise location, yield, count, time, and height of burst.

This program element develops and integrates the optical and X-ray sensors into the GPS satellites. This program complements PE 0102433F which develops and integrates EMP sensors into GPS satellites and develops/procures G/AITs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments

Program Element: #0301357F Project Number: # 0001
PE Title: NUDET Detection System (NDS) Budget Activity: 3-Strategic Programs

- (U) None planned.

2. (U) FY 1990 Planned Program:
   - (U) Continue development of NDS next generation optical and X-ray sensors begun in FY89 in PE 0305999F.
   - (U) Build prototype NDS next generation optical and X-ray sensors for GPS Block IIR satellites begun in FY 89 in PE 0305999F.

3. (U) FY 1991 Planned Program
   - (U) Complete integration, development, requalification, and testing of NDS next generation optical and X-ray sensors for GPS Block IIR satellites.
   - (U) Begin development of fixes for deficiencies identified during testing.

4. (U) Program to Completion:
   - (U) This is a continuing program.
   - (U) NDS sensor design and production are keyed to the GPS satellite schedule.
   - (U) Outyear RDT&E funds will support the development of fixes for deficiencies identified during testing and required system operational improvements.

D. (U) WORK PERFORMED BY: System development and procurement is accomplished by Air Force Systems Command's Space Systems Division, Los Angeles AFB, CA

Rockwell International, Seal Beach, CA, integrates the NDS sensors on Block II GPS satellites and produces the EMP sensor for Block II satellites. General Electric, East Windsor, NJ will integrate NDS sensors on Block II replenishment satellites. Science Applications International Corporation, Manhattan Beach, CA, and the Aerospace Corporation, El Segundo, CA, provide systems engineering support. Sandia National Laboratories, Albuquerque, NM, and Los Alamos National Laboratory, Los Alamos, NM, are under contract to the Department of Energy to produce the X-ray and optical nuclear detonation sensors. Texas Instruments, Dallas, TX, is developing the G/AIT. E-Systems, Garland, TX, is developing the EMP receiver/processor for the Block II satellites.

E. (U) COMPARISON WITH FY1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: None.
   3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) AFSPACECOM SON 4-77, Aug 77.
   - (U) AFSPACECOM SON 203-78, Nov 78; updated May 81.
   - (U) SAC SON 11-79, Sep 79.
   - (U) DCP 113, Feb 80.
   - (U) SOC, Dec 83.

Program Element: #0301357F Project Number: # 0001
PE Title: NUDET Detection System (NDS) Budget Activity: 3-Strategic Programs

- (U) JCS MROC 4-84, Feb 87.

G. (U) RELATED ACTIVITIES:
- (U) NDS sensors are flown on all Navstar GPS satellites (PE 0305165F) beginning with the GPS launch in July 1983.
- (U)

- (U) The EMP sensors are developed, procured, and integrated into GPS satellites under PE 0102433F.
- (U) G/AIT production for the E-4B will be funded in the National Emergency Airborne Command Post PE 0302015F.
- (U) Integration development of NDS optical and X-ray sensors into GPS satellites is also done under PE 0305999F.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. (U) Missile Procurement (BA 27)

	FY 1989 Actual	FY 1990 Estimate	FY1991 Estimate	To Complete
Cost				
Quantity	0	0	0	Continuing

2. (U) Military Construction: Not applicable.

I. (U) International Cooperative Agreements: None.

J. (U) MILESTONE SCHEDULE:

1. (U) DSARC II (GPS System)	Jun 1979
2. (U) Begin Block II Satellite Production	Sep 1982
3. (U) Launch 1st NDS Equipped GPS Spacecraft	Jul 1983
4. (U) Launch 1st Operational GPS Satellite	Feb 1989
5. (U) Award GPS/NDS Block II Replenishment Contract	Jun 1989
6. (U) Achieve Worldwide 2-Dimensional NUDET Location Capability*	2Q FY 91
7. (U) Achieve Worldwide 3-Dimensional NUDET Location Capability*	2Q FY 93

* Launch Schedule Dependent

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303110F
PE Title: Defense Satellite Communications System (DSCS)
Project Number: 0001
Budget Activity: #5 - Intelligence & Communications

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
DSCS	32,565	25,105	16,484	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: DSCS provides Super High Frequency satellite communications for secure voice and high data rate transmissions. Provides unique and vital national security communications for worldwide military command and control, crisis management, relay of intelligence and early warning data, treaty monitoring and surveillance information, and diplomatic traffic. Specifically, DSCS supports National Command Authorities, Worldwide Military Command and Control System, Diplomatic Telecommunications Service, White House Communications Agency, and mobile forces of all services.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Delivered DSCS satellites IIIB-11 and 12.
   - (U) Continued development of Integrated Apogee Boost Subsystem (IABS) and associated integration activities with ATLAS-II booster.
   - (U)
   - (U) Completed Concept Definition studies for DSCS III Follow-On.
   - (U) Continued low level RDT&E of DSCS communications technology.
   - (U) Continued development and implementation of fixes and improvements to satellites in production/storage.

2. (U) FY 1990 Planned Program:
   - (U) Deliver DSCS IIIB-13 satellite.
   - (U) Conduct structural and engine "Hot-Fire" tests for IABS development.
   - (U) Initiate development of satellite modification to incorporate solid state amplifier.
   - (U) Store DSCS satellites until launch.
   - (U) Continue IABS development and concurrent production.
   - (U) Begin activation of two satellites for launch in FY 91.
   - (U) Perform first time integration of DSCS IIIB/IABS on ATLAS II.
   - (U) Continue low level RDT&E of DSCS communications technology.
   - (U) Continue development and implementation of fixes and improvements to satellites in production and storage.

Program Element: #0303110F | Project Number: 0001
PE Title: Defense Satellite Communications System (DSCS) | Budget Activity: #5 - Intelligence & Communications

3. (U) FY 1991 Planned Program:
   - (U) Launch two DSCS satellites on ATLAS II.
   - (U) Deliver DSCS IIIB-14 satellite (last multiyear satellite).
   - (U) Continue storage of DSCS satellites until launch.
   - (U) Begin activation of two DSCS satellites for launch in FY 92.
   - (U) Continue production of IABS.
   - (U) Continue low level RDT&E of DSCS communications technology.
   - (U) Continue development and implementation of fixes and improvements to satellites in storage, prior to launch.

4. (U) Program to Completion:
   - (U) Continue launch of satellites in storage using ATLAS II.
   - (U) Continue low level RDT&E of DSCS communications technology.
   - (U) Continue development and implementation of fixes and improvements to satellites in storage, prior to launch.
   - (U) Begin development of SHF replenishment satellites. Plan first SHF replenishment launch for 1998.

D. (U) WORK PERFORMED BY: AF Space Systems Division, Los Angeles Air Force Base, CA is responsible for the space segment of DSCS. General Electric Co., Valley Forge, PA is the prime contractor for DSCS III. The Aerospace Corp., El Segundo, CA provides systems engineering and integration to the DSCS Program Office.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) DSCS Program Plan FY 1991-1995, 14 Oct 88.
   - (U) DSCS Acquisition Program Baseline, 11 Jun 89.
   - (U) DSCS SON draft received from AFSPACECOM Sep 89.
   - (U) Mission Need Statement draft due from JCS/DCA Apr 90.

G. (U) RELATED ACTIVITIES:
   - (U) DCA is responsible for overall program management, system engineering, and operational direction.
   - (U) Army procures ground terminals under PE 0303142A, DSCS.
   - (U) AF procures DSCS terminals, ground equipment, construction, operations and maintenance, and manpower support for its portion of the ground segment in PE 0303605F, Satellite Ground Terminals.
   - (U) Navy procures shipborne terminals under PE 0303109N, Satellite Communications System.
   - (U) AF is developing the ATLAS II booster, for launching DSCS, under PE 0305119F, Space Boosters.
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0303110F Project Number: 0001
PE Title: Defense Satellite Communications System (DSCS) Budget Activity: #5 - Intelligence & Communications

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

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(U) MISSILE BA 23 PROCUREMENT	53,713	48,189	63,917	Continuing	TBD
(U) QUANTITIES					
SATELLITES	-	-	-	-	1
IABS	-	3*	2	2	2

* One IABS engineering unit will be procured for a total of 10.

2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Signed MOU on "Shared use of DSCS satellites by UK SKYNET earth terminals for period 1989 - 1990", dated 6 Jan 1989.

J. (U) MILESTONE SCHEDULE:

1. (U) Satellite Deliveries

DSCS III - B12	Oct 89
- B13	Apr 90
- B14	Feb 91
- B15	1998

2. (U) Satellite Launches

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303126F Budget Activity: #5 - Tactical Programs and Communications
PE Title: Long Haul Communications

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2022 Automated Digital Communications Processing Techniques	1,643	1,057	1,125	Cont	TBD
2155 Systems Control	1,322	1,147	1,465	Cont	TBD
2157 Transmission Improvements	1,159	831	800	Cont	TBD
2206 Digital European Backbone	180	180	180	Cont	TBD
Total	4,304	3,215	3,570	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is the Air Force portion of the Tri-service RDT&E program for communications networks, including the Defense Communications System (DCS). The DCS provides the long distance, common user, and switched telecommunications networks to satisfy requirements of the National Command Authority, the Department of Defense, and other government agencies. This RDT&E program defines system architectures, specifies design parameters, and develops communications technology for modernizing and improving communications networks, including the DCS.

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

1. (U) Project 2022, Automated Digital Communications Processing: This project develops and tests systems designed to provide communications interoperability/survivability for long haul and local area networks to enhance command and control for tactical and strategic users of the DCS. Objectives are attained through a series of time-phased, related efforts in the areas of switching, routing, protocols and internetting communications network technologies. Efforts define architectures, specify design parameters, develop technology and performance specifications, produce initial models, perform tests and evaluate the resulting improvements to the DCS. A major part of the program is development of state-of-the-art technology to support the Defense Message System (DMS) Target Architecture and Implementation Strategy (TAIS).

(U) FY 1989 Accomplishments:
- (U) Completed the formal certification of the multinet gateway at the Military Airlift Command Global Decision Support System site at Scott AFB, Illinois.

Program Element: #0303126F Budget Activity: #5 - Tactical Programs and Communications
PE Title: Long Haul Communications

- (U) Implemented a routing algorithm design in the multinet gateway advanced development model to significantly improve DCS survivability.
- (U) Completed development of a protocol to enable a multinet gateway to coordinate routing functions with dissimiliar gateways in order to enhance survivability.
- (U) Initiated a program to develop an AUTODIN to Defense Data Network Interface (ADI) proof of concept system to define associated Defense Message System (DMS) policies and procedures.
- (U) Initiated development of a communications network operating system (CNOS), an advanced management and control mechanism for highly adaptive and survivable communications networks.

(U) FY 1990 Planned Program:
- (U) Continue development of the CNOS experimental system model.
- (U) Initiate study to assess benefits and limitations of using the X.400 protocol in the translation to DMS services.
- (U) Complete development of the DMS ADI.
- (U) Implement DMS R&D testbed on which to evaluate and refine the ADI system.
- (U) Initiate effort to define the Integrated Services Digital Network (ISDN) architecture required to implement Phase III of the DMS TAIS.

(U) FY 1991 Planned Program:
- (U) Complete initial experimental evaluation of the CNOS system model to demonstrate potential to operational systems.
- (U) Conduct a preliminary design review (PDR) on the multi-level secure (MLS) network architecture.
- (U) Continue definition of ISDN architecture to support DMS.
- (U) Provide DMS ADI recommendations to Implementation Working Group.

(U) Work Performed By: Air Force Systems Command (AFSC), Andrews AFB, MD manages this project through the Rome Air Development Center (RADC), Griffiss AFB, NY. Major contractors are: Rome Research Corporation, Rome NY; Ford Aerospace and Communications Corporation, San Jose, CA; Stanford Telecomunications, Reston VA; Sterling Software, Bellevue, NE.

(U) Related Activities:
(U) Program Element 0603617F, C^3 Applications
(U) Program Element 0603789F, C^3 Advanced Development
(U) Program Element 0208010F, TRI-TAC
(U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

Program Element: #0303126F Budget Activity: #5 - Tactical Programs and Communications
PE Title: Long Haul Communications

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3080	20,505	62,094	16,974	Continuing	TBD
3300	1,220	1,350	0	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 2155, Systems Control: This project improves DCS network management and control by developing techniques, hardware, and software to provide improved performance assessment, failure detection, failure isolation and reporting, and restoration and reconstitution on a worldwide basis. RADC is continuing development of the Machine Intelligent Technical Controller (MITEC) for near term application to the technical control facility problem domain. Work in this area is being expanded to investigate the applications of automated intelligent systems to other levels of the DCS control hierarchy. RADC is providing support to DCA in developing the Digital Patch and Access System (DPAS) control prototype. A continuing effort through FY 1990 will evaluate use of selected commercial-off-the-shelf (COTS) hardware and software in DoD communications networks. The goal is an integrated DCS control system which is adaptive to wartime communications requirements and constraints.

(U) FY 1989 Accomplishments:
- (U) Provided results of RADC's Integrated DCS Control (IDCSC) design study to DCA for incorporating into specification for the Defense Communications Operations Support System (DCOSS) program.
- (U) Completed System Management and Control Concepts for Integrated Communications Architectures study.
- (U) Accepted delivery and provide DPAS control software and updated system specifications to DCA for prototyping.
- (U) Continued MITEC prototype testbed, which will be used to evaluate the application of expert systems to technical control facilities.
- (U) Contracted for Expert Systems for Integrated DCS Control effort to investigate the application of automated intelligence within the DCS control hierarchy.

(U) FY 1990 Planned Program:
- (U) Conduct preliminary MITEC field test and continue development of MITEC system.
- (U) Identify functional requirements and locations for automated intelligent systems for integrated DCS control.
- (U) Provide technical support to DCA in development of DPAS control prototype.

Program Element: #0303126F Budget Activity: #5 - Tactical Programs and Communications
PE Title: Long Haul Communications

(U) FY 1991 Planned Program:
- (U) Complete development of MITEC prototype and transition to AFCC and DCA.
- (U) Begin development of prototype automated intelligence systems for integrated DCS control.

(U) Work Performed By: AFSC manages this project through RADC. Major contractors are: Harris Corporation Melbourne, FL; and Lincoln Labs, Lexington MA.

(U) Related Activities: See Project 2022.

(U) Other Appropriation Funds: See Project 2022

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 2157, Transmission Improvements: This project improves transmission, survivability, efficiency, capacity, and reliability of Air Force and DCS communications links by applying new techniques such as millimeter wave and fiber optics and by developing equipment embodying new Electronic Counter-Countermeasures (ECCM) technology.

(U) FY 1989 Accomplishments:
- (U) Completed angle diversity program for use by Digital European Backbone radios. Kits employ advanced diversity combining techniques to use the frequency spectrum more efficiently.
- (U) Conducted critical design review (CDR) of the meteor burst network simulator.
- (U) Initiated development of a multimedia communications radio based on the brassboard design produced under Project 2335.

(U) FY 1990 Planned Program:
- (U) Complete test and evaluation of HF frequency hop modem which provides jam resistance, high data rates and improved voice recognition features.
- (U) Conduct acceptance tests on the meteor burst simulator. Install same at RADC and initiate comprehensive study of this communications mode.
- (U) Conduct PDR of the multimedia radio.

(U) FY 1991 Planned Program:
- (U) Conduct CDR of the multimedia radio.
- (U) Based upon the approved design of the multimedia radio, initiate efforts to investigate the use of artificial intelligence technologies to improve the performance of this technology in the face of an increas'ngly sophisticated threat.

Program Element: #0303126F Budget Activity: #5 - Tactical Programs
PE Title: Long Haul Communications and Communications

(U) Work Performed By: AFSC manages this project through RADC. Major contractors are: Computer Sciences Corporation, Falls Church, VA; Signatron Inc, Lexington, MA; Motorola, Scottsdale, AZ; Harris Corporation Melbourne, FL; and Raytheon, Sudbury, MA.

(U) Related Activities: See Project 2022

(U) Other Appropriations Funds: See Project 2022

(U) International Cooperative Agreements: Not Applicable

4. (U) Project 2206, Digital European Backbone (DEB): DEB is the approved long-term program for digital upgrade of the Defense Communications system (DCS) in Europe. The program stems from the National Command Authority's direction to secure DCS links, the rapid growth of high speed data requirements, and major force deployments in Europe. One phase of DEB was completed in 1979. The remainder of DEB is planned to use the DCS standard digital radio and multiplex equipment known as DRAMA. The first segment of DEB using DRAMA equipment became operational in June 1984. The remainder of the DEB upgrade will extend the improved operation from the Northern Atlantic to Italy, Spain and the United Kingdom. The Air Force is the lead military department for the overall upgrade.

(U) FY 1989 Accomplishments:
- (U) Continued installation of DEB sites in the United Kingdom and Europe. Funded activities included travel, system training programs and Rome Air Development Center Support.

(U) FY 1990 Planned Program:
- (U) Continue European installation of DEB.

(U) FY 1991 Planned Program:
- (U) Continue above installation programs.

(U) Work Performed By: AFSC manages this project through the Electronic Systems Division (ESD), Hanscom Air Force Base, MA. ESD receives technical support from the MITRE Corp., Bedford, MA and Computer Engineering Associates, Avon, MA.

(U) Other Appropriation Funds: See Project 2022.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303131F Budget Activity: #3 - Strategic Programs
PE Title: Minimum Essential Emergency Communications Network (MEECN)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2832 Very Low Frequency/Low Frequency (VLF/LF) Improvements	22,424	8,935	9,427	Cont	TBD
2834 Ground Wave Emergency Network (GWEN)	18,996	1,099	250	6,931	266,582
Total	41,420	10,034	9,677	Cont	TBD

B. ( ) BRIEF DESCRIPTION OF ELEMENT: This element is the Air Force portion of a continuing program supporting the Chairman, Joint Chiefs of Staff, who is responsible for delivering the National Command Authority's decision in a precise and timely manner[Current emphasis is on improved command, control and communications to improve survivability, endurability and performance under adverse nuclear and jamming conditions. MEECN VLF/LF improvements project consists of communication systems specifically designed[

The MEECN GWEN project provides a communications system specifically designed for command and control of strategic forces in pre- and early trans-attack phases of conflict. Communications in the VLF/LF region of the spectrum have attributes useful in strategic communications. These include low ambient propagation loss, significant penetration of sea water, and good performance in a nuclear environment.

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

1. (U) Project 2832, Very Low Frequency/Low Frequency Improvements: This project consists of improvements to our VLF/LF communications system to extend range, improve resistance to jamming and nuclear effects, and increase message accuracy at all ranges. It includes adding VLF/LF receivers in B-1B and B-52H aircraft [Miniature Receive Terminal (MRT)], improving VLF/LF transmission with an enhanced power transmitter and improved trailing wire antenna on EC-135 and E-4B airborne command post aircraft [High Power Transmit Set (HPTS)], and development of VLF/LF improved transmitters [Diversity Reception Equipment (DRE)]. It includes continuing assessment of enhancements and improvements in the VLF/LF communications area.

(U) FY 1989 Accomplishments:
- (U) Development, design and fabrication of HPTS EC-135 engineering development models continued.
- (U) MRT depot support equipment development and reliability testing continued and B-1B and B-52H production began.
- (U) DRE development and testing continued.

Program Element: #0303131F Budget Activity: #3 - Strategic Programs
PE Title: Minimum Essential Emergency Communications Network (MEECN)

(U) FY 1990 Planned Program:
- (U) HPTS development progresses with prototype testing and installation for EC-135 aircraft beginning.
- (U) MRT depot support equipment development completes, field reliability testing and B-1B and B-52H production continues.
- (U) DRE development and testing completes.

(U) FY 1991 Planned Program:
- (U) Air Force support to on-going MEECN improvements continues and includes support for interoperability testing, threat studies, new VLF/LF modes and VLF/LF system improvements.
- (U) HPTS development, prototype testing/installation and Initial Operational Test and Evaluation (IOT&E) completes, EC-135 aircraft production begins and HPTS E-4B development begins.

(U) WORK PERFORMED BY: Rockwell International, Richardson, TX (MRT/HPTS); Sonicraft Incorporated, Chicago, IL (DRE); Analytical Systems Engineering Corporation, Burlington, MA; Mitre Corp, Bedford, MA; and Dual and Associates, Arlington, VA. Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA, has managerial responsibility for programs, except for HPTS for which the Navy's Naval Airborne Strategic Communications, PMA 271, Crystal City, VA has responsibility.

(U) RELATED ACTIVITIES:

- (U) PE 0101312F, PACCS/WWABNCP System EC-135 Class V Modifications contains funding for HPTS aircraft modification.
- (U) The HPTS is a joint development with Navy as lead. A Memorandum of Agreement is maintained at the Assistant Secretaries of the Air Force and Navy level.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS:

(U) AIRCRAFT PROCUREMENT (BA5) Class V Mods:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost (B-1B MRT)	10,600	10,200	-	-	64,700
Cost (B-52 MRT)	11,700	14,801	-	46,700	73,201
PE 0101312F (HPTS) Cost (EC-135)	-	-	22,600	137,009	159,609

. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

2. (U) Project 2834, Ground Wave Emergency Network: The project develops, tests, and deploys a proliferated ground wave communications system. The system provides U.S. strategic forces with the ability to maintain critical continental United States (CONUS) long-range command

Program Element: #0303131F Budget Activity: #3 - Strategic Programs
PE Title: Minimum Essential Emergency Communications Network (MEECN)

and control communications connectivity despite ionospheric disturbances caused by high altitude nuclear detonations. The network handles low speed data messages for tactical warning, CINCNORAD assessment, positive control launch of the bomber forces, and emergency actions message dissemination to CONUS commanders, and strategic forces. Survivability for this system is provided primarily by proliferated relay nodes, using unmanned electromagnetic pulse (EMP) hardened, low-frequency, ground wave radio equipment. The Thin Line Connectivity Capability (TLCC), the prototype network, interconnects command centers, warning sites, and strategic aircraft bases with 56 relay nodes. Initial Operational Capability is planned for FY 1991. Final Operational Capability phase expands the total relay nodes to 96 and adds users with a planned completion in the mid-1990's.

(U) FY 1989 Accomplishments:
- (U) Development of a Dual Frequency MEECN Receiver (DRMR) began.
- (U) Development of airborne terminals completed completed.
- (U) Siting of the four remaining TLCC relay nodes continued.

(U) FY 1990 Planned Program:
- (U) Previous efforts continue, EC-135C airborne terminal IOT&E completes and production begins, and peculiar support equipment development continues.
- (U) Siting continues/construction begins for TLCC relay nodes.

(U) FY 1991 Planned Program:
- (U) Residual tasks complete and future task planning begins.
- (U) Siting/construction of remaining TLCC nodes completes.

(U) Work Performed By: Air Force Systems Command's Electronic Systems Division, Hanscom AFB, MA, has management for the project. Major contractors are General Electric, Camden, NJ; Contel, Fairfax, VA; and Westinghouse Electric, Baltimore, MD. Mitre Corporation, Burlington, MA, provides system engineering support.

(U) Related Activities:
- (U) Program Element #0604312F, ICBM Modernization (Rail Garrison), contains FY 90/91 funding for completion of Dual Frequency MEECN Receiver development.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (BA 83):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	5,199	5,530	5,701	Continuing	TBD

Aircraft Procurement (BA 5): PE 0101312F C135 Class V Mods

Cost	-	6,200	7,100		13,300

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303144F Budget Activity: #5 - Intelligence & Communications
PE Title: Electromagnetic Compatibility Analysis Center (ECAC)

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Total	8,395	8,746	9,637	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: ECAC is a Joint DOD center established by DOD Directive 5160.57. Policy and program direction are provided jointly by the Chairman, Joint Chiefs of Staff, and the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (C3I). The Air Force is assigned the responsibility for planning, budgeting, and administration of the Center. The Air Force provides both RDT&E and O&M funds to support the DOD ECAC under Program Element 0303144F. The function of the Center is to ensure that the Air Force and other Services design, develop, and acquire communications-electronics (C-E) equipment (e.g., JTIDS, MILSTAR, CIS), supporting C3I and electronic warfare (EW), that will operate compatibly with other systems in strategic or tactical operations. Lack of mutual compatibility results in C-E system performance degradation due to radio interference, leading to LOSS OF AIRCRAFT, PREMATURE DETONATION OF EXPLOSIVES, OR LOSS OF COMMAND, CONTROL, AND OTHER VITAL FUNCTIONS.

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

1. PE 0303144F, ECAC:

(U) FY 1989 Accomplishments:
- (U) Completed software for CINC portion of Worldwide Frequency Management Engineering Support System; extended system to CINCPAC, CINCLANT, and CINCEUR; tested this portion of the system.
- (U) Initiated study on architecture of interconnections to the Worldwide Military Command and Control System.
- (U) Developed on-line capability to DOD Intelligence Information System.
- (U) Enhanced and further tested prototype Electronic Warfare Deconfliction System.
- (U) Modified Battlefield High-frequency Assignment Management System software for CINCPAC.
- (U) Managed/maintained/operated the Frequency Resource Record System on a daily basis.

Program Element: #0303144F Budget Activity: #5 - Intelligence & Communications
PE Title: Electromagnetic Compatibility Analysis Center (ECAC)

(U) FY 1990 Planned Program:
- (U) Integrate NATO data into the Worldwide Frequency Management Engineering Support System (WWFMESS).
- (U) Develop Automated Frequency Engineering Model.
- (U) Perform operational testing of entire distributed WWFMESS network; incorporate into system additional requirements identified by users and validated by JCS.
- (U) Develop prototype Tactical Battlefield Spectrum Management System (TBSMS).
- (U) Integrate Electronic Warfare Deconfliction System and Tactical Frequency Management System.
- (U) Develop Frequency Engineering Tool Kit for field use.
- (U) Evaluate transfer of intelligence and special access data.

(U) FY 1991 Planned Program:
- (U) Develop capability to interface WWFMESS with host-government data.
- (U) Develop statistical frequency usage summaries.
- (U) Develop advance data retrieval capabilities.
- (U) Complete TBSMS prototype; test in European field exercise.
- (U) Initiate research and development to improve electro-optical and infrared models.

(U) Work Performed By: The IIT Research Institute at Annapolis, Maryland, under contract through the Electronic Systems Division, Air Force Systems Command. Management of contractual effort performed by ECAC technical staff.

(U) Related Activities: None. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

Operations & Maintenance (BA 5)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Cost	5,309	2,455	5,885	Cont	TBD

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303152F Budget Activity: 3- Strategic Programs
PE Title: WWMCCS Information System

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3155 USAF WWMCCS ADP Modernization (AFWAM) Program	2,271	3,435	1,540	Cont.	TBD
Total	2,271	3,435	1,540	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Air Force WWMCCS ADP Modernization (AFWAM) program implements the Joint WWMCCS modernization program at Air Force WWMCCS sites. RDT&E funds are used to identify interface standards required to continue present integration of Air Force standard C2 software applications with modernized Joint applications.

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

1. (U) Project 3155, USAF WWMCCS ADP Modernization (AFWAM) Program: Implements Joint WAM Program at Air Force sites.

(U) FY 1989 Accomplishments:
- (U) Completed site planning and design for AF sites
- (U) Started installation of workstations at AF operational sites

(U) FY 1990 Planned Program:
- (U) Begin installation of local area networks and continue installation of workstations at AF operational sites
- (U) Determine site requirements for the implementation of the joint application software and upgrade present host processors

(U) FY 1991 Planned Program:
- (U) Continue installation of workstations and LANs at AF operational sites. Continue integration efforts between Joint and Air Force software systems.

(U) Work Performed By: Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. Contractor support provided by MITRE and CEA of Billerica, MA.

(U) Related Activities:
- (U) Program Element #0303154K, WWMCCS ADP Modernization (WAM) Program run by the Defense Communications Agency.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0303152F Budget Activity: 3- Strategic Programs
PE Title: WWMCCS Information System

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

Other Procurement (BA):

FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
9,709	14,631	6,638	Cont.	TBD

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303401F Budget Activity: 5-Intelligence & Communications
PE Title: Communications Security (COMSEC)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1 Communications Security					
Total	[		]	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Air Force Research and Development (R&D) portion of the overall Department of Defense (DOD) COMSEC program addresses problems encountered in adapting general purpose cryptographic equipment for use in new Air Force communications systems. The efforts are primarily directed at insuring that all systems being developed by the Air Force meet current national communication security requirements. The program develops ancillary systems such as voice digitizers, COMSEC equipment adapter units, and, with National Security Agency (NSA) development authority, integrated COMSEC systems to meet specific Air Force command, control, communication, and intelligence (C3I) requirements.

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

1. (U) Project XXX1, Communications Security:
Develops general purpose cryptographic equipment and ancillary systems to meet national communication security requirements.

(U) FY 1989 Accomplishments:
- (U) Twelve 1GHz broad-band antennas fabricated and transferred to Electronic Systems Command (ESC) for operational use.
- (U) Continued development of full 20GHz broad-band antenna.
- (U) 10K-1GHz fiber optic antenna successfully developed and tested.
- (U) A Sinusoidal Transform based digital speech algorithm was transferred to industry for a secure voice application.
- (U) Completed OT&E on COMSEC Custodial Software Package.

(U) FY 1990 Planned Program:
- (U) Broad-band antennas for the time domain collection system will be upgraded to full 20GHz range.
- (U) A COMSEC Custodial software package will be completed, operationally evaluated, and procurement specifications prepared for an ESC buy.
- (U) Digital-digital tandeming of wide-band and narrow-band secure voice systems at a Gateway will be demonstrated using the canonical transform.

Program Element: #0303401F Budget Activity: 5-Intelligence & Communications
PE Title: Communications Security (COMSEC)

(U) FY 1991 Planned Program:
- (U) Complete delivery of a broad-band time domain collection system to ESC.
- (U) Deliver a wideband digital recording system to ESC.
- (U) Continued development and delivery of a Computer Assisted Analysis System (CAAS) to ESC.
- (U) Deliver Tier Two of the Air Force Electronic Key Distribution System (AFEKDS).
- (U) Field demonstrate high quality secure voice tandeming among systems using canonical domain digital speech technology.
- (U) Continue TEMPEST, COMSEC and secure voice research and development to ensure Air Force fielded systems are capable of countering exploitation efforts.

(U) Work Performed By: All tasks under this program are managed through the Rome Air Development Center (RADC) Griffis AFB, NY, and Electronic System Division (ESD), Hanscom AFB, MA. Contractors are: Lincoln Laboratory, Bedford, MA. (digital speech research); Arcon Corp., Bedford, MA. (math analysis and software development for in-house activities); and Massachusetts Institute of Technology, Boston, MA.

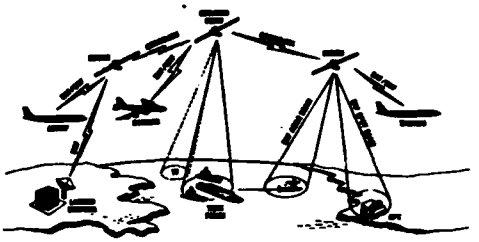
(U) Related Activities: The NSA is the overall manager of COMSEC development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303601F Project: #2487
PE Title: Milstar Satellite Communications System (Air Force Terminals) Budget Activity: 3 - Strategic Programs
Project Title: Milstar



POPULAR NAME: MILSTAR

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	Terminal MS IIIA	N/A	Terminal MS IIIB, FY92
Engineering Milestones	Complete FCA/PCA	System End-to-End Test	N/A	N/A
T&E Milestones	C-18 Flight Tests	Terminal IOT&E	N/A	System IOT&E, 3rd Qtr, FY92
Contract Milestones	MS IIIA LRIP Contract Award	Ongoing	Last Year LRIP	MS IIIB Contract Award
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	216,645	149,893	0	Continuing
Support Contract	24,100	20,800	12,625	Continuing
In-House Support	8,000	8,600	700	Continuing
GFE/ Other	56,600	30,900	11,100	Continuing
Total	305,345	210,193	24,425	Continuing

PE: #0303601F
PE Title: Milstar Satellite Communication System (Air Force Terminals)

Project: #2847
Budget Activity: 3 - Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program develops and acquires Air Force Satellite Communication (AFSATCOM) Ultra High Frequency terminal modifications, transponder test set upgrades, and gap filler AFSATCOM payloads, required for transition to the Milstar satellite system. It also provides resources for development and acquisition of Milstar Extremely High Frequency terminals for the Air Force. The Milstar satellite system will provide a highly survivable, jam-resistant, worldwide, secure communications system to support the President and the military Commanders-in-Chief for command and control of selected United States strategic and tactical forces in all levels of conflict.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
- (U) Continue installation of force element and command post dual modem and radio upgrades
- (U) Continue EHF core terminal development
- (U) Continue fabrication and installation of EDM terminals for EC-135C aircraft and selected ground sites
- (U) Continue C-18 flight test program
- (U) Continue interoperability testing with the satellite payload Enhanced Design Verification Model (EDVM)
- (U) Begin facility modifications of Mission Control Complex (MCC) at the Consolidated Space Operations Center at Falcon AFS, Co.
- (U) Received Defense Acquisition Board (DAB) Milestone IIIA direction to proceed into Low Rate Initial Production (LRIP) (2 Jun 89)
- (U) Awarded LRIP contract (25 Sep 89)
- (U) Continue Low Volume Force Element (LVFE) terminal concept definition

2. (U) FY 1990 Planned Program:
- (U) Continue installation of force element and command post dual modem and radio upgrades
- (U) Continue EHF core terminal development
- (U) Continue fabrication and installation of EDM terminals for EC-135C aircraft and selected ground sites
- (U) Continue C-18 flight test program
- (U) Begin terminal IOT&E and continue interoperability testing with the satellite payload EDVM
- (U) Complete facility modifications of MCC at the Consolidated Space Operations Center at Falcon AFS, Co
- (U) Continue LRIP
- (U) Continue LVFE terminal concept definition

3. (U) FY 1991 Planned Program:
- (U) Complete installation of force element and command post dual modem and radio upgrades
- (U) Complete EHF core terminal development
- (U) Continue development contract modifications for logistic

PE: #0303601F
PE Title: Milstar Satellite Communication System (Air Force Terminals)
Project: #2847
Budget Activity: 3 - Strategic Programs

supportability and required design modifications found during initial fielding and test
- (U) Complete fabrication and installation of EDM terminals for EC-135C aircraft and selected ground sites
- (U) Complete C-18 flight test program
- (U) Continue IOT&E and interoperability testing with the satellite payload EDVM
- (U) Award LRIP contract option
- (U) Complete LVFE terminal concept definition and begin LVFE terminal full scale development

4. (U) Program to Completion:
- (U) Complete LRIP
- (U) Begin Full Scale Production (Milestone IIIB)
- (U) Complete development and begin production of the LVFE terminal
- (U) Milstar is a continuing program

D. (U) WORK PERFORMED BY: Milstar terminals are being developed by Raytheon Company, Sudbury, MA and Rockwell International, Dallas, Tx. Federal Research Center support is provided by the MITRE Corporation, Bedford, MA, and Lincoln Laboratory, Bedford, MA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None

2. (U) SCHEDULE CHANGES: None

3. (U) COST CHANGES: Funding rephased to reflect execution delays

F. (U) PROGRAM DOCUMENTATION:
- (U) Joint Milstar Communications, Control and Operations Concept (JMCCOC), Volume I (1 Jun 89) and Volume II (1 Aug 89)

G. (U) RELATED ACTIVITIES:
- (U) PE 0303603F (Milstar Satellite Communications System (Space and Mission Control))
- (U) PE 0604577F (EHF Satellite Communications)
- (U) PE 0303142A (Tactical Communications Ground Environment)
- (U) PE 0303109N (Satellite Communications)
- (U) PE 0303605F (Satellite Communications Terminals)
- (U) PE 0305119F (Space Boosters)
- (U) PE 0303603N (Milstar Satellite Communications System)
- (U) PE 0101113F (B-52 Squadrons)
- (U) PE 0101126F (B-1B)
- (U) PE 0101213F (Minuteman Squadrons)
- (U) PE 0101312F (Post Attack Command and Control System/Worldwide Command Post, EC-135H/J/P)
- (U) PE 0208019F (Tactical Cryptologic Activities, RC-135)
- (U) PE 0302015F (National Emergency Airborne Command Post, E-4B)
- (U) There is no unnecessary duplication of effort within AF or DoD.

PE: #0303601F
PE Title: Milstar Satellite Communication System (Air Force Terminals)

Project: #2487
Budget Activity: 3 - Strategic Programs

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

	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Aircraft Procurement (BA 10)				
Funds (PE 0302015F)	20,500	6,100**	10,700	35,600
Initial Spares	652	0	4,001	Continuing
Quantity (Terminals)	2	1	1	4
Funds (PE 0101312F)	19,600	22,900**	51,300	Continuing
Initial Spares	2,200	4,942	8,810	Continuing
Quantity (Terminals)	2	2	4	Continuing
Funds (PE 0303601F)	0	0**	0	Continuing
Initial Spares	1,173	11,765	514	Continuing
Quantity (Terminals)	0	0	0	Continuing
Other Procurement* (BA 16)				
Funds	73,394	54,065**	178,014	Continuing
Initial Spares	30,865	12,180	27,206	Continuing
Quantity (Term/HHM/TDS)	7/95/6	6/27/1	26/138/26	Continuing
Military Construction (BA 14)				
Funds	4,000***	330	2,060	Continuing

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

EVENT	DATE	RESULTS
- AFSATCOM Compatibility Test	Aug-Sep 88	Demonstrated backward compatibility with AFSATCOM
- Phase I Interoperability DEMO (Support LRIP Decision)	Oct-Nov 88	Demonstarted terminal/satellite waveform compatibility and terminal interoperability
- Phase II Interoperability DEMO	Aug 89	Demonstarted tri-service interoperability
- Terminal/MCE interface	Nov 89	Demonstrated terminal and MCE compatibility

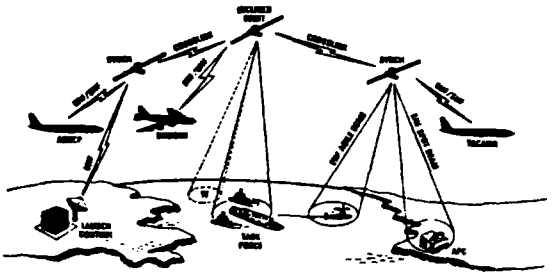
T&E ACTIVITY (TO COMPLETION)

EVENT	PLANNED DATE	REMARKS
- IOT&E	FY90	
- Phase IV Interoperability DEMO	FY92	Support FSP Decision

*Procures EHF/UHF and EHF only Terminals as well as Handheld Modules/Time Distribution Subsets (HHM/TDS)
**Approp Conf reduced the sum of the FY90 PB request for APAF and OPAF by 60%
***Funds inadvertently placed in PE 030605F, Air Force Satellite Terminals

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303603F Project: #2932
PE Title: Milstar Satellite Communications System (Space and Mission Control) Budget Activity: 3 - Strategic Programs
Project Title: Milstar



POPULAR NAME: Milstar

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	First Mission Control Element Element (MCE) Delivered	1st Satellite Communications Payload Delivered		MCE: MS IIIA, 1st Qtr, FY 92;
Engineering Milestones		Complete Satellite #1 Fabrication		
T&E Milestones	N/A	N/A	Conduct Satellite #1 Qual Tests	System IOT&E, 3rd Qtr, FY 93
Contract Milestones	Ongoing	Ongoing	Exercise Fab. Options for Sat. #s 4&5	Complete FSD; Satellite & MCE Prod.
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	246,583	374,623	718,740	Continuing
Support Contract	23,000	23,000	23,000	Continuing
In-House Support	844	844	844	Continuing
GFE/ Other	2,351	1,533	1,580	Continuing
Total	272,778	400,000	744,164	Continuing

Program Element: #0303603F Project: #2932
PE Title: Milstar Satellite Communications System (Space and Mission Control) Budget Activity: 3 - Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The Milstar Satellite Communications System is a joint service program to develop and acquire the Milstar Extremely High Frequency (EHF) satellite, its mission control segment, and new or modified communications terminals. The Milstar system will provide a highly survivable, jam-resistant, world-wide, secure communications system to meet the minimum essential wartime communications needs of the President and Commanders-in-Chief to command and control selected Air Force strategic and tactical forces through all levels of conflict. It will also support other high priority users in crisis/contingency situations. This Program Element (PE) funds for development of the Milstar satellite and its associated Mission Control Elements (MCE).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
- (U) Continued Developmental Flight Satellite #1 (DFS-1) hardware and software integration
- (U) Completed bus integration
- (U) Completed DFS-1 payload assembly at subcontractor
- (U) Continued launch vehicle integration
- (U) Conducted enhanced compatibility testing between communications payload and all three Service terminals
- (U) Continued fabrication of DFS-2 and DFS-3
- (U) Continued acquisition of long lead parts for DFS-4
- (U) Continued planning for Mission Control Complex (MCC) and Milstar Operations Center at Consolidated Space Operations Center (CSOC)
- (U) Began installation of engineering development model MCEs
- (U) Completed Independent Cost Analysis

2. (U) FY 1990 Planned Program:
- (U) Deliver DFS-1 payload to prime contractor
- (U) Complete fabrication of DFS-1 and continue with integration
- (U) Continue fabrication of DFS-2 and DFS-3
- (U) Begin qualification tests for DFS-1
- (U) Continue launch vehicle integration
- (U) Complete planning for system level end-to-end testing using DFS-1, MCE and terminals of all Services
- (U) Complete planning and begin activation of Milstar Operations Center (MOC) and Mission Control Center (MCC) at CSOC
- (U) Continue Mission Control Element (MCE) logistics support planning
- (U) Complete planning for MCE IOT&E
- (U) Continue installation of development model MCEs

Program Element: #0303603F Project: #2932
PE Title: Milstar Satellite Communications System (Space and Mission Control) Budget Activity: 3 - Strategic Programs

3. (U) FY 1991 Planned Program:
- (U)
- (U)
- (U)
- (U) Activate MOC and MCC at CSOC
- (U) Complete integration of engineering development model Mission Control Elements (MCEs) into IOT&E platforms
- (U) Conduct detailed planning for Milstar system-level Initial Operational Test and Evaluation (IOT&E)
- (U) Complete MCE qualification tests
- (U) Conduct MCE IOT&E

4. (U) Program to Completion
- (U) Complete development work on satellite and MCE
- (U)
- (U)
- (U) Begin Low Rate Initial Production (LRIP) of MCEs in FY 1992
- (U) Begin satellite production in FY 1992 with satellite #6
- (U) Begin installation of production model MCEs
- (U) Conduct system-level IOT&E
- (U) Milstar is a continuing program

D. (U) WORK PERFORMED BY: The development of the Milstar satellite and the MCE for the Milstar system is managed by Air Force Systems Command's Space Systems Division, Los Angeles AFB, CA. The contract for Full Scale Development of the Milstar satellite and MCE was awarded on 30 June 1983. The prime contractor is Lockheed Missiles & Space Co., Sunnyvale, CA. Subcontractors to Lockheed include: Hughes Aircraft Co., El Segundo, CA (crosslink and frequency and time standards); TRW, Inc., Redondo Beach, CA (communications payload); General Electric Co., Valley Forge, PA (data handling subsystem). The Aerospace Corporation, El Segundo, CA, provides general system engineering and integration.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None

2. (U) SCHEDULE CHANGES: First launch delayed one year by FY 90 Appropriations Bill. Mission Control Element (MCE) Low Rate Initial Production (LRIP) delayed one year by OSD Program Budget Decision (PBD).

Program Element: #0303603F Project: #2932
PE Title: Milstar Satellite Communications System (Space and Mission Control) Budget Activity: 3 - Strategic Programs

3. (U) COST CHANGES: $25M added to satellite RDT&E by OSD Program Budget Decision (PBD) and $167M added by OSD (PBD) to rephase funding to reflect impact of FY 90 Appropriations Bill adjustments.

F. (U) PROGRAM DOCUMENTATION:
- (U) Joint Milstar Communications, Control and Operations Concept (JMCCOC), Volume I (Jun 1989) and Volume II (Aug 1989).
- (U) Test and Evaluation Master Plan (TEMP), 1 Nov 1989.
- (U) System Operational Requirements Document (SORD), 27 Mar 1989

G. (U) RELATED ACTIVITIES:
- (U) PE0303601F (Milstar Satellite Communications System (AF Terminals))
- (U) PE0604577N (EHF Satellite Communications)
- (U) PE0303142A (Tactical Communications Ground Environment)
- (U) PE0303109N (Satellite Communications)
- (U) PE0303605F (Satellite Communications Terminals)
- (U) PE0305119F (Space Boosters)
- (U) PE0303603N (Milstar Satellite Communications System)
- (U) There is no unnecessary duplication of effort with the Air Force or the Department of Defense.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

EVENT	DATE	RESULTS
(U) Parts Radiation Characterization (Satellite & MCE)	FY84-Present	Meeting specifications
(U) Circuit Hardening Development Testing (Sat. & MCE)	FY84-Present	Meeting specifications
(U) Payload to Terminal Interfact Testing	FY88/FY89	Requirements met; supported terminal production
(U) Mission Control Element (MCE) Performance Testing	FY89/FY90	Meeting specifications
(U) Terminal Interoperability Test	Jul 88	Met interoperability requirements for Services

T&E ACTIVITY (TO COMPLETION)

EVENT	PLANNED DATE	REMARKS
(U) Satellite Qualification Testing	FY90/FY92	
(U) MCE to Terminal Interface Test	FY90	
(U) MCE Functional Qual. Test	FY91	
(U) System IOT&E	FY93/FY94	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303605F Budget Activity: #4 - Tactical Programs
PE Title: Military Satellite Communications (MILSATCOM) Terminals

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3163 UHF Satellite Terminal System (USTS)	7,360	1,760	306	Cont	TBD
3164 Ground Mobile Forces Terminals (GMFT)	4,925	4,155	5,765	Cont	TBD
3594 Universal SHF Satellite Communications Modem (UM)	5,368	0	0		
Total	17,653	5,915	6,071	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program develops military satellite communications terminals and associated modulator/demodulator (modem) equipment for use by the Air Force, other Services, and US Allies. Developments currently underway address strategic and tactical deficiencies of US Military Satellite Communications (MILSATCOM) systems. There are three satellite terminal projects in this program element.

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

1. (U) Project 3163, UHF Satellite Terminal System (USTS): Develops the UHF Satellite Terminal System (USTS) for the Air Force Military Airlift Command (MAC). The USTS will be a small UHF satellite communications terminal which will operate in either the airborne or ground mobile mode in support of MAC and other Air Force requirements. Key Feature: USTS will permit more effective military operations by providing Air Force users with a flexible, reliable, and secure worldwide Command and Control (C2) system through a Demand Assigned Multiple Access (DAMA) scheme for 5 KHz UHF satellite channels. The USTS DAMA scheme will greatly increase the number of users able to access the satellite channel at any one time. It will be the DOD standard for 5 KHz UHF operations and will be implemented in future Army and Navy terminal programs. The USTS DAMA scheme will also provide interoperability for Air Force terminals with the Navy developed 25 KHz UHF satellite DAMA systems.

(U) FY 1989 Accomplishments:
- (U) Performed interoperability demonstration with Navy 25 KHz DAMA system.
- (U) Initiated technical paper to study the Type I COMSEC for USTS.
- (U) Completed Developmental Test & Evaluation (DT&E) tempest testing

(U) FY 1990 Planned Program:
- (U) Complete DT&E
- (U) Initial Operational Test & Evaluation (IOT&E)
- (U) Prepare 5 KHz DAMA Technical Interface Specification
- (U) Begin production of USTS terminals and network control stations.

(U) FY 1991 Planned Program:
- (U) Conduct OT&E testing of USTS system.
- (U) Complete development of the USTS terminal and network control system with Type I COMSEC and interoperable 5 KHz and 25 KHz DAMA schemes.

Program Element: #0303605F Budget Activity: #4 - Tactical Programs
PE Title: Military Satellite Communications (MILSATCOM) Terminals

(U) Program to Completion:
- (U) Complete production of 300 terminals by FY 1994.
- (U) This is a continuing program.

(U) Work Performed By: Work is being performed by the Electronic Systems Division (ESD)(Air Force Systems Command), Hanscom AFB MA. Contractor: M/A-COM Government Systems Division, San Diego, CA.

(U) Related Activities:
- (U) The Navy has developed the 25 KHz UHF DAMA scheme that the USTS program will incorporate for interoperability on 25 KHz UHF satellite channels.
- (U) An Army development program for a manpack UHF terminal (Advanced Manpack UHF Terminal - AMUT) will incorporate the USTS 5 KHz DAMA scheme into its design. This is required in response to JCS direction making the USTS DAMA scheme the DOD standard for 5 KHz UHF satellite channels.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:
Other Procurement (BA 3):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	-	7,300	6,758	Cont	TBD

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 3164, Ground Mobile Forces Terminals: The US Air Force Ground Mobile Forces Program is completing fielding of Multi-Channel Supr High Frequency (SHF) transportable satellite terminals for the Tactical Air Control System and Combat Communications forces. These terminals will be retrofitted with the Army developed Anti-Jam Control Modem (AJCM) providing full interoperability among all Services° tactical SHF satellite communications terminals. The Air Force requires a small, lightweight SHF satellite communications terminal to provide reliable, secure voice and data for highly mobile combat teams such as Forward Air Controllers, Special Operations Forces, and Military Airlift Command (MAC) Combat Control Teams. This project will conduct a demonstration/validation effort for lightweight SHF satellite ground terminal technology to assess the feasibility of meeting user requirement with SHF manpack units. The development must achieve very compact lightweight units that can support flexible networks of many users with minimal impact on satellite resources. This program element also supports Air Force participation in the Army developed TSC-124 (Single Channel Objective Tactical Terminal - SCOTT).

(U) FY 1989 Accomplishments:
- (U) Supported integration of the AJCM modems into the multi-channel SHF terminals worldwide.
- (U) Initiated acquisition specification for SHF lightweight manpack terminals.

Program Element: #0303605F Budget Activity: #4 - Tactical Programs
PE Title: Military Satellite Communications (MILSATCOM) Terminals

(U) FY 1990 Planned Program:
- (U) Complete the integration of AJCM modems into the multi-channel SHF terminals.
- (U) Initiate the demonstration/validation program for SHF lightweight manpack terminals.
- (U) Support Air Force participation in the Army SCOTT program.
- (U) Develop Multi-Command Required Operational Capability (MROC) and associated Technical Analysis/Cost Estimate (TA/CE) for Super High Frequency Demand Assigned Multiple Access (DAMA) networks, as tasked by the Joint Staff.

(U) FY 1991 Planned Program:
- (U) Complete the Demonstration/Validation program for SHF lightweight manpack terminals.
- (U) Continue Air Force participation in the Army SCOTT development and procurement program in support of Air Force user requirements for CINC warfighting communications.

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

(U) Work Performed By: The SHF multi-channel terminals currently being fielded, were developed and manufactured by RCA, Camden NJ. Electronic Systems Division (Air Force Systems Command), Hanscom AFB, MA manages the program for the Air Force. The US Army Satellite Communications Agency was the contracting office for this project.

(U) Related Activities:
- (U) The GMF Satellite Communications (GMFSC) program is a joint service program addressing tactical forces satellite communications requirements of the Army, Air Force and Marine Corps.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (BA 3):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	1,579	6,099	4,324	Cont	TBD

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 3594, Universal SHF Satellite Communications Modem: Develops an SHF satellite modem to provide direct interoperability among strategic and tactical SHF terminals as well as with Allies, and to support all data rate communications in a hostile, electromagnetic and nuclear effects environment. The direction for this program was provided by the Assistant Secretary of Defense for Command, Control, Communications and Intelligence in response to Congressional mandates for interoperability. This program is a joint US/United Kindom program. At the direction of OASD/C3I this program will be transferred to the Army beginning in FY1990.

(U) FY 1989 Accomplishments:
- (U) Conducted brassboard (prototype) demonstration testing.
- (U) Evaluated results of brassboard testing.

Program Element: #0303605F Budget Activity: #4 - Tactical Programs
PE Title: Military Satellite Communications (MILSATCOM) Terminals

(U) Program to Completion:
- (U) Complete production of 300 terminals by FY 1994.
- (U) This is a continuing program.

(U) Work Performed By: Work is being performed by the Electronic Systems Division (ESD)(Air Force Systems Command), Hanscom AFB MA. Contractor: M/A-COM Government Systems Division, San Diego, CA.

(U) Related Activities:
- (U) The Navy has developed the 25 KHz UHF DAMA scheme that the USTS program will incorporate for interoperability on 25 KHz UHF satellite channels.
- (U) An Army development program for a manpack UHF terminal (Advanced Manpack UHF Terminal - AMUT) will incorporate the USTS 5 KHz DAMA scheme into its design. This is required in response to JCS direction making the USTS DAMA scheme the DOD standard for 5 KHz UHF satellite channels.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:
Other Procurement (BA 4):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	-	7,300	6,758	Cont	TBD

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 3164, Ground Mobile Forces Terminals: The US Air Force Ground Mobile Forces Program is completing fielding of Multi-Channel Super High Frequency (SHF) transportable satellite terminals for the Tactical Air Control System and Combat Communications forces. These terminals will be retrofitted with the Army developed Anti-Jam Control Modem (AJCM) providing full interoperability among all Services' tactical SHF satellite communications terminals. The Air Force requires a small, lightweight SHF satellite communications terminal to provide reliable, secure voice and data for highly mobile combat teams such as Forward Air Controllers, Special Operations Forces, and Military Airlift Command (MAC) Combat Control Teams. This project will conduct a demonstration/validation effort for lightweight SHF satellite ground terminal technology to assess the feasibility of meeting user requirement with SHF manpack units. The development must achieve very compact lightweight units that can support flexible networks of many users with minimal impact on satellite resources. This program element also supports Air Force participation in the Army developed TSC-124 (Single Channel Objective Tactical Terminal - SCOTT).

(U) FY 1989 Accomplishments:
- (U) Supported integration of the AJCM modems into the multi-channel SHF terminals worldwide.
- (U) Initiated acquisition specification for SHF lightweight manpack terminals.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0305110F
PE Title: Satellite Control Facility (SCF)
Project Number: XXX1
Budget Activity: #6-Defense Wide Mission Support

A. (U) RDT&E RESOURCES ($ in Thousands)
Project Title: SCF

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SCF	92254	85579	127454	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The SCF program funds the development, acquisition, and continuing support to a highly reliable national satellite tracking, telemetry and commanding capability in support of developmental and operational satellite systems. The SCF is evolving to the Air Force Satellite Control Network (AFSCN). The AFSCN is a global network of communications and computer systems required to support a growing inventory of increasingly complex space vehicles which support operational forces in peace and wartime. The AFSCN must continue to be responsive to the requirements of the satellite systems it supports.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) Provided system engineering and development of network hardware/software modifications to meet evolving satellite needs.
- (U) Continued transition of satellite programs from the old data system configuration to a new computer configuration.
- (U) Installed and checked out equipment in the Northern Europe Station and achieved station IOC. Completed ARTS Acquisition I stations.
- (U) Initiated upgrade of second increment of three tracking stations under ARTS Acquisition II.
- (U) Plan for the Survivable Satellite Command and Control (S^2C^2) with focus on operational capabilities necessary for interoperable, enduring satellite control in peace and war.

(U) FY 1990 Planned Program:
- (U) Provide system engineering and development of network hardware/software modifications to meet evolving satellite program requirements.
- (U) Continue transition of satellite programs from the old data systems configuration to a new computer configuration.
- (U) Initiate upgrade of third increment of three stations under ARTS Acquisition II.
- (U) S^2C^2 planning discontinued due to OSD reduction.

(U) FY 1991 Planned Program:
- (U) Provide system engineering and development of network hardware/software modifications to meet evolving satellite program requirements.

PROGRAM ELEMENT: #0305110F
TITLE: Satellite Control Facility (SCF)
PROJECT NUMBER: XXX1
BUDGET ACTIVITY: #6-Defense Wide Mission Support

- (U) Continue transition of satellite programs from the old data systems configuration to a new computer configuration.
- (U) Initiate upgrade of fourth increment of four stations under ARTS Acquisition II.
- (U) ARTS Diego Garcia tracking station IOC.
- S^2C^2 planning discontinued due to OSD reduction.

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

D. (U) WORK PERFORMED BY: In-house efforts will be accomplished by Air Force Systems Command Space Systems Division, Los Angeles, CA. Principal contractors are: Ford Aerospace Corporation (FAC), Sunnyvale, CA, provides study and development analysis for the range facilities and communications; Aerospace Corporation, El Segundo, CA, provides general system engineering and integration support; Space Applications Corporation, San Jose, CA, provides system engineering integration and test analysis (Small Business Set-Aside); Ford Aerospace Corporation, Sunnyvale, CA, provides development and acquisition of the ARTS program.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: RDT&E Sustaining engineering funds for new AFSCN computer system transferred to O&M based on Congressional direction.
2. (U) SCHEDULE CHANGES: (a) ARTS station IOCs delayed six months consistent with OSD budget reductions. (b) S^2C^2 planning and development slipped to FY 92 consistent with budget reductions. (c) Transition of all satellite programs to new computer system delayed to FY 93 consistent with Air Force TOA. The effect of the FY 90 budget reduction is still being evaluated. Transition may slip to FY 94.
3. (U) COST CHANGES: Congressional FY90 RDT&E reduction of $17.0M.

F. (U) PROGRAM DOCUMENTATION:
Multi-Command Required Operational Capability (MROC) for Integrated Satellite Control System (ISCS) 4-88, Sep 88

G. (U) RELATED ACTIVITIES:
- (U) Satellite Control Network and non-DCS telecommunications program activities are in PE 0305151F, (SCF Telecommunications).
- (U) Real property maintenance activities are in PE 0305894F, (Real Property Maintenance, AFSC.)
- (U) Base operating support is in PE 0305896F, (Base Operating Support, AFSC).
- (U) Consolidated Space Operations Center, PE 0305130F, will share control functions with the Consolidated Space Test Center.

PROGRAM ELEMENT: #0305110F
TITLE: Satellite Control Facility (SCF)
PROJECT NUMBER: XXX1
BUDGET ACTIVITY: #6-Defense Wide Mission Support

- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
1. Other Procurement: BA 83 Funds	52,813	63,215	83,025	TBD
2. Military Construction: Funds	8,237	20,200	4,600	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1.	(U) Automated Remote Tracking Station (ARTS) Contract Award	Jun 1984
2.	(U) Command and Control Sustaining Engineering Contract Award	Jan 1986
3.	(U) ARTS-Thule Tracking Station Initial Operational Capability	Mar 1988
4.	(U) ARTS Acquisition II Contract Award	Aug 1988
5.	(U) ARTS-Diego Garcia Station IOC	Feb 1991
6.	(U) ARTS Modification of Existing Stations	1990 - 1993
7.	(U) ARTS-Full Operational Capability	Sep 1993

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0305114F
PE Title: Air Traffic Control And Landing Systems (ATCALS)
Budget Activity: #5-Intelligence and Communications

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2026 System Support	2,420	339	356	Cont	TBD
2759 Mobile Microwave Landing System (MMLS)	9,944	7,200	0	0	37,731
2967 Air Traffic Control Survivability	5,000	0	0	0	16,000
3042 BAMBOO TREE	400	317	200	Cont	TBD
3587 Microwave Landing Systems (MLS) Avionics	12,849	12,953	16,001	Cont	TBD
TOTAL	30,613	20,809	16,557	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides the Air Force with the Air Traffic Control And Landing Systems (ATCALS) (formerly called Traffic Control And Landing Systems (TRACALS)) equipment required for the safe, efficient, worldwide, and all weather flying operations. The mission is to provide takeoff, enroute, and landing guidance (surveillance) in order to meet wartime sortie requirements. In peacetime, the mission is to support training, logistics, and other operational flying with maximum safety. Equipment in the above projects supports tactical/mobile needs of the Air Force. Microwave Landing Systems (MLS) avionics will be interoperable with both fixed-base and mobile MLS equipment.

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

1. (U) Project 2026, System Support: Continued support for ATCALS programs including several joint efforts with the Federal Aviation Administration (FAA).

(U) FY 1989 Accomplishments:
- (U) Continued definition of the USAF - FAA interface for the National Airspace System. See PE #0305137, National Airspace System Descriptive Summary.
- (U) Continued definition studies to use the Global Positioning System (GPS) as an interface with the air traffic control system for both USAF and the FAA.
- (U) Definition study for the Military Airspace Management System (MAMS).

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

(U) FY 1990 Planned Program:
- (U) Continued support for all ATCALS projects.
- (U) Increased role for USAF and the NAS.
- (U) Continued definition of GPS capabilities.
- (U) MAMS evaluation.

(U) FY 1991 Planned Programs:
- (U) Continued essential work to ensure the USAF keeps pace with changes in the air traffic control system.
- (U) Ensure operational capabilities in the air traffic control environment.
- (U) Continuing program keeping pace with civil airspace modernization and the NAS.

(U) Work Performed By: Air Force Systems Command Electronic Systems Division, Hanscom AFB, MA manages the overall ATCALS effort. Mitre Corporation, Bedford, MA, provides system support.

(U) Related Activities:
- (U) Program Element #0305137F, National Airspace System.
- (U) Program Element #0305164F, Navstar Global Positioning System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 2759, Mobile Microwave Landing System (MMLS): Provides a compact rapidly deployable MMLS for use at austere airfields providing precision landing capabilities.

(U) FY 1989 Accomplishments:
- (U) Completed Preliminary and Critical Design Reviews (PDR/CDR).
- (U) System breadboarding and architecture development.

(U) FY 1990 Planned Program:
- (U) Start Developmental Test and Evaluation (DT&E).

(U) FY 1991 Planned Program:
- (U) Start Initial Operational Test and Evaluation (IOT&E).
- (U) Production decision.
- (U) Start production of 8 systems in first procurement option.

(U) Work Performed By: Bell Aerospace, Buffalo, NY. Air Force Systems Command Electronic Systems Division, Hanscom AFB, MA, manages the MMLS effort. ARINC

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

Research Corporation, Annapolis, MD and Mitre Corporation, Bedford, MA provide technical and cost support.

(U) Related Activities: None.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

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

Other Procurement (3080):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	0	10,345	18,000	28,345

(U) International Cooperative Agreements: None.

3. (U) Project 2967, Air Traffic Control Survivability: Provides the capability to restore essential air traffic control services to battle damaged locations through the use of a Tower Restoral Vehicle (TRV) and a Surveillance Restoral Vehicle (SRV).

(U) FY 1989 Accomplishments:
- (U) Development contract awarded to provide prototypes of the TRV and SRV for test and evaluations.

(U) FY 1990 Planned Program:
- (U) None.

(U) FY 1991 Planned Program:
- (U) None.

(U) Work Performed By: Contract awarded to Airspace Technology Corp, Irvine, CA, for development of the TRV/SRV. Air Force Systems Command Electronic Systems Division manages the TRV/SRV effort.

(U) Related Activities: None.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

4. (U) Project 3042, BAMBOO TREE: BAMBOO TREE provides continued support to ensure the United States has air access to the Berlin corridors.

(U) FY 1989 Accomplishments:
- (U) Upgraded the Templehof Central Airport radio system.

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

(U) FY 1990 Planned Program:
- (U) Integration of the Templehof radio system.

(U) FY 1991 Planned Program:
- (U) Provide continuing support to the BAMBOO TREE mission.

(U) Work Performed By: Air Force Systems Command Electronic Systems Division manages the BAMBOO TREE effort. Air Force Communication Command will install the upgrade.

(U) Related Activities: None.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

Other Procurement (3080):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	378	1,345	0	0	2,907

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0305114F
PE Title: Air Traffic Control And Landing Systems (ATCALS)
Project Number: # 3587
Budget Activity: # 5 - Intelligence and Communications

Project Title: Military Microwave Landing System Avionics (MMLSA)

No Photo Available

POPULAR NAME: Not Applicable

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	FSD Decision Jun 89			Production Decision Aug 94
Engineerng Milestones				
T&E Milestones				Start DT&E/IOT&E Jun 93/Jan 94
Contract Milestones		FSD Contract Award Dec 89		Production Contract Sep 94
BUDGET ($000)	FY 1989	FY 1990	FY 1991	(To Complete)
Major Contract	Funds for Dec 89 Award 8,264	3 FSD Contracts Continue 7,941	3 Contracts Continue 9,643	Contract Continues 2,833
Support Contract	MITRE 1,960 ARINC 1,500 SSAI 215	MITRE 1,800 ARINC 630 SSAI 215	MITRE 3,400 ARINC 1,672 SSAI 482	MITRE 6,554 ARINC 5,562 SSAI 2,300
In-House Support	Logistics, Travel, SPO 229	Logistics, Travel, SPO 153	Logistics, Travel, SPO 170	Logistics, Travel, SPO 491
GFE/ Other	88	A-Kit Integration 2,201	A-Kit Integration 463	10,082
Total	12,849 *	12,953	16,001	Continuing

* Includes $669K for Commercial MLS Avionics modifications.

Program Element: # 0305114F
PE Title: Air Traffic Control And Landing Systems (ATCALS)
Project Number: # 3587
Budget Activity: # 5 - Intelligence and Communications

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES: The Military Microwave Landing System Avionics (MMLSA) acquisition is part of a twenty year program to transition the Air Force operations from use of Precision Approach Radars (PAR) and Instrument Landing Systems (ILS) to the international Microwave Landing System (MLS) for precision landing operations. The MMLSA will be developed for integration and installation on high performance and space constrained aircraft. MMLSA will have both MLS and ILS capabilities. The MMLSA will work in the airborne uninhabited fighter environment, capable of high-G stress, and have a significantly increased Mean Time Between Failure (MTBF) rate in comparison to current systems (7,000 hour fielded MTBF planned).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) FSD RFP Release May 89.
   - (U) AFSARC FSD decision Jun 89.

3. (U) FY 1990 Planned Program:
   - (U) Contract Award Dec 89.
   - (U) Continue MMLSA development.

4. (U) FY 1991 Planned Program:
   - (U) Continue MMLSA development.
   - (U) Start F-16 integration.
   - (U) Start FSD DT&E.

5. (U) Program to Completion:
   - (U) Early Operational Assessment (EOA) in Apr 92.
   - (U) Start DT&E Nov 93 and IOT&E Feb 94.
   - (U) Production decision Aug 94.
   - (U) IOC FY 1996.
   - (U) Acquisition of 7542 systems through FY 2005.

D. (U) WORK PERFORMED BY: The MMLSA FSD contract was awarded to Rockwell International, Ceder Rapids, Iowa; Plessey Electronics Corp, Wayne, NJ; and Hazeltine Corp, Greenlawn, NY. Three contractors were selected for FSD with full and open competition to select two contractors for production.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Contract award slip from Aug 89 to Dec 89.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) Air Force Communications Command General Operating

Program Element: # 0305114F | Project Number: # 3587
PE Title: Air Traffic Control And Landing Systems (ATCALS) | Budget Activity: # 5 - Intelligence and Communications

Requirement, Advanced Military Landing System, 16 Feb 78.
- (U) Justification of Major System New Start, 5 May 82.
- (U) R-S 2026(5)/35114F, PMD for TRACALS (404L), 23 Oct 81, as amended.
- (U) HQ USAF/RDS Ltr, Service Responsibilities for MLS, 4 Apr 83.
- (U) DOD MLS Implementation Plan, 1 Jun 84.
- (U) Joint Requirements Oversight Council Memo, MLS, Action Memo, 27 Mar 87.
- (U) NATO Air Force Armaments Group V on Avionics and Landing Systems Standardization Agreement on MLS (STANAG 4184).
- (U) 4030(9)/35114F, PMD for MLS, 6 Jun 89.
- (U) MLS Acquisition Decision Memorandum, 27 Jul 89.

G. (U) RELATED ACTIVITIES:
- (U) Part of the overall effort for the USAF acquisition of the Fixed Base MLS, Commercial MLS Avionics, and Mobile MLS.
- (U) USAF lead agency for tri-service program working concurrently with the FAA.
- (U) Global Positioning System (GPS) to be investigated as an alternative to precision distance measuring equipment (Program Element #0305164F).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3010	1,200	6,208	10,434	403,658	421,500

2. (U) MILITARY CONSTRUCTION: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
FSED	Sep 88	Five contractors successfully completed FSED.

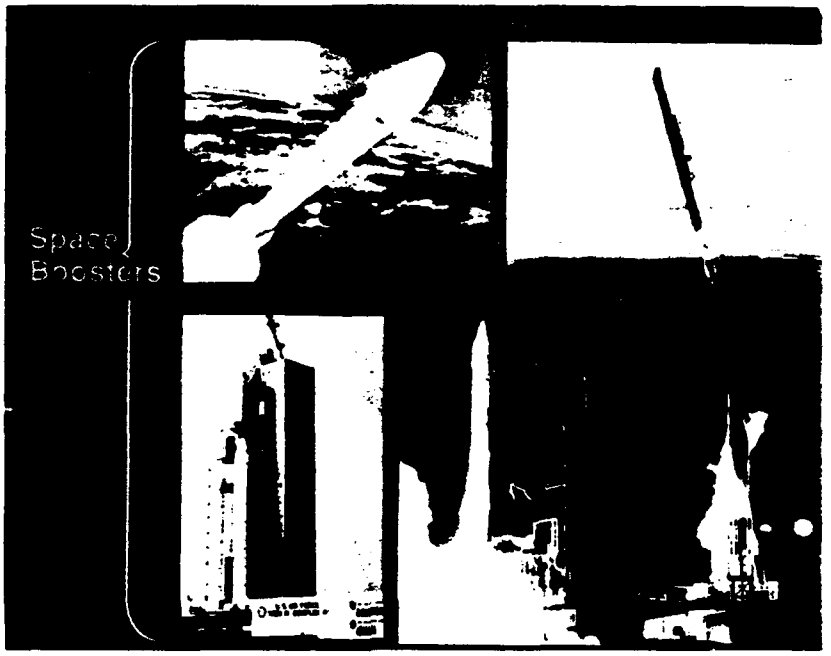
Program Element: # 0305114F
PE Title: Air Traffic Control And Landing Systems (ATCALS)
Project Number: # 3587
Budget Activity: # 5 - Intelligence and Communications

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
EOA/DT&E	2nd Qtr 92	Start
EOA/DT&E	3rd Qtr 92	End
FAT Phase	3rd Qtr 92	Start
FAT/DT&E	3rd Qtr 93	Start
FAT/DT&E	1st Qtr 94	End
FAT/OT&E	1st Qtr 94	Start
FAT/OT&E	3rd Qtr 94	End

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305119F
PE Title: SPACE BOOSTERS
Project: # N/A
Budget Activity: #6 - DEFENSE WIDE MISSION SUPPORT



POPULAR NAME: EXPENDABLE LAUNCH VEHICLES (ELVs)

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Final Titan 34D Launch			
Engineering Milestones	Delta II ILC - Feb 89 - - - - - - - - Titan IV/IUS ILC - Cape Canaveral, Feb 89		Atlas II ILC - 2 QTR - - - - - - - - Titan IV/NUS ILC Vandenberg 1 Qtr - - - - - - - - Titan IV/ Centaur ILC Cape Canaveral 3 Qtr	Titan IV 2nd Pad (LC-40) Cape Canaveral 4 Qtr FY 92 - - - - - - - - Titan IV 2nd Pad Vandenberg 1 Qtr FY 96
T&E Milestones	N/A	N/A	N/A	N/A

Program Element: #0305119F
PE Title: SPACE BOOSTERS
Project: # N/A
Budget Activity: #6 - DEFENSE WIDE MISSION SUPPORT

	FY 1989	FY 1990	FY 1991	Program Total
Contract Milestones	Delta II option Jan 89 - - - - - - - - - Atlas II option Oct 88	Atlas II Option Oct 89 - - - - - - - - - Titan IV Follow-on buy 1 Qtr - - - - - - - - - Delta II Follow-on buy 4 Qtr	Atlas II Option Oct 90	Atlas II Option (annually)
BUDGET ($000)				
Major Contracts	Delta II 3374 Titan II 10430 Atlas II 36417 Pegasus 6270 Titan IV 385900	Delta II 2105 Atlas II 2300 Titan II 530 Pegasus 3650 Titan IV 297828	Delta II 1075 Titan II 10751 Pegasus 5114 Titan IV 171976	
Support Contract	11402	9043	11869	
In-House Support	7388	8985	10756	
GFE/ Other	Delta II 592 Atlas II 319	Delta II 6398 N Test Rg 10800 DII QPQ 19888	Delta II 5351 Pegasus 3617 DII QPQ 13788	
Total	462092	361527	234297	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: National security requirements dictate a continuing, highly reliable means of placing critical Department of Defense (DOD) satellites into required orbits. Assured access to space, directed by the President in the National Security Launch Strategy, will be accomplished through the use of a robust mix of Expendable Launch Vehicles (ELVs) in this program and by the Space Transportation System. The Space Boosters program provides development, procurement and launch of DOD ELVs, including Titan IV, Delta II, and Atlas II at Cape Canaveral AFS, Florida and Titan IV, Titan II Space Launch Vehicle (SLV),Atlas E and Pegasus at Vandenberg AFB, California. Major Development efforts include the following: For Titan IV, development of three different configurations (Inertial Upper Stage, Centaur Upper Stage, and No Upper Stage), payload fairings, Centaur upper stage, and solid rocket motor upgrade; Titan II SLV subsystem modifications; Delta II upgrades, composite solid rocket motor cases, liquid rocket engine changes and new payload fairings. Procurement of 41 Titan IVs, development and modification of 15 Titan II SLVs, development and procurement of up to 24 Delta II's and planning for up to 10 Atlas II launches are ongoing. The Delta II program also is providing ELVs for NASA through the Quid Pro Quo (QPQ) agreement between DoD and NASA through FY 91. This program also provides for engineering support of active launch programs and post-flight

Program Element: #0305119F Project: # N/A
PE Title: SPACE BOOSTERS Budget Activity: #6 - DEFENSE WIDE MISSION SUPPORT

assessment of DOD ELVs to maintain their high demonstrated reliability. A summary ELV performance capabilities, by booster type, follows:

BOOSTER/CONFIGURATION	MISSION ORBIT	PERFORMANCE (lbs to orbit)
Titan IV/Centaur	Geosynchronous	10,000
Titan IV/Inertial Upper Stage	Geosynchronous	5,200
Titan IV/No Upper Stage (NUS)	Low Easterly	39,100
Titan IV/NUS	Low Polar	31,100
Atlas II	Geo-Transfer	5,800
Delta II	Semi-Synchronous	2,500
Titan II Space Launch Vehicle	Low Polar	4,200
Atlas E	Low Polar	1,750

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued Development of Delta II, Atlas II, and Titan IV
   - (U) Launched First Delta II and Titan IV launch vehicles
   - (U) Continued Centaur upper stage and Titan IV SRMU development

2. (U) FY 1990 Planned Program:
   - (U) Begin modification of SLC-40 at CCAFS for Titan IV
   - (U) Begin construction of second Titan IV pad at Vandenberg AFB
   - (U) Begin Construction of Solid Motor Assembly Building at CCAFS

3. (U) FY 1991 Planned Program:
   - (U) Launch Pegasus with AF payload
   - (U) Complete modification of SRMAF
   - (U) Launch first Atlas II launch vehicle
   - (U) Deliver first Titan IV Centaur Upper Stage
   - (U) Launch first Titan IV Centaur from CCAFS
   - (U) Launch first Titan IV from Vandenberg AFB

4. (U) Program to Completion
   - (U) This is a continuing program
   - (U) Continue Titan II, Titan IV, Delta II, Atlas II, and Pegasus flight assessment, reliability maintenance and obsolete component replacement until all vehicles have been launched
   - (U) Complete development on Delta II, Atlas II and Titan IV

D. (U) WORK PERFORMED BY: Air Force Systems Command's Space Systems Division, Los Angeles AFB, CA is responsible for program management. Systems Engineering is provided by the Aerospace Corp, El Segundo, CA. Titan Contractors include Martin Marietta Corp, Denver, CO; Aerojet Techsystems Co., Sacramento, CA; McDonnell Douglas Astronautics Corp, Huntington Beach, CA United Technologies Chemical Systems Division, Sunnyvale, CA; Hercules Corp, Magna, UT; General Motors Delco Electronics Division, Santa Barbara, CA; General Dynamics Convair Division, San Diego, CA; and Boeing Aerospace Corp, Seattle, WA. Delta II prime contractor is McDonnell Douglas Astronautics Corp, Huntington Beach, CA with subcontracts to Rockwell International Rocketdyne Division, Canoga Park, CA; Aerojet Techsystems Co, Sacramento, CA; General

Program Element: #0305119F Project: # N/A
PE Title: SPACE BOOSTERS Budget Activity: #6 - DEFENSE WIDE MISSION SUPPORT

Motors Delco Electronics Division, Santa Barbara, CA; Morton Thiokol Corp, Huntsville, AL and Elkton, MD; and Hercules Corp, Magna, UT. Atlas E and Atlas II contractors are General Dynamics Convair Division, San Diego, CA and Rockwell International Rocketdyne Division, Canoga Park, CA. Pegasus prime contractor is Orbital Sciences Corp, Fairfax, VA, with subcontract with Hercules Corp, Magna, UT.

E. (U) COMPARISON WITH FY 1990/1991 DESCRIPTIVE SUMMARY
1. (U) TECHNICAL CHANGES: Pegasus options on DARPA contract will be exercised in FY 90 and FY 91.
2. (U) SCHEDULE CHANGES: Titan IV/ILC moved to Feb 89.
Titan IV Centaur ILC moved to 3 Qtr 91
Delta II ILC moved to Feb 89.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) National Space Policy, January 1988
- (U) Program Decision Memorandum, 25 July 1988

G. (U) RELATED ACTIVITIES:
- (U) Classified space programs*
- (U) Defense Satellite Communications System (PE 0303110F)
- (U) Global Positioning System (PE 0305165F)
- (U) Defense Meteorological Satellite Program (PE 030516F)
- (U) Defense Support Program (PE 0102431F)
- (U) Milstar (PE 0303603F)
- (U) Space Test Program (PE 0603402)
- (U) The National Oceanic and Atmospheric Administration polar orbiting meteorological and earth resources satellites*
- (U) There is no unnecessary duplication of this effort within the Air Force or the Department of Defense.

* Note: Asterisks indicate related activities which reimburse the Space Boosters Program for expendable launch vehicle services.

H. (U) OTHER APPROPRIATION FUNDS
1. (U) PROCUREMENT:

	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	FY 1992 Estimate	Total Program
Missile Procurement, BA 5	595,198	395,147	478,311	584,792	continuing
Other Procurement, BA 83	2,972	0	0	0	36,693
Military Construction	0	89,000	29,200	24,000	142,200

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

PROGRAM ELEMENT: #0305130F
TITLE: Consolidated Space Operations Center (CSOC)
PROJECT NUMBER: XXX1
BUDGET ACTIVITY: #6-Defense Wide Mission Support

A. (U) RDT&E RESOURCES ($ in Thousands)

Project Title: CSOC

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
CSOC	34,913	26,938	24,323	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Consolidated Space Operations Center (CSOC) program funds the development, acquisition, and continuing operation of a major facility for the planning and execution of Department of Defense (DOD) space operations. CSOC, located at Falcon Air Force Base, CO, will function as a major operational center within the Air Force Satellite Control Network (AFSCN), a worldwide configuration of ground resources consisting of Remote Tracking Station, communications and control centers. CSOC's main element is the Satellite Operations Complex (SOC). Supporting elements include the Communications Segment (CS) and Network Control Segment (NCS). The SOC will control operational DOD satellites. The CS provides intrastation communications and connectivity to the existing AFSCN. The NCS schedules and controls the RTS. The CSOC will correct vulnerability, electronic privacy and capacity deficiencies in the existing satellite control architecture.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:

- (U) MCC-1A developmental testing continued and initial operational test and evaluation began. GPS on-orbit operations continued along with GPS launch support from CSOC.
- (U) Primary control authority for the GPS constellation transitioned from Onizuka AFB, Ca to MCC-1A at CSOC.
- (U) Developmental testing and on-orbit support for Defense Meteorological Satellite Program (DMSP) and the Defense Support Program (DPS) support capability was performed in MCC-1B.
- (U) Initial SOC Training completed.
- (U) Initial operations of Operations Control Center (OCC) and the Training Element.

(U) FY 1990 Planned Program:

- (U) Test and transition of MCC-1 (A&B) and MCC-2. System tests will demonstrate tracking, monitoring and commanding of DSP and DMSP in MCC-1 and military communications satellites (COMSAT) in MCC-2. Operational testing will culminate in operational turnover of MCC-1A (GPS), DMSP operations in MCC-1B, MCC-2, Weather Support Unit, and Security Control System to AF Space Command.
- (U) Initial CS training.

PROGRAM ELEMENT: #0305130F
TITLE: Consolidated Space Operations Center
PROJECT NUMBER: XXX1
BUDGET ACTIVITY: #6-Defense Wide Mission Support

(U) FY 1991 Planned Program:
- (U) The NCS/range scheduling/control will become fully operational.
- (U) Operational testing of DSP operations in MCC-1B culminating in operational turnover.
- (U) Development testing of the communications segment.

(U) Program To Completion:
- (U) Operational testing of the communications segment and final CSOC program turnover for operations.
- (U) This is a continuing program
- (U) RDT&E portion of this program element will continue for sustaining engineering support to satellite operations.

D. (U) WORK PERFORMED BY: In-house efforts will be accomplished by the Air Force Systems Command Space Systems Division, Los Angeles, CA. Major contractors are TRW, Redondo Beach, CA; Space Communications Co., a CONTEL division, Gaithersburg, MD; ISYS Security Systems, a JWP division, Los Alamitos, CA; Lockheed Space and Missile Co., Sunnyvale, CA and INFOTEC Corp., Costa Mesa, CA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) Technical Changes: None
2. (U) Schedule Changes: Rebaseline of command/control software and communications systems installations due to prior year budget reduction and technical problems. Program rebaselined to include incremental operational turnovers to provide capabilities in a timely manner. Effects of the FY 90 budget reduction are still being evaluated.
3. (U) Cost Changes: Congressional FY90 RDT&E reduction of $2.50M.

F. (U) PROGRAM DOCUMENTATION:
- (U) Mission Element Need Statement (MENS) Sep 1979
- (U) Test and Evaluation Master Plan (TEMP)- Annual Update Nov 1989

G. (U) RELATED ACTIVITIES:
- (U) Program management is funded in PE 0702806F, Acquisition/Command Support.
- (U) PE 0303112F, AF Communications, and 0303126F, Long Haul Communications, provide operational communications support.
- (U) PE 0305110F, Satellite Control Facility, funds the Data System Modernization project which develops CSOC's satellite control equipment.
- (U) Air Training Command participation in CSOC operations training is supported by part of PEs 08004731F, General Skill Training; 0804772F, Training Development; and 0805796F, Base Operations (Training).
- (U) Base operations support funded by PE 0102496F, Base Operations-AFSPACECOM.

PROGRAM ELEMENT: #0305130F PROJECT NUMBER: XXX1
TITLE: Consolidated Space Operations Center BUDGET ACTIVITY: #6-Defense Wide Mission Support

- (U) Logistics support funded by PE 0701112F, Inventory Control Pt. Operations.
- (U) Utilities/facilities maintenance in PE 0102894F, Real Property Maintenance.
- (U) PE 03005165F funds the GPS Master Control Station collocated at Falcon AFB.
- (U) PE 0303603F funds development, Initial Operational Test and Evaluation and operation of Milstar Master Control Station also collocated at Falcon AFB.
- (U) Funding/manning in PEs 0702891F, Commissary/Retail Sales, and 0807792F, Hospitals/Medical Clinics support CSOC personnel.
- (U) There is no unnecessary duplication of effort within the Air Force or DoD.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. Other Procurement: BA 83 Funds	3,318	2,094	6,341	Cont	TBD

2. Military Construction: Not applicable.

I. (U) INTERNATIONAL AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

1.	(U) Construction Start	May 1983
2.	(U) Facility Occupancy	Oct 1985
3.	(U) GPS Master Control Station Operational	Jan 1986
4.	(U) 1st Cadre of Mission Controllers Complete Training	Jun 1987
5.	(U) Mission Control Center (MCC-1A) Operational	Dec 1989
6.	(U) Mission Control Center (MCC-2) Operational	1Q FY 1991
7.	(U) Mission Control (MCC-1B) Operational	3Q FY 1991
8.	(U) Complete Communications Segment (CS) Operational	2Q FY 1992
9.	(U) CSOC Full Operational Capability (FOC)	4Q FY 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0305137F Budget Activity: #5-Intelligence and Communications
PE Title: National Airspace System (NAS)

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
National Airspace System	0	0	35,000	351,700	386,700
TOTAL	* 0	* 0	35,000	351,700	386,700

* Funding in FY 1989 and FY 1990 contained in PE 0305114F, ATCALS.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides for the modernization of the DOD air traffic control system in conjunction with the Federal Aviation Administration (FAA). The program provides systems and facilities compatible/interoperable with the FAA modernization, prevents DOD flight delays/cancellations, continues DOD's access to and operations within Special Use Airspace, provides transparent services to military and civil aircraft, reduces manpower and maintenance requirements, replaces aging DOD ATC systems, and increases flight safety. The NAS program element will involve the following projects: Advanced Automation System, Digital Airport Surveillance Radar (ASR-10), Advanced Radar Beacon System (Mode S), Military Airspace Management System (MAMS), the Voice Communications Switching System, and possibly others.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0305137F
PE Title: National Airspace System (NAS)
Project Number: # TBD
Budget Activity: # 5 - Intelligence and Communications

Project Title: National Airspace System (NAS)

No Photo Available

POPULAR NAME: Not Applicable

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Milestone 0 Mar 90	Milestone I Nov 90	IOC FY 96
Engineerng Milestones				
T&E Milestones				
Contract Milestones			ASR-10 FSD MAMS Prototype FAA Options	
BUDGET ($000)	FY 1989	FY 1990	FY 1991	(To Complete)
Major Contract			ASR-10 11,700 MAMS 2,970 FAA Opts 7,000	
Support Contract			MITRE 3,000 MM * 9,330	
In-House Support			Logistics Travel, SPO 540	
GFE/ Other			Site Surveys 460	
Total			35,000	351,700

* Martin-Marietta NAS technical engineering management support.

Program Element: # 0305137F Project Number: # TBD
PE Title: National Airspace System (NAS) Budget Activity: # 5 - Intelligence and Communications

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:
The DOD National Airspace System program will modernize the DOD air traffic control (ATC) system in parallel with the FAA. DOD will acquire, to the maximum extent practical, systems on contract or systems to be on contract with the FAA to reduce development costs and prevent duplication. To avoid sortie delays and cancellation as well as a reduction in flying safety and access to Special Use Airspace (SUA), DOD ATC facilities must be compatible with the modernized FAA NAS and provide common (transparent) services to civil and military aircraft. The FAA's efforts to modernize the nation's ATC system will eliminate or severely reduce the degree of interoperability between FAA and DOD facilities. This will have a negative impact on DOD flight operations. The DOD NAS program provides systems and facilities compatible/interoperable with the FAA modernization, prevents DOD flight delays/cancellations, continues DOD's access into SUA, provides transparent services to military and civil aircraft, reduces DOD manpower and maintenance requirements, replaces aging DOD ATC systems, and increases flight safety. DOD will upgrade voice, data, and sensor systems as well as facility configurations and operations concepts to provided continued quantity and quality of ATC services to the aviation community. DOD military ATC and fighting/flying readiness will be maintained. FY 89 and FY 90 NAS efforts funded under PE #03051114F, Air Traffic Control And Landing Systems (ATCALS), Systems Support.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments: Not Applicable.

2. (U) FY 1990 Planned Program: Not Applicable.

3. (U) FY 1991 Planned Program:
   - (U) Continued DOD NAS Implementation Plan development initiated under PE #0305114F, ATCALS..
   - (U) Risk reduction program for the ASR-10 radar.
   - (U) MAMS rapid prototyping effort.
   - (U) Communications/site surveys.
   - (U) Tower/Remote-Tower HAPCON development for DOD.
   - (U) Interfacility architecture development.

4. (U) Program to Completion:
   - (U) Development and installation of the ASR-10 and MAMS.
   - (U) Acquisition and installation, if appropriate, of the Advanced Automation System, Voice Communications Switching System, Mode S, and other systems starting in FY 94.
   - (U) DOD ATC facilities modifications/construction starting in FY 93.
   - (U) IOC FY 1996.
   - (U) Installation and integration of DOD NAS systems/

Program Element: # 0305137F | Project Number: # TBD
PE Title: National Airspace System (NAS) | Budget Activity: # 5 - Intelligence and Communications

facilities during the period FY 1996-2000.

D. (U) WORK PERFORMED BY: This program is managed by Electronic Systems Division, Hanscom AFB, MA. USAF is the lead Service and responsible for the management of the Joint Service program office. Contractor(s) are TBD.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

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

F. (U) PROGRAM DOCUMENTATION:
- (U) Air Force Communications Command Statement of Need 04-87, National Airspace System Compatible Air Traffic Control Facilities, 27 Oct 87.
- (U) Memorandum of Agreement Between the Federal Aviation Administration and the Department of Defense on Radar Approach Controls in the NAS, 14 Dec 88.
- (U) Joint Systems Operational Requirements Document, Draft, DOD NAS Plan, May 89.
- (U) Joint Requirements Oversight Council Mission Need Statement for NAS modernization, JROCSM 89-019-89, 17 May 89.
- (U) DOD Directive 5030.19, DOD Responsibilities on Federal Aviation and NAS Matters, 22 Jun 89.
- (U) Federal Aviation Administration NAS Plan, Sep 89.
- (U) NAS Acquisition Decision Memorandum, 11 Oct 89.

G. (U) RELATED ACTIVITIES:
- (U) FY 89 and FY 90 NAS efforts funded under PE #0305114F, ATCALS Systems Support.
- (U) Part of the overall effort for the USAF acquisition of Air Traffic Control and Landing Systems (ATCALS) (PE #0305114F) including the Fixed Base Microwave Landing Systems (MLS), Commercial MLS Avionics, Mobile MLS, and Military MLS Avionics.
- (U) USAF lead agency for tri-service program working concurrently with the FAA.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

Program Element: # 0305137F
PE Title: National Airspace System (NAS)
Project Number: # TBD
Budget Activity: # 5 - Intelligence and Communications

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
None.		

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
To Be Determined.		

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0305158F Budget Activity: #4 - Tactical Programs
PE Title: CONSTANT SOURCE

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0001 CONSTANT SOURCE	0	0	6714	Cont	TBD
Total	0	0	6714	Cont	TBD

Note: FY 90 and prior years funds provided from classified programs.

B. (U) BRIEF DESCRIPTION OF ELEMENT: PE established as part of the AF TENCAP acquisition normalization effort. This program [redacted] for mission planning and mission execution. This information enables air crews to effectively avoid, defeat or destroy enemy surface-to-air and air-to-air missile systems.

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

1. (U) Project 0001, CONSTANT SOURCE: Efforts include development of a multi-channel, multi-source capability [redacted] and development of a miniaturized system for airborne applications.

(U) FY 1989 Accomplishments:
- (U) Deployed Phase I single channel prototype systems.
- (U) Continued development and testing of a Phase II ground based multi-channel/multi-source capability.
- (U) Continued development of a miniaturised system for airborne applications (Phase III).
- (U) Baselined the correlation software.

(U) FY 1990 Planned Program:
- (U) Complete development and testing of the Phase II system.
- (U) Continue development of the airborne qualified Phase III system.
- (U) Incorporate embedded correlation into the baseline Phase III system.
- (U) Upgrade software as required.

Program Element: # 0305158F Budget Activity: #4 - Tactical Programs
PE Title: CONSTANT SOURCE

(U) FY 1991 Planned Program:
- (U) Continue development and testing of the Phase III system.
- (U) Commence integration R&D for
- (U) Update software as required.
- (U) Prepare for a FY92 production contract award for Phase II and Phase III systems.

(U) Work Performed By: A multitude of contractors are involved with the CONSTANT SOURCE program. Work is managed by the Directorate of Communication and Intelligence Systems, Electronic Systems Division (ESD/IC), Hansom AFB, Mass.

(U) Related Activities:
- (U) Program Element #0207247F, AF TENCAP
- (U) Program Element #0305159I, Defense Reconnaissance Support Program
- (U) Program Element #0305885G, Tactical Cryptologic Program
- (U) Program Element #0304111F, Special Activities
- (U) CONSTANT SOURCE formally interfaces with numerous national programs/agencies, the Major Commands and their components, the Air Staff, Office of the Secretary of Defense, Secretary of the Air Force, and the other Services in order to optimize the system's utility and to synchronize design efforts with
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds ($ in Thousands): Procurement funds indicated below represent programmed dollars to provide prototype units at critical operational nodes.

Other Procurement (PE #0208019F):

	FY 1989 Actual	FY 1990 Estimate	FY1991 Estimate	To Complete	Total Program
Cost	3272	1962	0	**	**

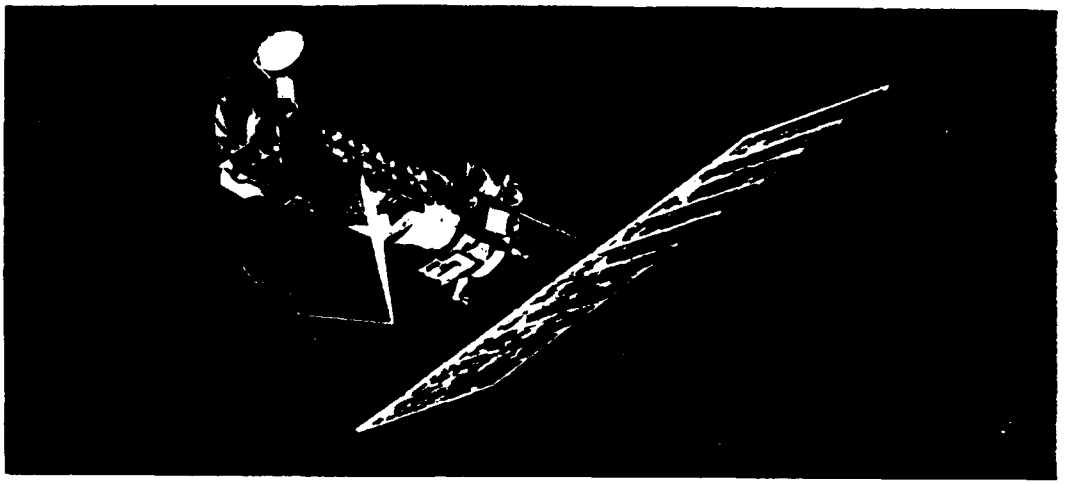
** Note: FY92 SYDP procurement funds programmed in PE #0305158F.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305160F
PE Title: Defense Meteorological Satellite Program (DMSP)
Project: #XXX1
Budget Activity: 6-Defense Wide Mission Support

PROJECT TITLE: DMSP



POPULAR NAME: DMSP

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

SCHEDULE	FY 1989	FY 1990	FY 1991	TO COMPLETE
Program Milestones		F-10 Launch	F-11 Launch	Milestone V 4th Qtr Fy1993
Engineering Milestones			Begin Blk 6 Risk Reduction	Begin Block 6 FSD 1st Qtr FY1995
T&E Milestones	FSOC OT&E Mar-May 89	Begin Mark IVB OT&E Sep 90	Complete Mark IVB OT&E Jan 91	
Contract Milestone	Award 5D-3 Multiyear Jun 1989		Begin Mark IVB Prodctn FY 1991	Final Mark IVB Delivery 4th Qtr FY 1995
BUDGET	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	28,237	28,502	32,999	Continuing
Support Contract	12,878	12,170	14,580	Continuing
In-House Support	1,458	1,515	1,520	Continuing
GFE/ Other	8,808	5,454	567	Continuing
Total	51,381	47,641	49,666	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The DMSP is a fully operational Joint-Service program which supports all military services. Operational commanders require timely, quality weather information to effectively employ weapon systems and protect DOD resources. DMSP is the DOD's most important single source of global weather data. DMSP provides visible and infrared cloud cover imagery (1/3 nm constant resolution) and other meteorological, oceanographical and solar-geophysical information. These data are required over the entire earth in support of strategic and tactical operations. At least two satellites are required in sun synchronous 450 nm polar orbit at all times. (Sun synchronous means that the satellites cross the equator, going north, at the same local sun time on each of their 14 orbits/day). This program includes the spacecraft and sensors; ground command, control and communications (C^3) facilities and personnel; Air Force strategic and fixed and transportable tactical data receipt and processing terminals; and operations and maintenance. Through the next decade DMSP will gradually transition from Block 5D production to increasing effort on Block 6 development. This is due to the long lead times for satellite system development and production (10 or more years). Thus Block 6 development must proceed in parallel with the current Block 5D efforts. DMSP will launch on Atlas-E launch vehicles through FY 1991, then transition to Titan II.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - -(U) The first Block 5D-3 satellite completed subsystem level testing and started system integration and test with all sensors.
   - -(U) The new microwave water vapor sounder was integrated on to a Block 5D-2 satellite and mission sensor calibration/validation (Cal/Val) work continued.
   - -(U) Fairchild SOC OT&E was conducted and system became operational.
   - -(U) Awarded Mark IVB tactical terminal upgrade contract.
   - -(U) Competitive contract awarded for Block 5D-3 microwave imager/sounders.

2. (U) FY 1990 Planned Program:
   - -(U) Complete Titan II integration.
   - -(U) Continue system integration and test and sensor development, calibration and validation and related support activities.
   - -(U) Upgrade C^3 system encryption hardware and interfaces.
   - -(U) Complete Mark IVB development and begin OT&E.
   - -(U) Complete first phase of Block 6 competitive concept studies.

3. (U) FY 1991 Planned Program:
   - -(U) Begin Block 5D-3 launch facility upgrades.
   - -(U) Continue system integration and test and sensor development, calibration and validation and related support activities.
   - -(U) Complete all C^3 segment upgrades.
   - -(U) Complete Mark IVB OT&E and begin production.
   - -(U) Deliver the first Block 5D-3 satellite (S-15).
   - -(U) Award two parallel competitive Block 6 advance development contracts for technology risk reduction.

4. (U) Program to Completion:

-(U) This is a continuing program.
-(U) Continue Mark IVB production into FY 1995.
-(U) Transition from Atlas-E to Titan II in FY 1992.
-(U) Continue Block 6 risk reduction through FY 1994, down select to one prime contractor and begin Full Scale Development (FSD) in FY 1995 after the completion of Milestone review.

D. (U) WORK PERFORMED BY: Development and procurement are managed by Space Systems Division, Air Force Systems Command (AFSC), Los Angeles AFB CA. Major contractors include: General Electric, Astro Space Division, East Windsor NJ (spacecraft, satellite integration, and Block 6 studies); Westinghouse Electric Corporation, Baltimore MD (primary cloud imaging sensor); Hughes Aircraft Company, El Segundo CA (microwave imager and Block 6 studies); Aeroject Electro-system Azuza CA (microwave sounders); Harris Corporation, Melbourne FL (ground systems); and Lockheed Missiles & Space Company, Sunnyvale CA (Block 6 studies and Mark IVB).

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) Technical Changes: None
2. (U) Schedule Changes: None
3. (U) Cost Changes: None

F. (U) PROGRAM DOCUMENTATION:

- (U) Joint-Service MOA (USAF/USN/USA/DOD), 15 Dec 76
- (U) MAC SON 508-78, 28 Dec 78
- (U) MAC SON 01-83, 17 Mar 83
- (U) AFSPACECOM SON 07-84, 3 Jun 85
- (U) JCS Requirements Memorandum 154-86, 1 Aug 86
- (U) MAC SON 02-80, 14 Feb 86
- (U) SOC, 21 Sep 87
- (U) TEMP, 22 Jan 88
- (U) MAC SON 505-79, 8 Sept 88

G. (U) RELATED ACTIVITIES:

- (U) DMSP is a Joint-Service program in accordance with the above MOA. The Air Force is the Executive Agent with responsibility for the Space, C^3, and Air Force User Segments. Each Service funds its own User Segment and any Service unique changes to the other segments.
- (U) Navy developing and procuring 73 SMQ-11 shipboard and shore based tactical terminals. They are also jointly funding microwave imager procurement with the Air Force in PE #0305160N.
- (U) The Marine Corps procured 12 Mark IV tactical terminals.
- (U) Army, Navy, and Air Force user representatives are integrated into the program office to insure close coordination.
- (U) Close coordination is maintained with the civilian weather satellite programs of the Department of Commerce (DOC). The DOD and DOC systems have different missions and sensors. Interchange of technology and joint efforts have been continuous, with special

emphasis on avoiding duplication of effort.
- (U) Atlas-E and Titan II launch services provided by the Space Boosters Program, PE #0305119F.
- (U) Leased communications by DMSP Communications, PE #0305162F.
- (U) Navy and Army jointly funding Block 6 studies.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. (U) Procurement	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
Missile Procurement, BA 23				
Funds	157,324	116,607	147,719	Cont
Quantity	1	1	1	
Other Procurement, BA 83				
Funds	16,110	1,976	18,471	Cont

2. (U) Military Construction: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
F-9 On-orbit Checkout and Turnover to AFSPACECOM	Feb 88	Fully Operational
Microwave Imager Calibration/Validation	FY 87-FY 89	Data Quality Exceeding Rqmts Minor Thermal Problems
Thule Antenna/DMSP OT&E	Apr 88	89.9% Mission Success
Fairchild SOC OT&E	May 89	Fully Operational

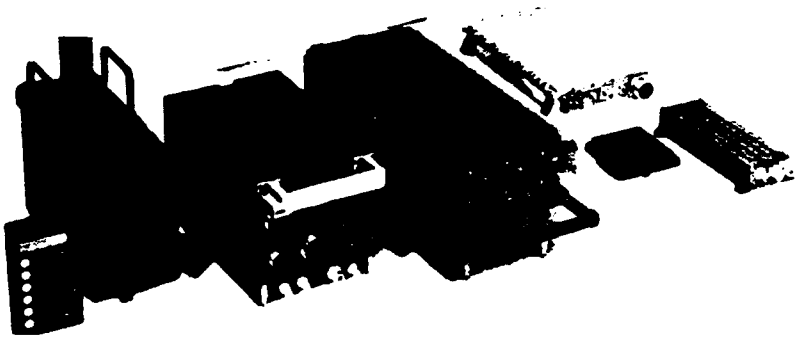
T&E ACTIVITY (TO COMPLETION)

Mark IVB OT&E	Sept 90-Jan 91

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305164F
PE Title: Navstar Global Positioning System (GPS) User Equipment
Project Number: # N/A
Budget Activity: 5-Intelligence and Communications

Project Title: GPS



POPULAR NAME: GPS

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

Schedule	FY1989	FY1990	FY1991	To Complete
Program Milestones	N/A	Milestone IIIB Jun 90	User Equip PMRT 3Q 91	Production Continues Thru 1990's
Engineering Milestones	N/A	N/A	N/A	N/A
T&E Milestones	OT&E 8/89-12/89	N/A	N/A	N/A
Contract Milestones	Phase III LRIP Opt 5 June	Full Rate Production Begins July	Full Rate Production Opt 1Q91	Rate Prod. Options Continue
BUDGET	FY 1989	FY 1990	FY 1991	Program Total
Major Cont	27,540	28,805	8,436	Continuing
Spt Contract	5,567	3,550	3,340	Continuing
In House Spt	3,946	1,026	840	Continuing
GFE/Other	3,683	1,790	307	Continuing
Total	40,736	35,171	12,923	N/A

Program Element: #0305164 Project Number: # N/A
PE Title: Navstar Global Positioning System (GPS) User Equipment Budget Activity: 5-Intelligence and Communications

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES
This program element funds Research and Development to integrate Navstar Global Positioning System (GPS) user equipment into approximately 10,000 Air Force airborne and ground platforms. Military forces need precise location data to enhance command and control and to engage in strategic and tactical warfare. A global, common grid positioning and navigation system is required to increase both accuracy and availability of current weapon systems, especially at night and in adverse weather. The GPS satisfies these requirements and improves strategic target mapping, the probability of target acquisition, flexible routing, low-level ingress/egress, and accuracy of weapons delivery. GPS is a space based radio positioning and navigation system which provides highly accurate three-dimensional position (16 meter spherical error probable), velocity (0.1 meter/second) and time (within 0.1 microsecond). GPS consists of three segments. The space segment (funded in PE 0305165F) is the satellite constellation which provides the worldwide navigation signals. The control segment (also funded in PE 0305165F) measures and corrects satellite performance parameters and provides a user interface to the system. The user equipment segment consists of the electronic equipment and interfaces necessary to receive and process GPS satellite signals into position, velocity and time data for its various military uses.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments
- (U) Began design of status reporting system for mission planning.
- (U) Other previously initiated development activities continued.
- (U) Integration development began for F-111D/F, F-15 A-D, and EC-130 CC, MH-60 and F-4 family aircraft.
- (U) Began operational testing of 3A Receiver in preparation for full rate production in Jun 90.

(U) FY 1990 Planned Program:
- (U) Other previous integration development activities continue.
- (U) Integration development begins for A-10, C-141, C-5, OV-10, and C-135 family aircraft.
- (U) Continue development of status reporting system.

(U) FY 1991 Planned Program
- (U) Continue other previously initiated integrations and development activities.

(U) Program to Completion
- (U) Continuing program. Efforts will continue beyond the year 2000 to integrate GPS into all Air Force aircraft for world-wide navigation in lieu of other radionavigation systems.

D. (U) WORK PERFORMED BY: The acquisition and implementation of GPS are managed by a Joint Program Office located at the Air Force Systems Command's Space Systems Division, Los Angeles AFB, CA. User equipment is produced by Rockwell International, Collins Government Avionics Division, Cedar Rapids,

Program Element: #0305164 Project Number: # N/A
PE Title: Navstar Global Positioning System (GPS) User Equipment Budget Activity: 5-Intelligence and Communications

IA. Aerospace Corp., El Segundo, CA, provides technical and engineering support. Intermetrics, Cambridge, MA, is the user equipment software independent verification/validation contractor. The Naval Air Development Center, Warminster, PA; the Naval Avionics Center, Indianapolis, IN; and the Army Avionics Research and Development Activity, Ft Monmouth, NJ, are providing technical and validation support to the program office for joint service user equipment development and production.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None

2. (U) SCHEDULE CHANGES: Integration engineering on C-18, C-20, C-22, C-137, C-12, B-1, KC-10, OA-37, and H/CH-3 has been delayed 12-24 months.

3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) DCP 133 (Rev A), 17 Jan 78
- (U) SDDM, 11 Jul 86
- (U) Integrated Multi-Service TEMP, Nov 87
- (U) SORD (Draft), Apr 89
- (U) Navstar GPS Baseline, 22 Dec 89

G. (U) RELATED ACTIVITIES:
- (U) GPS development and operational implementation are joint activities
- (U) Other agencies are the Army, Navy, Marine Corps, Defense Mapping Agency, Department of Transportation and North Atlantic Treaty Organization (NATO)
- (U) Coordination obtained through a Joint Program Office.
- (U) PE 0603601F, Conventional Weapon Technology, explores use of GPS to provide guidance corrections for tactical missiles.
- (U) PE 0603202F, Advanced Avionics for Aircraft, examines advanced antijamming techniques.
- (U) PE 0101221N, Fleet Ballistic Missile Systems, range positioning.
- (U) PEs 0301357F and 0102433F, Nuclear Detonation Detection System (NDS), fund NDS payloads on the GPS satellites.
- (U) PE0305165F, Navstar GPS (Space/Ground), provides the satellites and control capability to produce signals used by the user equipment for positioning, navigation and timing.
- (U) PE 0305119F Space Boosters, funds launch services (Delta II).
- (U) PE 0305130F, Consolidated Space Operations Center (CSOC), funds CSOC which hosts the operational GPS Master Control Station.
- (U) No unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0305164 Project Number: # N/A
PE Title: Navstar Global Positioning System (GPS) User Equipment Budget Activity: 5-Intelligence and Communications

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

1. Procurement:

Program	FY 1989 Actual	FY 1990 Actual	FY1991 Estimate	Total Estimate
Aircraft Procurement (BP 11,16,19)				
Funds	103,717	84,123	106,016	N/A
Quantities (Receivers)	(344)	(397)	(770)	
Other Procurement (BA 83)				
Funds	18,342	9,739	5,462	N/A
Quantities (Manpacks)	(447)	(146)	(70)	

2. Military Construction: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: In April, 1978, a Memorandum of Understanding (MOU) was signed with nine NATO allies and with Australia to permit NATO and Australian participation in the development of GPS user equipment. The MOU created an international team at the US Joint Program Office (JPO), with each nation providing representatives. Nations involved included Britain, Norway, the Netherlands, Italy, Germany, France, Denmark, Canada, Belgium and Australia. Also, during 1987, Spain became the tenth NATO signatory to the MOU. Allied personnel are fully integrated into the user equipment, program management, and operational applications areas of the JPO.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
OT&E	Jul-Dec 89 (Air Force and Navy)	Met all major test objectives and reliability/maintainability requirements.

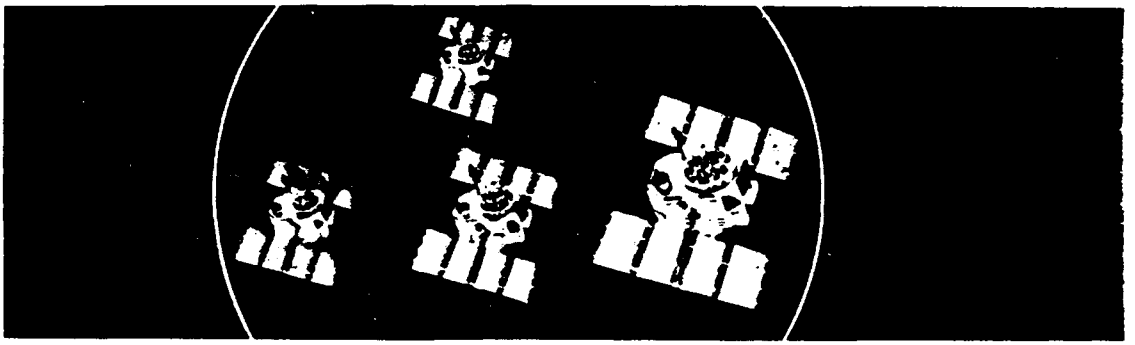
T&E ACTIVITY (TO COMPLETION)

Event	Date	Results
OT&E	Army OT&E dates are Feb 90-Jul 90.	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) Space/Control
Project Number: # N/A
Budget Activity: 5-Intelligence and Communications

Project Title: GPS



POPULAR NAME: GPS

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

Schedule	FY1989	FY1990	FY1991	To Complete
Program Milestones	First Prod Sat Launch Feb 89		18 Sats On-orbit Sep 91	3-D Coverage FY 93
Engineering Milestones	N/A	Block IIR CDR Jun 90	N/A	N/A
T&E Milestones	Cntrl Seg Opnl S/W Tst 11/88-6/89	N/A	N/A	N/A
Contract Milestones	Award IIR Sat Phse II Cont Jun 89	IIR Long Lead Cont Award Feb91	Begin IIR Sat Prod FY 92	Deliver First Rlock IIR Sat 1995
BUDGET	FY 1989	FY 1990	FY 1991	Program Total
Major Cont	41,358	26,501	43,847	Continuing
Spt Contract	1,241	2,200	2,000	Continuing
In House Spt	1,581	1,624	1,594	Continuing
GFE/Other	3,241	2,538	1,430	Continuing
Total	46,421	32,863	48,871	N/A

Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) Space/Control

Project Number: # N/A
Budget Activity: 5-Intelligence and Communications

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES

This program element funds Research and Development for the Navstar Global Positioning System (GPS) space and control segments of the overall GPS program. This includes: satellite development, procurement, deployment, operation of the ground control segment; upgrades to improve survivability of both the space and ground segments; and R&D efforts to support deployment of the entire GPS system. Military forces need precise location data to enhance command and control and to engage in strategic and tactical warfare. A global, common grid positioning and navigation system is required to increase both accuracy and availability of current weapon systems, especially at night and in adverse weather. The GPS satisfies these requirements. GPS is a space based radio positioning and navigation system which provides highly accurate three-dimensional position (16 meter spherical error probable), velocity (0.1 meter/second) and time (within 0.1 microsecond). These capabilities, coupled with the inherent feature of highly accurate silent user operation, enhance the force effectiveness and survivability of many U.S. weapon systems. GPS consists of three segments. The space segment is the satellite constellation which provides the worldwide navigation signals. GPS satellites will also carry Nuclear Detonation (NUDET) Detection System sensors as additional payloads. The control segment measures and corrects satellite performance parameters and provides a user interface to the system. It consists of five monitor stations and three ground antennae located around the world and a Master Control Station (MCS) at Falcon AFB CO. The user equipment segment (funded by PE 0305164F) consists of the electronic equipment and interfaces necessary to receive and process GPS satellite signals into position, velocity and time data for its various military uses.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments

- (U) Operational satellite launches began 14 Feb 89.
- (U) Control segment support to development and production satellites, as launched, continued.
- (U) Operational testing of control segment software began.
- (U) Development of GPS replenishment satellites began.

(U) FY 1990 Planned Program:

- (U) Operational satellite launches will continue (nine production satellites on orbit by end of FY). Will provide 12-20 hours of 3-dimensional navigation coverage (with R&D satellites).
- (U) Development of GPS replenishment satellites will continue.
- (U) Control segment support to on-orbit constellation continues.
- (U) Development of constellation management/status reporting system begins.
- (U) Complete operational testing of control segment software.
- (U) Complete OCS turnover to AFSPACECOM.

Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) Space/Control

Project Number: # N/A
Budget Activity: 5-Intelligence and Communications

(U) FY 1991 Planned Program
- (U) Operational satellite launches/on-orbit support continue.
- (U) Complete replenishment satellite design; begin piece part qualification and test development hardware. Procurement of replenishment satellites will begin.
- (U) Initial capability will be in place for constellation management/system status reporting.

(U) Program to Completion
- (U) Continuing program. Support of the operational satellite constellation will continue. Development and deployment of replenishment satellites will continue.

D. (U) WORK PERFORMED BY: The acquisition and implementation of GPS are managed by a Joint Program Office located at the Air Force Systems Command's Space Systems Division, Los Angeles AFB, CA. The Block II satellite contractor is Rockwell International, Seal Beach, CA. International Telephone and Telegraph, Nutley, NJ, and Rockwell International, Autonetics Strategic Systems Division, Anaheim CA, are the subcontractors for the navigation subsystems. Aerospace Corp., El Segundo, CA, provides technical and engineering support. General Electric, East Windsor, NJ was competitively selected in June 89 to develop and produce the Block IIR satellites. Operational control segment development and deployment is being done by International Business Machines, Federal Systems Div., Gaithersburg, MD. User equipment is produced by Rockwell International, Collins Government Avionics Division, Cedar Rapids, IA.

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

1. (U) TECHNICAL CHANGES: None

2. (U) SCHEDULE CHANGES: None

3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) DCP 133 (Rev A), 17 Jan 78
- (U) SORD (Draft), Apr 89

G. (U) RELATED ACTIVITIES:
- (U) GPS development and operational implementation are joint activities
- (U) Other agencies are the Army, Navy, Marine Corps, Defense Mapping Agency, Department of Transportation and NATO.
- (U) Coordination obtained through a Joint Program Office.
- (U) PE 0305164F, Navstar GPS (User Equipment), provides receivers to use the positioning, navigation and timing signals from satellites.
- (U) PE 0603601F, Conventional Weapon Technology, explores use of GPS to provide guidance corrections for tactical missiles.
- (U) PE 0603202F, Advanced Avionics for Aircraft, examines advanced antijamming techniques.

Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) Space/Control
Project Number: # N/A
Budget Activity: 5-Intelligence and Communications

- (U) PE 0101221N, Fleet Ballistic Missile Systems, range positioning.
- (U) PEs 0301357F and 0102433F, Nuclear Detonation Detection System (NDS), fund NDS payloads on the GPS satellites.
- (U) PE 0305119F Space Boosters, funds launch services (Delta II).
- (U) PE 0305130F, Consolidated Space Operations Center (CSOC), funds CSOC which hosts the operational GPS Master Control Station.
- (U) No unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. (U) Procurement

	FY 1989 Actual	FY 1990 Estimate	FY1991 Estimate	Total Program
Missile Procurement (BA23)				
Funds (satellites)	74,411	48,000	201,745	N/A
Quantities (Order/ Full Fund)	(0/0)	(0/0)	(4/0)	
Other Procurement BA 83				
Funds	907	0	219	N/A
Quantities			Not Applicable	

2. (U) Military Construction: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Satellite compatibility tests	Apr-Jun 87	Results verified acceptable satellite performance
System interface compatibility test	Jan-Jul 88	Verified system interface performance.
Control Segment Software Operational Testing	Feb 89 - Nov 89	Verified Control Segment capability to manage and control operational satellite constellation.

T&E ACTIVITY (TO COMPLETION)

Event	Date	Results
Control Segment Follow on OT&E	1992	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305171F
PE Title: Space Shuttle Operations
Project Number: 0001
Budget Activity: 6 -Defense Wide Mission Support

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SLS	Space Launch Support				
	26,532	40,868	14,240	Cont	TBD
US	Upper Stages				
	11,200	13,749	4,819	Cont	TBD
Total	37,732	54,617	19,059	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Department of Defense places heavy reliance on its space assets to accomplish its strategic, tactical, and airlift missions. Requirements include such capabilities as communications, navigation, weather, early warning, and surveillance. An access to space is required for these space assets to perform their respective missions. The Space Shuttle Operations program provides the Space Transportation resources needed to transport Air Force space payloads to their mission orbits. Main program objectives are to provide consolidated management, programming, and execution of Air Force Space Shuttle missions, Inertial Upper Stages (IUS), and upper stage programs and the Vandenberg Shuttle Launch and Landing Site (VLS). DOD use of the Space Transportation System (STS) is paid for in the form of Orbiter Flight Charge reimbursement made to NASA one year prior to the scheduled launch date, but agreed to three years in advance.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) DOD to fly two dedicated missions on Shuttle
  -- Provide secure operations at all NASA centers
- (U) DOD to resume flying secondary payloads on Shuttle (includes research and development experiments, small payloads - [illegible] available basis)
  -- Resume payment of secondary payload Shuttle flight charges to NASA (as required)
  -- Develop maintain and use airborne support equipment (ASE)
- (U) NASA to fly two IUS missions on Shuttle
- (U) No Orbiter flight charge payment to NASA (Will use 3 in FY 90 of 7 flight credits due to DOD -- 4 remain in FY 90)

(U) FY 1990 Planned Program:
- (U) DOD to fly three dedicated Shuttle missions
  -- Includes an IUS mission
  -- Provide secure operations at all NASA centers

Program Element: #0305171F
PE Title: Space Shuttle Operations

Project Number: 0001
Budget Activity: 6 -Defense Wide Mission Support

- (U) DOD to fly secondary payloads on Shuttle
- (U) NASA to fly one IUS mission on Shuttle
- (U) No Orbiter flight charge payment to NASA (will use 3 in FY 91 of 4 flight credits due to DOD -- 1 remains in FY 91)
- (U) Plan for phase out of secure operations at NASA centers after last secure DOD mission planned Jul 90

(U) FY 1991 Planned Program:

- (U) DOD to fly three dedicated Shuttle missions (no secure requirement)
  - -- Includes an IUS mission
  - -- Includes two research and development missions (AF & SDIO)
  - -- Provide integration support for flight
- (U) DOD to fly secondary payloads on Shuttle
- (U) NASA to fly two IUS missions on Shuttle
- (U) Phase out of secure operations at NASA centers

(U) Program to Completion:

- (U) This is a continuing program
- (U) Average .33/year research and development flights/Orbiter flight charge payments to NASA (as required)
- (U) Planning for Space Test Program use of Shuttle/PAM D-II in FY 94
- (U) Upper stage procurements/launch services as required

D. (U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force System Command's Space Division, Los Angeles, CA. Systems engineering is provided by the Aerospace Corporation, El Segundo, CA. The Inertial Upper Stage and associate integration and engineering support contractor is Boeing Aerospace Company, Seattle, WA. The Payload Assist Module II contractor is the McDonnell-Douglas Company, Hunting Beach, CA. The Shuttle integration contractor is Rockwell Corporation, Downey, CA. The National Aeronautics and Space Administration is the Shuttle manager with major interfaces at Kennedy Space Center, FL and Johnson Space Center, TX. The Vandenberg Shuttle contractor is Lockheed Space Operations Company, Titusville, FL.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

		NARRATIVE DESCRIPTION OF CHANGES
1.	TECHNICAL CHANGES:	Delete two Shuttle launches of GPS. More efficient launch of GPS on Delta II.
2.	SCHEDULE CHANGES:	Phase out of secure operations moved from STS-44 (Mar 91) to STS-38 (Jul 90)
3.	COST CHANGES:	None

F. (U) PROGRAM DOCUMENTATION: NASA Jan 1989 Manifest
NASA Jun 1989 Manifest

Program Element: #0305171F
PE Title: Space Shuttle Operations

Project Number: 0001
Budget Activity: 6 -Defense Wide Mission Support

G. (U) RELATED ACTIVITIES: The research and development satellite program supported is the Space Test Program (PE 0603402F). The resources for the Orbiter Flight Charges and support for other Department of Defense programs are included in their elements. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS ($ In Thousands)

1. (U) Procurement:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MISSILE PROCUREMENT:	6,575	28,200	15,128	Continuing	TBD

2. (U) Military Construction: Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

	DATE
1. (U) Last Secure Shuttle Mission	Jul 1990*
2. (U) NASA planetary mission (Ulysses)/IUS	OCT 1990*

* NASA Milestone

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305887F Budget Activity: #4 - Tactical Programs
PE Title: Electronic Combat Intelligence Support

A. (U) RESOURCES ($ in Thousands)

Project Number	Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2907	Electronic Combat (EC) Intelligence Support					
		*	1744	1793	Cont	TBD
Total			1744	1841	Cont	TBD

* (U) NOTE: This is not a new start. This program was initially funded in FY82 in PE0305887F to support R&D efforts at FTD for intelligence support to EC/EW. In FY89, it was funded in PE 0604270F.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This project continues development and production of intelligence data input packages (IDIPs) to support Air Force electronic combat operations and aircrew training to include the design, development, validation, and testing of threat emitter simulators (SIMVAL). This project also supports Red Mission Analysis (RMA) through continued Electronic Warfare Intelligence Support (EWIS) to software development of digital intelligence products, Reference Threat Packages (RTP), specifically targeted for application to digital computer models and simulations to support the entire life cycle of EC weapon systems.

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

(U) Project 2907, Electronic Combat Intelligence Support:

(U) Develops the intelligence data to program/reprogram Electronic Combat threat warning and jamming systems. The USAF has a heavy investment in reprogrammable threat warning and jamming equipment to include specific weapon systems such as F4-G, EF-111A, and COMPASS CALL. The SIMVAL program evaluates the accuracy of threat emitter simulators to replicate, electronically, actual hostile emitters. IDIPs provide EW equipment designers and engineers the intelligence data required to produce threat warning and jamming equipment that effectively counters enemy threat emitters. RMA through digital intelligence analysis, processing, and dissemination, supports digital computer models and simulations which will support the life cycle of EC equipment/weapons systems into the future.

(U) FY 1989 Accomplishments:

- (U) Expanded data base subfiles on Soviet ECM and Electro-Optical (EO) and Infrared (IR) systems.
- (U) Continued expansion of baseline data to support SIMVAL and Range Improvement Program.

Program Element: #035887F Budget Activity: #4 - Tactical Programs
PE Title: Electronic Combat Intelligence Support

(U) FY 1990 Planned Programs
- (U) Continue subfile development of threat EO/IR systems.
- (U) Continue update and development of IDIPs to support SIMVAL efforts.
- (U) Continue EWIS to RMA effort to develop digital intelligence products (Reference Threat Packages) for digital computer models and simulators.

(U) FY 1991 Planned Program:
- (U) Continue IDIP production to support SIMVAL and threat data base expansion.
- (U) Expand EWIS to RMA digital software capability to meet present and future requirements.
- (U) Continue EWIS for EWIR database maintenance/development and SIMVAL efforts.
- (U) Continue IDIP production.

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

(U) Work Performed By: The Foreign Technology Division (FTD) at Wright-Patterson AFB, OH performs EWIS project tasks, SIMVAL tasks, and RMA, using in-house and contract resources. Current EWIS data file development is being accomplished by the Planning Research Corporation (PRC) field office in Dayton, OH. FTD does threat SIMVAL program tasks with assistance by radar engineers from Sverdrup Technology, Inc of Tulahoma, Tenn.

(U) Related Activities: This project supports and directly interfaces with other EC projects within PE 0305887F. It also interfaces with basic intelligence analysis efforts funded by PE 030131F and supports programs funded in 0604270F. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: NOT APPLICABLE.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0401840F Project Number: N/A
PE Title: Military Airlift Command Command and Control System (MAC C2) Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: Information Processing System (IPS)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
IPS	9,907	10,919	11,626	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project, the Information Processing System (IPS), develops and procures basic communications and information processing hardware and software for all echelons of the MAC C2 system. It satisfies essential elements of the MAC C2 architecture validated in MAC Statement of Need 3-81. The integration of IPS computer resources and software with improved High Frequency (HF) equipment, new UHF satellite networks, and other available communications media will result in a unified MAC command and control system. The IPS will be developed and installed in three increments. Increment I will provide a digital data message handling capability at each IPS node and implement mission execution monitoring. Increment II will build on Increment I software to support mission planning and scheduling. Increment III will augment the planning and scheduling capabilities of Increment II as well as install UHF and VHF communications interfaces.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Selected implementation phase contractor.
   - (U) Developed system design and architecture.
   - (U) Began development of Increment I applications software.

2. (U) FY 1990 Planned Program:
   - (U) Continue software development.
   - (U) Accomplish initial site surveys.
   - (U) Begin hardware buy and installation of IPS Increment I.

3. (U) FY 1991 Planned Program:
   - (U) Continue installation of Increment I.
   - (U) Begin development of Increment II applications software.

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

D. (U) WORK PERFORMED BY: The IPS contractor is Computer Sciences Corporation, Moorestown, NJ.

Program Element: #0401840F Project Number: N/A
PE Title: Military Airlift Command Command and Control System (MAC C2) Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) MAC SON 3-81, dated 11 Dec 81, amended 12 Dec 86.

G. (U) RELATED ACTIVITIES:
- (U) RDT&E funding for Ultra High Frequency (UHF) satellite terminals is in PE 0303605F, Satellite Communications Terminals.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

1. (U) PROCUREMENT:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete
Other Procurement:	425	2,085	14,307	TBD

Only that portion of the total procurement funding in PE 0408140F dedicated to the IPS is shown here. There are other programs (e.g. Automatic Communications Processor) within MAC C2 which do not have any RDT&E funds, but have other procurement funds.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1. (U) Implementation Phase contract award	Dec 1988
2. (U) First Increment I node installed	Oct 1990
3. (U) Begin development of Increment II	Oct 1990

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3275 A-7 Avionics Test Station Replacement	9,546	3,936	-0-	-0-	22,566
3606 A-7 Upgrade	69,452	16,009	-0-	-0-	163,272
Total	78,998	19,945	-0-	-0-	185,838

B. (U) BRIEF DESCRIPTION OF ELEMENT: The development effort provides a replacement for the A-7 "Big Eight" intermediate level avionics test stations with new modular automatic test equipment compliant test stations that will support the present A-7 force. The A-7 Upgrade Program will prototype two A-7D aircraft which will be fitted with an augmented engine and aerodynamic improvements. This requires a stretch of the fuselage, fore and aft. The end result would be a reprocurement data package to support a competitive production program.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3275 - A-7 Avionics Test Station Replacement: This project replaces the existing A-7 "Big Eight" Intermediate Level Avionics Test Stations with new Modular Automatic Test Equipment (MATE) compliant test stations. The new, deployable equipment will provide full diagnostic and repair capability for current and planned A-7 bombing and navigation avionics at 20 continental United States locations.

(U) FY 1989 Accomplishments:
- (U) Began ATE engineering/integration testing.
- (U) Delivered first prototype - May 89.
- (U) IV&V support continued.
- (U) Developed test program sets (TPSs).
- (U) Continued Development Test and Evaluation (DT&E).
- (U) Production go-ahead.
- (U) Began production deliveries.

(U) FY 1990 Planned Program:
- (U) Conduct Operational Test and Evaluation (OT&E).
- (U) Continue TPS development.
- (U) IV&V support.
- (U) Begin TPS deliveries.
- (U) Begin test station deliveries.

(U) FY 1991 Planned Program: Not Applicable.

(U) Work Performed By: Contract with Allied-Signal Aerospace Co., Teterborough NJ and managed by the San Antonio Air Logistics Center, Kelly AFB TX.

Budget Activity: #4 - Tactica
Programs

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)

(U) Related Activities:
- (U) Modular Automatic Test Equipment (MATE) program, PE 0604247F, provides the A-7 test stations control and support software as government furnished equipment (GFE) - NOTE: test stations are fully MATE compatible.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)
Project Number: 3606
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title: A-7 Upgrade Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
A-7 Plus	69,452	16,009	-0-	-0-	163,272

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The A-7 Upgrade is a program to modernize the current A-7D and K model aircraft. The Air Force needs a Close Air Support/Battlefield Air Interdiction (CAS/BAI) aircraft to support the Army's Air-Land Battle doctrine. The current A-7 is tasked with CAS/BAI missions and is rapidly becoming obsolete and increasingly vulnerable to the increasing threat. The modified A-7 Upgrade is a potential solution to the need for a CAS/BAI aircraft. It has high payload/range, speed maneuverability, reliability, can operate from short fields, under the weather (day or night) and achieve first-pass target destruction. The A-7 Plus reduces mobility requirements by 53% (from 19 to 9 C-141B aircraft equivalents) and achieves a 23% reduction in maintenance personnel. Improved systems reliability and maintainability would provide a mission capable rate of 88%. The current engine would be replaced with an augmented engine. The engine bay would be reconfigured. Approved and proposed airframe and avionics modifications would be included in the final configuration of the aircraft. The airframe mods are: strakes, augmented flaps, lift dump spoilers, airframe mounted accessory drive, 60 KVA generator, larger fuel lines, improved air conditioning system, on-board oxygen generating system, new wiring, hands on throttle and stick, data transfer module, and improved com/nav control. The RDT&E funds are required for two prototype aircraft and associated data packages.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) A-7F survivability study completed.
   - (U) Aircraft #1 was configured with an augmented engine, associated airframe, and aerodynamic mods required to provide the desired handling qualities and survivability improvements.
   - (U) Aircraft #2 modifications were 90% completed.
   - (U) Reprocurement data development was initiated.

2. (U) FY 1990 Planned Program:
   - (U) Aircraft #1 First Flight at LTV, Nov 89.
   - (U) Aircraft #1 flown to Edwards AFB, Dec 89.
   - (U) Delivery of Second Prototype.
   - (U) Conduct the flight test of the two YA-7Fs.
   - (U) Completes the associated reduction and analysis of flight test data and preparation of the final flight test report.
   - (U) Proposed engineering changes and service reports will be included with, but not in corporated into, the reprocurement data package.
   - (U) Decision on disposition of the two aircraft will be made.

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)

Project Number: 3606
Budget Activity: # 4 - Tactical Programs

3. (U) FY 1991 Planned Program:
   - (U) Obtain the final contractor reports.

4. (U) Program to Completion: Not Applicable.

D. (U) WORK PERFORMED BY: A-7 Upgrade project is on contract with LTV Aerospace, Dallas TX and managed by Aeronautical Systems Division, Wright-Patterson AFB OH.

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

1. (U) TECHNICAL CHANGES: Schedule slip, coupled with funding reduction in FY 1990 and elimination of FY 1991 funding, result in a reduced flight test program.
2. (U) SCHEDULE CHANGES: Program incurred a 6 month schedule slip due to problems experienced in modifying the aircraft. Since contract is Firm Fixed Price (FFP), there is no impact on cost to the Air Force.
3. (U) COST CHANGES: $ 8.2M reduction in FY 90 as result of overall $ 10M Congressional cut to A-7 squadrons RDT&E and $ 4.9M reduction in FY 91 (which reduced FY 91 funding to zero) as part of overall AF budget reductions.

F. (U) PROGRAM DOCUMENTATION:
- (U) Program Budget Decision (PBD) 235A, 19 Dec 86.
- (U) SON TAF/ANG/AFRES 503-86, 19 Feb 87.
- (U) PMD 7206(3), 23 Feb 89

G. (U) RELATED ACTIVITIES:
- (U) None.
- (U) There is no unnecssary duplication of effort within the Air Force or the Department of Defense.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

Milestones	Dates
- (U) Contract Award	May 1987
- (U) YA-7F #1 First Flight	Nov 1989
- (U) YA-7F #2 Disposition	Feb 1990
- (U) Reprocurement Data Delivery	Dec 1990
- (U) Production Decision	TBD

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0601101F Budget Activity: #1 - Technology Base
PE Title: In-House Laboratory Independent Research

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
In-House Laboratory Independent Research	6,942	7,450	8,318	Cont	TBD
Total	6,942	7,450	8,318	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides discretionary funds for Air Force Laboratory Directors to use in pursuing promising, high risk, high payoff research opportunities which arise during the fiscal year. This program permits Air Force Laboratories to maintain an aggressive research program vital to their role as leaders in national research. The Air Force manages this program with the intent that it be unencumbered by programmatic justification and budgetary documentation prior to beginning work, relying instead on the discretion of the Laboratory Directors who annually report their achievements and the status of their projects of the past year. Distribution of funds is based on these after-the-fact reviews.

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

(U) FY 1989 Accomplishments:

- (U) Discovered a new ramjet fuel which should provide a 50 percent cost saving over present day with only a 0.3 percent reduction in volumetric energy.
- (U) Demonstrated a novel turbine blade cooling concept which uses engine fuel as a coolant. Concept may reduce cooling air requirements, allowing higher inlet temperatures, and lead to increased turbine engine performance.
- (U) Demonstrated an optical sensor that rapidly locates the direction of incident light. Research may yield a low-cost, lightweight system for satellite attack detection.
- (U) Verified that bistatic polarization clutter nulls can be observed at microwave frequencies under field site conditions. Experimental and analytical results offer the potential for enhanced detection of low observable targets.
- (U) Studies of advanced electro-optic materials for switching devices led to a novel 2 by 2 guided-wave switching device which allows low voltage operation and dense packing of devices.
- (U) Demonstrated a new laser deposition process for selectively depositing gold metallization on superconductor material. This process could yield an electrical interface in a superconductor electronic device, making practical advanced signal processors for Air Force applications.

Program Element: 0601101F Budget Activity: #1 - Technology Base
PE Title: In-House Laboratory Independent Research

(U) FY 1990 Planned Program:
- (U) Since the purpose of this Program Element is to provide discretionary funds, work units do not require prior approval. Results of the FY 1989 program were reviewed during Sep 1989.
- (U) Distribution of the FY 1990 budget was made after the Sep 1989 review.
- (U) A portion of the work begun in FY 1989 will continue into FY 1990.
- (U) New efforts will be selected by the Laboratory Directors.
- (U) Extramural contracting has been significantly reduced so that the program is now primarily performed in-house.

(U) FY 1991 Planned Program:
- (U) The same management approach will be used as in FY 1990.

(U) Worked Performed By: This is totally a laboratory directed research program in which all Air Force laboratories participate, performing work in-house and awarding a few contracts of exceptional content to universities and industrial research laboratories. During FY 1989, the last year for significant contractual involvement, Georgia Institute of Technology, Atlanta, GA; Massachusetts Institute of Technology, Cambridge, MA; Allison Gas Turbine Division, General Motors, Indianapolis, IN; Westinghouse Electric Inc., Baltimore, MD; and University of North Carolina, Chapel Hill, NC, were the major extramural contributors.

(U) Related Activities:
- (U) PE 0601101A, In-House Laboratory Independent Research
- (U) PE 0601152N, In-House Laboratory Independent Research
- (U) Program results transition to a variety of laboratory development activities for continued funding.
- (U) Oversight responsibility resides in the Office of the Deputy Director, Defense Research & Engineering.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0601102F
PE Title: Defense Research Sciences

Budget Activity: #1-Technology Base

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2301 Physics	20,627	19,751	20,942	Cont	TBD
2302 Structures	11,796	11,294	11,974	Cont	TBD
2303 Chemistry	25,383	24,303	25,768	Cont	TBD
2304 Mathematics	21,763	20,836	22,093	Cont	TBD
2305 Electronics	21,351	20,442	21,674	Cont	TBD
2306 Materials	24,315	23,280	24,683	Cont	TBD
2307 Fluid Mechanics	15,510	14,850	15,746	Cont	TBD
2308 Energy Conversion	10,037	9,610	10,189	Cont	TBD
2309 Terrestrial Sciences	1,778	1,703	1,806	Cont	TBD
2310 Atmospheric Sciences	10,641	10,188	10,803	Cont	TBD
2311 Astronomy & Astrophysics	7,167	6,862	7,277	Cont	TBD
2312 Biological & Medical Sciences	10,752	10,294	10,914	Cont	TBD
2313 Human Resources	9,150	8,761	9,289	Cont	TBD
Total	190,270	182,174	193,158	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Defense Research Sciences Program Element (PE) is the primary PE for investing in scientific and engineering research. The PE funds research in all scientific disciplines contributing to the Air Force mission. Its goal is to increase scientific and engineering knowledge related to long-term technology needs for national defense. The research program ensures that personnel with the technical expertise to support the Air Force requirements are available at Air Force laboratories, at universities, and in industry. Research represents an investment in the technologies which the Air Force will need to meet new challenges in the twenty-first century. Areas of research include: aerospace structures and aerodynamics; materials; propulsion and power; electronics; computer science and mathematics; directed energy and conventional weapons; life sciences; and terrestrial, atmospheric, and space sciences. The research initiatives for FY 1989 included:

multifunctional wafer level union; interactive flow control; nonlinear flight mechanics; neurophysiology of sensory information processing; and constituent mechanics of nonhomogeneous materials. For FY 1990 new initiatives are planned in the following areas: turbulence simulation; polymer/polymer interactions; quantum devices; fatigue and fracture; chronobiology; spatial orientation; optimal design; signals to symbols; electro-optical techniques for millimeter wave integrated circuits; and reaction control by positive feedback from internal energy. Results from the PE support the entire technology base and transition to the breadth of Air Force Development Programs. During FY 1989 over 1,000 awards were made to 350 institutions in the amount of $179.067 million. Due to the large number of activities sponsored under each Project, the material presented under the Accomplishments and the Planned Programs sections represents only a portion of the work being conducted each year.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2301, Physics: This project provides scientific knowledge to support the development of advanced weapon concepts and to advance capabilities in areas such as electromagnetic countermeasures, nuclear weapons effects, communications and radar, nondestructive and nonintrusive testing and analysis, and new materials development. Work is supported in optical physics, plasma physics, atomic and molecular physics, particle beam physics, pulsed and prime power generation, and advanced energy concepts.

(U) FY 1989 Accomplishments:

- (U) Established nationwide plasma simulation group to share national electromagnetic and plasma physics modeling resources with nine universities and three DOD labs.
- (U) Demonstrated new concept electronic device, the nonlinear element transmission line with switching speed at high voltage, of 1.6 picoseconds, the fastest ever in an electronic device. Devices also demonstrated as sampling probes for measurements in high speed circuits, and are in process of being licensed to U.S. commercial electronics manufacturers.
- (U) Placed in service a specialized molecular beam epitaxy machine for fabrication of optical reflecting elements at x-ray wavelengths. The machine has already produced state-of-art reflectors, and shows unique promise to produce complex x-ray elements needed to make x-ray lithography of microelectronic devices a military and commercial success.
- (U) Developed a factored frame representation for analysis of molecular collision processes, permitting independent calculations for regions of different molecular forces.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

(U) FY 1990 Planned Program:
- (U) Begin emphasis in x-ray optics in areas of high resolution lithography and in element selective soft x-ray microscopic and holographic imaging.
- (U) Begin initiative in chemical reaction control using small amounts of energy to control large amounts of reaction energy. Work could lead to radical advances in safe energetic fuels, combustion control, and low temperature materials growth and processing.
- (U) Begin initiative in electro-optical techniques for millimeter wave integrated circuits, including optical concepts, processing, control, and testing.
- (U) Begin experiments to study physics of absorption and scattering of radar signals by plasma volumes as possible radar countermeasure.

(U) FY 1991 Planned Program:
- (U) Begin to emphasize particle acceleration and very high power microwave devices using advanced beam-plasma interaction concepts and new numerical modeling tools. These concepts could lead to revolutionary advances in size and weight of high energy particle accelerators and high power microwave sources.
- (U) Demonstrate nonlinear transmission lines as a means of efficiently converting microwaves into high frequency millimeter waves. This would make millimeter wave sources for important projected applications available by taking advantage of existing technology in the microwave regime.
- (U) Demonstrate integrated optical devices for producing, converting, and controlling the wavelength of optical radiation all on the same chip. This would provide compact and efficient laser sources at any desirable wavelength, with controllable characteristics.

(U) Work Performed By: The following Air Force (AF) Laboratories are conducting research under this project: The AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; the AF Weapons Laboratory, Kirtland AFB NM; and the Frank J. Seiler Research Laboratory, USAF Academy CO. The top five universities or contractors for this project are: Stanford University, Stanford CA; University of New Mexico, Albuquerque NM; University of Arizona, Tucson AZ; University of Maryland, College Park MD; and University of Southern California (USC), Los Angeles CA.

(U) Related Activities:
- (U) Program Element #0602203F, Aerospace Propulsion.
- (U) Program Element #0602601F, Advanced Weapons.
- (U) No duplication of effort within the AF or the Department of Defense (DOD).

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2302, Structures: Provides basic understanding for cost effective, safe design of aerospace and airbase structures of importance to the Air Force. Research is pursued in aerospace and civil engineering structures-related topics, including dynamics and stability, damage processes and mechanisms, and response of structures and materials. This research supports the development of hypersonic flight vehicles, advanced fighter concepts, high performance turbine engine technology, and air base structures.

(U) FY 1989 Accomplishments:
- (U) Started mesomechanics programs to establish microstructural basis for mechanistic analysis of structural materials. First year efforts have already improved our understanding of the connection between the make-up of the material and its behavior.
- (U) Investigated effect of combined thermal and structural loads on cooled non-metallic and metallic structures for hypersonic systems. Led to more accurate predictions of the behavior of hypersonic structures.
- (U) Evaluated pavement system failure modes and new materials. Failure of damaged pavements can now be predicted within twenty percent.
- (U) Investigated combined structure-control-fluids interactions for highly maneuverable vehicles. Made possible the construction of realistic computational models.

(U) FY 1990 Planned Program:
- (U) Investigate constitutive mechanics for soil response to blast and impulsive loading. Potential for improving protective airbase structures.
- (U) Begin computational thermoelasticity program to provide numerical simulations of hypersonic structural response. Potential for improving hypersonic vehicle design.
- (U) Investigate interface structures for newly developed cement-based materials. Potential for developing much better pavement materials.
- (U) Investigate physical damage mechanisms in high-temperature composite materials. Potential for developing tougher high-temperature materials.

(U) FY 1991 Planned Program:
- (U) Investigate parallel computation techniques for structural optimization. Potential for improving the efficiency of structural analysis computations.
- (U) Study wave propagation in granular materials. Potential

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

for designing structures which can resist dynamic loads.
- (U) Investigate the energy release mechanisms in brittle materials. Potential for developing damage-tolerant light-weight structures.
- (U) Study the microstructure of naturally-occurring fiber-reinforced composite materials. Potential for developing multi-functional, durable aerospace materials.

(U) Work Performed By: The following AF Laboratories are conducting research under this project: the AF Armament Laboratory, Eglin AFB FL; the AF Astronautics Laboratory, Edwards AFB CA; the AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; the AF Weapons Laboratory, Kirtland AFB NM; and the Frank J. Seiler Research Laboratory, USAF Academy CO. The top five universities or contractors for this project are: Massachusetts Institute of Technology (MIT), Cambridge MA; Northwestern University, Evanston IL; Texas A and M Research Foundation, College Station TX; University of California (UCLA), Los Angeles CA; and Computational Mechanics Company, Inc, Austin TX.

(U) Related Activities:
- (U) Program Element #0602102F, Materials.
- (U) Program Element #0602201F, Aerospace Flight Dynamics.
- (U) Program Element #0602206F, Civil Engineering and Environmental Quality.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 2303, Chemistry: Chemical research is conducted to promote advances in composite materials, geo-environmental characterization, conventional and electromagnetic weaponry and electric power sources. Areas of emphasis include structural chemistry, electrochemistry, surface chemistry, materials synthesis, high energy density materials, thermomechanical decomposition, gas-surface interactions, chemical lasers, chemiluminescent reactions, and reactions in the space environment.

(U) FY 1989 Accomplishments:
- (U) Developed a satellite dielectric coating that promises over one hundred times the oxidation resistance of coatings now in use.
- (U) Determined interfacial reactivity that controls the high temperature service life of solid molybdenum disulfide bearing lubricants.
- (U) Determined how to forecast infrared airglow emission

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

backgrounds (from atmospheric hydroxyl radicals) that can limit the sensitivity of satellite surveillance systems.

(U) FY 1990 Planned Program:
- (U) Begin research on a new class of multifunctional macromolecules that combine high mechanical strength with intrinsic electro-optical properties for aircraft structures and skins.
- (U) Conduct research on new families of polymer alloys based on theoretical modeling of polymer interactions.
- (U) Investigate chemical laser systems operating at near ultraviolet frequencies.

(U) FY 1991 Planned Program:
- (U) Initiate evaluation of the phenomenon of spontaneous ionization of gases surrounding spacecraft and satellites in order to understand the effects on communication, surveillance, and optical and radar signatures.
- (U) Begin new program to control molecular architecture of polymers for artificial neural network applications for optical computing.
- (U) Conduct research on sol-gel ultraviolet glass optics for transpiration cooled hypersonic vehicle windows and intracavity ion laser components for precision optical imaging.

(U) Work Performed By: The following AF organizations are conducting research under this project: the AF Armament Laboratory, Eglin AFB FL; the AF Geophysics Laboratory, Hanscom AFB MA; AF Astronautics Laboratory, Edwards AFB CA; the AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; AF Weapons Laboratory, Kirtland AFB NM; the AF Engineering Services Center, Tyndall AFB FL; and the Frank J. Seiler Research Laboratory, USAF Academy CO. The top five universities or contractors for this project are: California Institute of Technology, Pasadena CA; Cornell University, Ithaca NY; Massachusetts Institute of Technology, Cambridge, Mass; SRI International, Menlo Park CA; and UCLA.

(U) Related Activities:
- (U) Program Element #0602102F, Materials.
- (U) Program Element #0602302F, Rocket Propulsion.
- (U) Program Element #0602601F, Advanced Weapons.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

4. (U) Project 2304, Mathematics: Research in mathematics and computer science to provide models, analytical tools and computational methods for simulation, analysis, design, and control of complex systems. The research addresses issues of importance to the Air Force including optimal design and control of aerospace structures, signal processing, reliability and maintainability of systems, and very large scheduling and allocation problems. Research areas include control theory, computational methods, computer science, artificial intelligence, applied mathematics, statistics, and optimization.

(U) FY 1989 Accomplishments:
- (U) Developed computationally tractable synthesis technique, which integrates both state-space and frequency design methods, for robust multivariable feedback control.
- (U) A new approach, based upon geometrically exact structural models, was developed for the modelling of the dynamics of large flexible structures, such as those occurring in space applications. This approach results in analytical and computational tools for the design of systems with coupled rigid and flexible components.
- (U) A modified trim means (moving average) processing technique was developed that enhances the performance of constant false alarm radar detection processes for detecting multiple targets in varying cluttered environments.
- (U) Tri-service leader and first substantial founder of multidisciplinary program in wavelets with the potential for improved detection of low observable and transient signals.

(U) FY 1990 Planned Program:
- (U) Begin signals to symbols initiative which will merge artificial intelligence processing with numerical computation to achieve a transition from numerical (signal level) computing to higher level cognitive (symbolic level) processing for processing and interpreting signals and images.
- (U) Begin a new initiative in design optimization which will explore mathematical methods for producing reliable optimal designs for large-scale systems and for integrating performance and reliability measures into the design process.

(U) FY 1991 Planned Program:
- (U) Begin a new initiative in theoretical materials modeling which will extend advances in the mathematical calculation of exotic material properties.
- (U) Begin an initiative in discrete mathematics which will explore emerging results in graph theory and discrete event dynamical systems; and their application to modeling and

control of transportation, computer architectures and networks, and manufacturing processes.
- (U) Expand efforts in intelligent real time problem solving, to expand applicability of expert systems to situations involving critical time constraints.

(U) Work Performed By: The following AF organizations are conducting research under this project: the AF Armament Laboratory, Eglin AFB FL; the Rome Air Development Center, Griffiss AFB NY; AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; and AF Weapons Laboratory, Kirtland AFB NM. The top five universities or contractors for this project are: Massachusetts Institute of Technology, Cambridge, Mass; University of Illinois, Urbana IL; University of Maryland, College Park MD; University of North Carolina, Chapel Hill NC; and University of Wisconsin, Madison WI.

(U) Related Activities:
- (U) Program Element #0602201F, Aerospace Flight Dynamics.
- (U) Program Element #0602702F, Command Control Communication.
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 2305, Electronics: Provides fundamental knowledge to advance AF capabilities in surveillance, guidance and control, information and signal processing, electronic warfare and communications, command and control. Areas of emphasis include electronic devices, optical electronics, electrical and optical systems, and antennas and propagation.

(U) FY 1989 Accomplishments:
- (U) Demonstrated record speed for photoconductive switch using new low temperature semiconductor buffer layer.
- (U) Designed and fabricated a novel quantum well diode (QWITT) producing the highest microwave output power.
- (U) Developed a tunable femtosecond optical laser source for ultrafast carrier studies.
- (U) Applied molecular dynamics simulations resulting in significantly improved radiation hardness for optical fibers.
- (U) Produced the first oriented ferrite films on Gallium Arsenide for application to electronically steerable antennas.
- (U) Applied high temperature superconducting thin film material to demonstrate a potential electronic interface circuit

which offers higher performance at a lower power requirement.

(U) FY 1990 Planned Program:
- (U) Begin research on space-borne charged particle beam antenna for secure communication applications.
- (U) Conduct research supporting development of novel efficient spacial light modulator for high volume, real-time optical computer applications.

(U) FY 1991 Planned Program:
- (U) Investigate self learning, adaptive optical neural computers for real-time applications such as in electronic location determination or pilot speech enhancement systems.
- (U) Search for alternatives to mercury cadmium telluride for forward looking infrared imaging systems on aircraft.
- (U) Initiate electronic materials study on a new type of gallium arsenide which has shown high promise for ultrafast detection of optical and electronic signals.

(U) Work Performed By: The following AF organizations are conducting research under this project: the AF Armament Laboratory, Eglin AFB FL; the Rome Air Development Center, Griffiss AFB NY; AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; and the AF Weapons Laboratory, Kirtland AFB NM. The top five universities or contractors for this project are: University of California, Santa Barbara CA; University of California, Berkeley CA; USC; University of Texas, Austin TX; and Cornell University, Ithaca NY.

(U) Related Activities:
- (U) Program Element #0602204F, Aerospace Avionics.
- (U) Program Element #0602702F, Command Control Communications.
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 2306, Materials: Provides knowledge required for improving performance, cost and reliability of structural and electronic materials. Structural materials include airframe, turbine engine and spacecraft materials. Electronic materials include semiconductors, superconductors, optical and magnetic materials. Areas of interest include metallic materials, nonmetallic materials, composites, processing and manufacturing sciences, electronic materials, optical films and substrates.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

(U) FY 1989 Accomplishments:
- (U) Developed technique for processing superior ceramic superconducting thin films.
- (U) Demonstrated high temperature creep resistance in 50% aluminia - 50% zirconia ceramics.
- (U) Atomic level computer simulation of cleavage fracture in carbon-based ceramics.
- (U) Elucidated crystallization of oxide ceramics from sol-gel percursors.
- (U) Definition of interfacial structure in titanium aluminide intermetallics.
- (U) Toughening of Titanium-Aluminum intermetallic alloys.

(U) FY 1990 Planned Program:
- (U) Conduct fatigue and fracture studies of recently developed novel, advanced aerospace materials.
- (U) Increase effort on ceramic matrix composites.
- (U) Continue advanced semiconductor processing research.

(U) FY 1991 Planned Program:
- (U) Study wide bandgap semiconductors for solar blind ultraviolet (UV) detection of objects in space environment.
- (U) Investigate thin magnetic films grown on standard semiconductors with the aim to reduce cost on microwave T/R (transmit/receive) modules.
- (U) Initiate research on the understanding and control of interface phenomena in novel structural materials in order to improve mechanical properties and enhance reliability.

(U) Work Performed By: The following AF Laboratories are conducting research under this project: the AF Astronautics Laboratory, Edwards AFB CA; the AF Wright Aeronautical Laboratories, Wright Patterson AFB OH; Rome Air Development Center, Griffiss AFB NY; and the AF Weapons Laboratory, Kirtland AFB NM. The top five universities or contractors for this project are: Massachusetts Institute of Technology, Cambridge, Mass; University of Illinois, Urbana Ill; Rockwell International, Thousand Oaks CA; Stanford University, Stanford CA; and Westinghouse Electric Corporation, Pittsburg PA.

(U) Related Activities:
- (U) Program Element #0602102F, Materials.
- (U) Program Element #0603211F, Aerospace Structures/Materials.
- (U) Program Element #0708011F, Manufacturing Technology.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

7. (U) Project 2307, Fluid Mechanics: Provides basic understanding for improved aerodynamics including drag reduction, maneuverability, and supersonic and hypersonic flows. Research is supported in the areas of external aerodynamics, turbulence structure control, unsteady and separated flows, and internal flows for gas turbine engines and lasers.

(U) FY 1989 Accomplishments:
- (U) A reduction of more than fifty percent in wake velccity contributing to aerodynamic drag was achieved by control of vortex shedding.
- (U) The stable flow regime of hypersonic boundary layers for aerospace vehicles was doubled through the application of wall cooling.

(U) FY 1990 Planned Program:
- (U) Begin a new program based on direct numerical simulation which will focus on improved turbulence models. Potential for significant aircraft and missile drag reduction and enhanced engine performance.

(U) FY 1991 Planned Program:
- (U) Begin major emphasis on developing methods for exploring massive computational parallelism for computational fluid dynamics. Potential for accurate prediction of whole aircraft aerodynamics.
- (U) Launch new initiative on convection heat transfer in gas turbine engines. Potential for contributing to IHPTET goal to double engine thrust to weight ratio.
- (U) Begin new research thrust on chaotic advection for improved fluid mixing. Potential to enhance mixing in air breathing combustors.

(U) Work Performed By: The following AF Laboratories are conducting research under this project: the AF Armament Laboratory, Eglin AFB FL; the AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; the AF Weapons Laboratory, Kirtland AFB NM; and the Frank J. Seiler Research Laboratory, USAF Academy CO. The top five universities or contractors for this project are: Massachusetts Institute of Technology, Cambridge, Mass; Princeton University, Princeton NJ; Stanford University, Stanford CA; University of Southern California (USC), Los Angeles CA; and University of Washington, Seattle WA.

(U) Related Activities:
- (U) Program Element #0602102F, Materials.
- (U) Program Element #0602201F, Aerospace Flight Dynamics.
- (U) Program Element #0602203F, Aerospace Propulsion.
- (U) No duplication of effort within the AF or DOD.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

8. (U) Project 2308, Energy Conversion: This project involves the efficient use of energy in Air Force propulsion and weapon systems, including airbreathing engines and chemical and non-chemical rockets. Research is organized into the areas of chemically reacting flow, non-chemical energetics, and diagnostics. Among systems to be supported by the chemically reactive flow research are supersonic combustion ramjets for hypersonic flight vehicles, and solid and liquid propellant rockets. The non-chemical energetics research addresses plasma and beamed energy propulsion systems and ultrahigh energy thermionic power sources for space applications. The research in diagnostics provides critically needed measurement capability for processes such as liquid and solid propellant combustion and plasma propulsion.

(U) FY 1989 Accomplishments:
- (U) A three-fold increase in the performance of magneto plasmadynamic space thrusters was achieved by the addition of a conducting ring coil.
- (U) A novel vortex mixer concept for supersonic combustion was demonstrated and transitioned for application to the National Aerospace Plane.

(U) FY 1990 Planned Program:
- (U) Emphasize research in plasma-based space propulsion including stabilization and pulsed-plasma phenomena. Potential for a three-fold increase in useful payload at fixed gross launch weight for earth-to-orbit missions.

(U) FY 1991 Planned Program:
- (U) Emphasize research on fluid flow/chemical kinetics research to understand and control combustion instability. Potential for increased performance and increased reliability of propulsion systems.
- (U) Exploit concepts such as ionized cluster beams to obtain efficient high-thrust orbit raising rocket propulsion systems in the specific impulse range of 1000-1500 seconds. Potential for a ten-fold increase in the thrust density of ion engines.
- (U) Study the coupling between fuel droplets and turbulence in combustors. Potential to improve combustor design codes by identifying a previously unknown combustion enhancement mechanism.

(U) Work Performed By: The following AF Laboratories are conducting research under this project: the AF Astronautics

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

Laboratory, Edwards AFB CA; and the AF Wright Aeronautical Laboratories, Wright-Patterson OH. The top five universities or contractors for this project are: California Institute of Technology, Pasadena CA; Massachusetts Institute of Technology, Cambridge, Mass; Pennsylvania State University (Penn State), University Park PA; Princeton University, Princeton NJ; Yale University, New Haven CT.

(U) Related Activities:
- (U) Program Element #0602102F, Materials.
- (U) Program Element #0602203F, Aerospace Propulsion.
- (U) Program Element #0602302F, Civil Engineering Technology.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

9. (U) Project 2309, Terrestrial Sciences: This project provides basic research in geodesy, gravity, and seismology on problems associated with improving missile accuracy and nuclear test ban treaty monitoring. Research in seismology is required to improve the Air Force's capability to monitor nuclear test ban treaties. Seismology research also is required to determine the effect of ground motion generated from earthquakes, nuclear explosions and other seismic sources on the accuracy of systems and critical facilities. Research in geodesy is required to determine the position of targets with respect to missile launch sites. Research in gravity is required to determine its effect on missile guidance systems.

(U) FY 1989 Accomplishments:
- (U) Results from a Global Positioning System (GPS) survey on Vandenberg Air Force Base indicate significant tectonic strain rates and deformation that could affect Air Force systems and critical facilities.
- (U) More complete analysis of experimental gravity data indicate deviations from Newtonian laws of gravity may not be as large as previous results indicated.
- (U) Completed seismic analysis that improved the capability to locate underground nuclear explosions.

(U) FY 1990 Planned Program:
- (U) Initiate a major seismic research program that focuses on the analysis of seismic data recorded in the USSR to improve the regional nuclear test monitoring capability in that region.
- (U) Perform high altitude gravity measurements to confirm Newtonian laws of gravity.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

- (U) Begin seismic studies to improve the knowledge of wave propagation in South America.
- (U) Intensify deployment of GPS receivers at Vandenberg Air Force Base to more accurately determine sources of tectonic activity.

(U) FY 1991 Planned Program:
- (U) Develop techniques to more accurately define earth surface positions in regions inaccessible to placement of Global Positioning System receivers.
- (U) Deploy continuous monitoring Global Positioning System receivers at Vandenberg Air Force Base.
- (U) Focus seismic research program on formulating the physical basis for discrimination and yield estimation techniques at lower magnitudes.
- (U) Clarify role of short-range gravitational forces. Understanding these forces is important for strategic missile system accuracy.

(U) Work Performed By: The Geophysics Laboratory, Hanscom AFB MA is conducting research under this project. The four universities or contractors for this project are: Southern Methodist University, Dallas TX; University of Texas at El Paso, El Paso, TX; Massachusetts Institute of Technology, Cambridge, MA; and University of Federal Armed Forces, Munich, Germany.

(U) Related Activities:
- (U) Program Element #0602101F, Geophysics.
- (U) Program Element #0602204F, Aerospace Avionics.
- (U) Program Element #0602206F, Civil Engineering Environmental Quality.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

10. (U) Project 2310, Atmospheric Sciences: Research in the atmospheric sciences includes the physics, dynamics, and chemistry of processes which determine the structure and variability of the earth's atmosphere. Atmospheric properties such as wind, density, clouds and precipitation, ionization, and optical/infrared transmissivity/emissivity all affect the performance of Air Force systems. Major research efforts focus on the optical/infrared environment, ionospheric dynamics, and meteorology.

(U) FY 1989 Accomplishments:
- (U) Developed a new technique for detecting atmospheric charge (lightning threat) using polarized radar.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

- (U) Devised a new nonlinear theory for electron accelerations in the magnetosphere--solved mystery of what causes aurora.
- (U) Invented a computer algorithm for incorporating satellite-observed outgoing longwave radiation into global weather models--significantly improves tropical cloud and hurricane/typhoon predictions.

(U) FY 1990 Planned Program:
- (U) Increase emphasis on modeling of the neutral and ionized environment to improve understanding of geomagnetic disturbances in upper atmosphere for minimizing atmospheric interference to C3 and early warning systems.
- (U) Continue emphasis on computer modeling of battlefield-scale weather systems which will lead to better weather forecasts.

(U) FY 1991 Planned Program:
- (U) Begin research in atmospheric electricity to develop improved techniques for remotely sensing atmospheric charge for warning of potential lightning strikes.
- (U) Conduct research on modeling of fine-scale atmospheric structure observed with newly fielded wind profilers and Doppler radars for improved weather forecasts.
- (U) Begin work on improved remote sensing techniques to improve weather intelligence needed for combat operations.

(U) Work Performed By: The AF Geophysics Laboratory, Hanscom AFB MA is conducting research under this project. The top five universities or contractors for this project are: Massachusetts Institute of Technology; Colorado State University, Fort Collins CO; Utah State University, Logan, Utah; Penn State; SRI International, Menlo Park CA.

(U) Related Activities:
- (U) Program Element #0602101F, Geophysics.
- (U) Program Element #0305160F, Defense Meteorological Satellite Program.
- (U) Program Element #0603220C, Surveillance Acquisition, Tracking and Kill (SDI).
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

11. (U) Project 2311, Astronomy and Astrophysics: Provides the basic knowledge of the space and celestial environment needed for the design and calibration of advanced Air Force systems for missions requiring surveillance, communication and weather forecasts. Space environmental conditions produced by electromagnetic radiation and

charged atomic particles can endanger the mission and degrade the performance of military spacecraft and communication systems operating in or through the charged particle space environment. The project supports the Air Weather Service by improving observation and forecasting techniques that are needed to support military operations. The project also supports studies of celestial and stellar radiation backgrounds and contributes to the knowledge of how such radiation will affect Air Force surveillance, discrimination and tracking activities for future systems.

(U) FY 1989 Accomplishments:

- (U) Showed that total solar emission in the Calcium K-line indicates the degree of solar activity. Changes in solar ultraviolet radiation affects the properties of the earth's atmosphere and impacts Air Force operations.
- (U) Performed a comprehensive study of significant solar proton events detected at the earth during the past three solar cycles. These events can seriously disrupt and degrade Air Force systems operating in space.
- (U) Developed a new model for the start of magnetic storms in the earth's magnetosphere. Magnetic storms release energy into the high latitude ionosphere and affect Air Force spacecraft and communication systems.
- (U) Completed a model and computer simulation of electrons in the presence of arbitrary electromagnetic wave fields. This model will be used to predict particle energization effects of radiation from future Air Force high power, ground and space based antennas.
- (U) Demonstrated a real time display capability for infrared celestial sources detected with the Geophysics Laboratory array spectrometer. This capability will allow increased acquisition efficiency and fainter source measurements in future Air Force space surveillance systems.
- (U) Studied interactions of a beam emitting rocket and neutral gas releases. The results may provide a technique for controlling surface potentials of Air Force high power space systems.

(U) FY 1990 Planned Program:

- (U) Produce major advances in understanding solar activity processes and complete new instruments and techniques to develop and test activity prediction models.
- (U) Develop models of dynamic magnetospheric processes critical to space weather specification and prediction models needed by the Air Weather Service and Military Airlift Command.
- (U) Study the propagation of electron beams in space by conducting rocket flights and analyzing the data.
- (U) Continue the program of spectral and spatial imaging on infrared celestial sources to characterize infrared background components important to Air Force acquisition and tracking missions.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

(U) FY 1991 Planned Program:
- (U) Test recent advances in the magnetohydrodynamic modeling of solar processes using data from an intensive global observational program so that we may develop better space weather prediction models needed by Air Weather Service and Military Airlift Command.
- (U) Continue the work relating solar activity to geomagnetic disturbances through remote sensing and in-situ measurements of traveling interplanetary disturbances. This work will continue advances on specification and prediction of solar energetic particles that can seriously degrade Air Force space assets.
- (U) Carry out rocket flights to determine the feasibility of using modulated high current electron beams at low frequencies as survivable communications antennas.
- (U) Study background sources from the infrared astronomical satellite to aid in strategic scene generation, which is of importance to space surveillance.

(U) Work Performed By: The AF Geophysics Laboratory, Hanscom AFB MA is conducting research under this project. The top five universities or contractors for this project are: National Science Foundation, Washington DC; Boston College, Chestnut Hill MA; University of Wyoming, Laramie WY; Columbia University, New York NY; and California Institute of Technology, Pasadena CA.

(U) Related Activities:
- (U) Program Element #0602101F, Geophysics.
- (U) Program Element #0602702F, Command Control Communication.
- (U) Program Element #0603410F, Space Systems Environment Interactions.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

12. (U) Project 2312, Biological and Medical Sciences: Provides the knowledge needed to protect AF personnel and to enable them to perform effectively in hostile environments. Research is conducted in three areas: (1) chemical toxicology and biological effects of radiation, (2) neuroscience and (3) physiology and biophysics.

(U) FY 1989 Accomplishments:
- (U) Developed an adaptive neural network model which captures learning abilities that can be applied to adaptive flight control and robotics.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

- (U) Demonstrated the potential usefulness of the nutrient tyrosine to alleviate some of the cardiac stress responses that occur due to altered gravitational environments.
- (U) Developed new methods for assessing the acute and delayed toxic effects of critical AF chemicals to be used in the Advanced Tactical Fighter.

(U) FY 1990 Planned Program:
- (U) Start research on neurobiology of circadian rhythms to reduce effects of jet-lag, fatigue, and sleep disruption.
- (U) Start research on subclinical cardiovascular disease to prevent unnecessary grounding of aircrew.
- (U) Continue research on biological effects and environmental fate and impact of toxic chemicals.

(U) FY 1991 Planned Program:
- (U) Continue research on toxicology, neural regulation, circadian rhythms, and subclinical cardiovascular disease.
- (U) Facilitate collaboration between neuroscientists and experimental psychologists studying the neural mechanisms of skilled human performance.
- (U) Enhance research on the biodegradation of toxic AF chemicals.

(U) Work Performed By: The following AF organizations are conducting research under this project: AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; the Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB OH; and the USAF School of Aerospace Medicine, Brooks AFB TX. The top five universities or contractors for this project are: Hahnemann University, Philadelphia PA; University of Illinois, Urbana IL; Massachusetts Institute of Technology, Cambridge MA; University of Wisconsin, Madison WI; and Yale University, New Haven CT.

(U) Related Activities:
- (U) Program Element #0602202F, Human Systems Technology.
- (U) Program Element #0602205F, Personnel, Training and Simulation.
- (U) Program Element #0603231F, Crew Systems and Personnel Protection.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

13. (U) Project 2313, Human Resources: Under this project the Air Force investigates how humans acquire and process information. Insights gained may enhance human performance in the areas of hearing,

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

seeing, perception, attention span, memory, learning, and problem solving and improve the man-machine interfaces for complex systems such as aircraft. This knowledge may also find application in the design of smart systems to emulate the human capabilities to recognize visual scenes, speech and solve problems. Information on the way humans process information is expected to contribute to improved criteria and testing techniques for matching personnel skills with job requirements. This will yield better mission performance through selection of better qualified personnel to operate complex systems and a monetary savings in terms of more efficient training.

(U) FY 1989 Accomplishments:
- (U) Developed a model of sensory-motor learning and control that will undergo advanced development for robotics.
- (U) A computational model of peripheral auditory function was developed and comparisons with human listening are underway to validate its use for speech recognition systems.

(U) FY 1990 Planned Program:
- (U) Begin new research initiative on spatial orientation to find ways to prevent accidents caused by crew disorientation in high-performance aircraft.
- (U) Continue research on how humans process visual and auditory information and on cognitive functions.

(U) FY 1991 Planned Program:
- (U) Expand research on cognitive maps, which humans use to navigate through their environment and to track physical relationships of objects.
- (U) Continue research on how humans process visual and auditory information in order to develop new sensors and displays more compatible with human operators.
- (U) Begin new research on decision-making under time pressure in order to develop decision-making strategies and improve the ability of humans to make correct decisions in emergency situations.

(U) Work Performed By: The following AF organizations are conducting research under this project: the AF Human Resources Laboratory, Brooks AFB TX; the Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB OH; and the USAF School of Aerospace Medicine, Brooks AFB TX. The top five universities or contractors for this project are: Central Institute for the Deaf, St. Louis MO; New York University, New York NY; SRI International, Menlo Park CA; Yale University, New Haven CT; and University of York, Ontario Canada.

Program Element: #0601102F Budget Activity: #1-Technology Base
PE Title: Defense Research Sciences

(U) Related Activities:
- (U) Program Element #0602202F, Human Systems Technology.
- (U) Program Element #0603231F, Crew Systems and Personnel Protection.
- (U) No duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06GL Laboratory Operations	24,115	24,158	23,503	Cont	TBD
3054 Infrared Target and Background Signatures	1,967	2,043	2,016	Cont	TBD
4643 Ionospheric Specification	2,191	2,264	2,234	Cont	TBD
6670 Atmospheric Science and Technology	1,040	1,196	1,180	Cont	TBD
7600 Terrestrial Geophysics	604	639	630	Cont	TBD
7601 Space Effects on Air Force Systems	3,773	4,072	4,432	Cont	TBD
7659 Aerospace Systems Technology	570	592	584	Cont	TBD
7670 Optical/Infrared Properties of the Environment	1,833	1,904	1,878	Cont	TBD
Total	36,093	36,868	36,457	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program develops the groundwork for countering and exploiting effects of the geophysical environment to improve performance and operations of Air Force weapon systems. The focus is on better exploitation of the geophysical environment to yield support to developers and users of systems such as improved missile guidance, air launch and recovery, target identification, space vehicle tracking and satellite surveillance, and communications. The research is extensively coordinated outside the Air Force--National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, Office of the Deputy Director for Defense Research and Engineering (Research and Advanced Technology), etc. This ensures the effectiveness of joint efforts and precludes duplication.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06GL, Laboratory Operations. This project supports and complements all other projects in this program element and provides for management, support, and operation of the Geophysics Laboratory, Hanscom AFB MA and its operations at four locations stateside. It provides pay and related costs of civilian services, procurement of supplies and equipment, and contractor support services for maintenance and modification of facilities.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	Total Program
- (U) Military Construction Funds (PE 0702806F)	0	5,700	0	5,700

2. (U) Project 3054, Infrared Target and Background Signatures. Infrared (IR) target and background research responds to the Air Force's growing reliance on infrared sensors for surveillance, warning, and guidance. The goal is to characterize the different types of atmospheric environments that will exist normally as well as those that may exist during wartime so that IR surveillance systems can detect targets. Background and target signature data from rockets, aircraft, balloons, and Shuttle measurement platforms are compared with theoretical and laboratory data. Results are integrated into computer models to assist IR systems designers, developers, and operators to detect targets.

(U) FY 1989 Accomplishments:
- (U) Designed advanced high resolution, environmental IR sensors for use in enhancing area and electromagnetic spectrum of surveillance systems for detecting stealthy targets and other small signal targets in environmental clutter.
- (U) Designed shuttle IR instruments and planned experiments to expand knowledge of IR environment in space for establishing design specifications for IR sensors.

(U) FY 1990 Planned Program:
- (U) Begin evaluation of high resolution IR sensor which exploits a supersensitive photomultiplier in conjunction with an interferometer to detect low visibility targets.
- (U) Continue field measurement program using flying infrared laboratory for measuring the infrared signatures of aircraft, backgrounds, and natural and man made objects and providing calibrated data bases to program offices.
- (U) Measure shuttle infrared glow phenomena as a basis for understanding glow on space based platforms and methods to mask the glow to minimize sensor contamination and platform detectability.

(U) FY 1991 Planned Program:
- (U) Conduct rocket experiment to determine optimum strategic spectral bands for IR earthlimb radiance model needed to design future missile surveillance systems.
- (U) Complete and transition IR clutter models for auroral and atmospheric radiance and their spectral and spatial characteristics to satellite surveillance system program offices as basis for advanced surveillance systems development.
- (U) Install state-of-the-art focal plane IR Camera (640x480) in flying IR Signature Target Aircraft and validate aircraft

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

IR spectral signature date based for design of low observable systems.

(U) Work Performed By: Geophysics Laboratory (GL), Hanscom AFB MA manages and performs work in this project. Contractors are: Visidyne, Burlington MA; SSG, Waltham MA; Aerodyne Research, Billerica MA; Photometrics, Inc., Burlington MA; Spectral Sciences, Inc., Bedford MA.

(U) Related Activities:
- (U) Program Element #0601102F, Defense Research Sciences.
- (U) Program Element #0603707F, Weather Systems.
- (U) Program Element #0305160F, Defense Meteorological Satellite Program (DMSP).
- (U) There is no unnecessary duplication of effort within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 4643, Ionospheric Specification. Increasingly, Air Force systems operate in the ionosphere. The performance of communications and surveillance systems depend on ionospheric conditions. This project develops the capability to predict, mitigate, and exploit the effects of the ionosphere on these systems. Specific efforts include measuring the effect of ionospheric conductivity on radio wave propagation, specifying and predicting polar cap ionospheric irregularities that disturb high latitude communications and radars, developing techniques to predict ionospheric characteristics that affect the performance of communication and surveillance systems, and developing instrumentation and techniques for the Defense Meteorological Satellite System.

(U) FY 1989 Accomplishments:
- (U) Developed technique for oblique remote sensing of electron density profiles critical for frequency management over data denied areas to support over-the-horizon radars in detecting targets.
- (U) Identified candidate chemicals for use in reducing free electrons in space surrounding reentry vehicles which cause communications blackout.
- (U) Began transition of ionospheric and neutral density specification models into Air Weather Service operational capabilities.

(U) FY 1990 Planned Program:
- (U) Complete effort to chemically reduce ionospheric radio plasma blackout for vehicles like the National Aerospace Plane (NASP).

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

- (U) Complete theory and feasibility study of artificially stimulating the ionosphere for command, control, and communications enhancement to ensure reliable systems operation.

(U) FY 1991 Planned Program:
- (U) Field test chemical ionospheric modification techniques to reduce the communication blackout conditions that impact on reentry vehicles such as NASP.
- (U) Complete transition of global Ionospheric Conductivity and Electron Density model to MAC (Air Weather Service) for use in the real-time prediction of radio frequency propagation conditions needed by several Air Force C3I systems.

(U) Work performed By: GL, Hanscom AFB MA manages and performs work in this project. Contractors are: Northwest Research Assoc, San Diego CA; University of Lowell, Lowell MA; University of Michigan, Ann Arbor MI; Emmanuel College, Boston MA; Canadian Commercial Corp., Ottawa, Canada.

(U) Related Activities:
- (U) Program Element #0601102F, Defense Research Sciences.
- (U) Program Element #0603707F, Weather Systems.
- (U) Program Element #0603402F, Space Test Program.
- (U) Program Element #0305160F, DMSP.
- (U) There is no unnecessary duplication of effort within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

4. (U) Projects 6670, Atmospheric Science & Technology. This project develops capabilities for measuring, modeling, and predicting atmospheric properties. Current atmospheric global models can not provide adequate resolution for many operational missions. A thrust of this project is to develop higher resolution battlefield scale models and conduct supporting measurements which will provide the required detail. These new techniques will help satisfy requirements for an ever-expanding mission in support of emerging communications, surveillance, and target acquisition systems technologies which the atmosphere impacts.

(U) FY 1989 Accomplishments:
- (U) Completed the integrated data base management system including the artificial intelligence framework for the Advanced Meteorological Processing System (AMPS) development. The AMPS development will enable cloud analysis work using available satellite, radar, and

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

conventional weather data for next generation operational forecast systems.
- (U) Complete evaluation of neural net program to forecast both natural lightning and the potential for lightning triggered by missile and shuttle launches for implementation by launch control offices.

(U) FY 1990 Planned Program:
- (U) Participate in joint AF/NASA lightning field research program at Kennedy Space Center to establish safe missile and Shuttle launch criteria under stressed environmental conditions.
- (U) Begin effort to upgrade Air Weather Service high resolution cloud prediction model for target and surveillance support.

(U) FY 1991 Planned Program:
- (U) Implement AMPS demonstration test facility as test bed for future USAF base weather stations.
- (U) Upgrade single-station forecast system by including climatological and terrain data to support theater-scale operations under data sparse conditions.
- (U) Evaluate vertical wind profiler as a tool to monitor missile wind loading during launch operations.

(U) Work Performed By: GL, Hanscom AFB MA manages and performs work in this project. Contractors are: AER, Cambridge MA; CDC, Minneapolis MN; University of California, La Jolla CA; Science and Technology Corp., Hampton VA; The Analytical Sciences Corp., Reading MA.

(U) Related Activities:
- (U) Program Element #0601102F, Defense Research Sciences.
- (U) Program Element #0603707F, Weather Systems.
- (U) Program Element #0305160F, DMSP.
- (U) There is no unnecessary duplication of effort within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 7600, Terrestrial Geophysics: This project advances technology in the areas of the earth's geometry, motion, gravity, and seismology to support Air Force strategic systems and nuclear test ban treaty monitoring. Missile launch region and space gravity models are improved by satellite-to-satellite tracking and experimental refinement of gravity models. The application of superconducting technology to inertial instrumentation for autonomous gravity correction is under study. Seismo-acoustic techniques are being evaluated for detection and tracking of low-flying, stealthy aircraft and missiles.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

(U) FY 1989 Accomplishments:
- (U) Completed design of Superconducting Tensor Gravity Gradiometer (STGG) for inertial autonomous navigation applications which will eliminate requirement for presurveyed gravity fields.
- (U) Evaluated requirements of Peacekeeper Rail Garrison system for mobile launch gravity references.
- (U) Completed geology model of Soviet nuclear test site.

(U) FY 1990 Planned Program:
- (U) Construct and test conceptual model of Superfluid Helium Interference Gyroscope (SHIG).

(U) FY 1991 Planned Program:
- (U) Assemble and bench test Superconducting Tensor Gravity Gradiometer (STGG) as the final step before transitioning results to Wright Research and Development Center.
- (U) Develop techniques for discriminating between quarry blasts, natural rockbursts, and Soviet low-yield nuclear tests in order to improve performance in monitoring compliance with existing threshold test ban treaties.
- (U) Develop techniques for discriminating between quarry blasts, natural rockbursts, and Soviet low-yield nuclear tests.

(U) Work Performed By: GL, Hanscom AFB MA manages and performs work in this project. Contractors are: University of Maryland, College Park MD; Boston College, Chestnut Hill MA; Mayflower Communications Corp., Wakefield MA; Ohio State University, Columbus OH.

(U) Related Activities:
- (U) Program Element #0601102F, Defense Research Sciences.
- (U) Program Element #0603402F, Space Test Program.
- (U) There is no unnecessary duplication of effort within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 7601, Space Effects on Air Force Systems. This project measures, models, and forecasts both the space environment phenomena resulting from spacecraft interacting with the space environment phenomena and spacecraft contamination. Technology is developed to: (1) increase the reliability/survivability and autonomy of Air Force space systems through the mitigation of particle, radiation, and contamination effects, (2) quantify/model satellite signatures and phenomenology for space object discrimination, (3) predict space weather for satellite operations,

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

C3I, and military man-in-space, and (4) exploit the space environment as a medium for supporting strategic and tactical military operations.

(U) FY 1989 Accomplishments:
- (U) Delivered Space Radiation Effects Satellite sensors to the spacecraft integrator.
- (U) Developed experimental ground-based reflecting solar telescope for subcentimeter space debris detection.
- (U) Accomplished critical design review of magnetospheric specification model including completion of basic simplifying algorithms.

(U) FY 1990 Planned Program:
- (U) Complete study of high energy particle dynamics and transition results to space radiation models.
- (U) Transition dynamic magnetospheric specification models to AFSPACECOM, MAC, and Air Weather Service.
- (U) Launch Combined Release Radiation Effects Satellite (CRRES).
- (U) Start development of static and dynamic general radiation models using data gathered from the launched CRRES.

(U) FY 1991 Planned Program:
- (U) Initiate development of space radiation effects microelectronic package models using particle detector data from the CRRES as empirical data input. Such models are needed to cost-effectively design satellite microeletronics that will not be adversely affected by space radiation.
- (U) Deliver satellite contamination code to satellite designers for use in specifying and reducing contaminants that degrade satellite optical system components.
- (U) Develop full-spectrum spacecraft phenomenology codes for remote spacecraft mission assessment by AF Space Command.

(U) Work Performed By: GL, Hanscom AFB MA manages and performs work in this project. The Naval Research Laboratory, Washington DC also provides support. Contractors are Boston College, Chestnut Hill MA; Spectral Sciences, Burlington MA; University of California, Berkeley CA; Massachusetts Technological Laboratory, Inc., West Newton MA; S-Cubed, La Jolla CA.

(U) Related Activities:
- (U) Program Element #0601102F, Defense Research Sciences.
- (U) Program Element #0603410F, Space Systems Environmental Interactions Technology.
- (U) Program Element #0603438F, Satellite Systems Survivability.
- (U) Program Element #0603707F, Weather Systems.
- (U) Program Element #0603402F, Space Test Program.
- (U) Program Element #0102431F, Defense Support Program.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

- (U) Program Element #0305160F, DMSP.
- (U) There is no unnecessary duplication of effort within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

7. (U) Project 7659, Aerospace Systems Technology. This project improves the usefulness of the spacecraft, balloon, and sounding rocket payload systems used as experiment carriers by Geophysics Laboratory and DOD. The only DOD high altitude balloon capability is contained in this project. The work is focused on applying modern technology, particularly microelectronics, in developing experimental sensor platforms and efficient data management techniques.

(U) FY 1989 Accomplishments:
- (U) Completed timer/locater system for high altitude pathfinder balloon.

(U) FY 1990 Planned Program:
- (U) Test laser disk recorder in instrument aboard space Shuttle.
- (U) Complete testing of balloon navigation system for use by high altitude experiments needing precise balloon tracking.

(U) FY 1991 Planned Program:
- (U) Complete fullscale system for testing attitude control system after completion of rocket assembly in order to eliminate malfunctions which are caused during final assembly.

(U) Work Performed By: GL, Hanscom AFB MA manages and performs work in this project. Contractors are: Wentworth Institute of Boston College, Chestnut Hill MA; SIE, Lexington MA.

(U) Related Activities:
- (U) Program Element #0601102F, Defense Research Sciences.
- (U) Program Element #0603410F, Space Systems Environmental Interactions Technology.
- (U) Program Element #0603707F, Weather Systems.
- (U) Program Element #0603402F, Space Test Program.
- (U) Program Element #0305160F, DMSP.
- (U) There is no unnecessary duplication of effort within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

8. (U) Project 7670, Optical/Infrared Properties of the Environment. This project develops: (1) laser radar technology to measure atmospheric properties from space, (2) models and tools to predict the impact of the atmospheric environment on DOD electrooptical weapons and surveillance systems, and (3) models, data bases, and scene generators of the celestial space background for surveillance and tracking systems used to find and track space vehicles.

(U) FY 1989 Accomplishments:
- (U) Developed self-sensing algorithms for infrared sensors to automatically correct for atmospheric limitations on ranging and imaging for smart weapons.
- (U) Pushed lidar state-of-the-art technology to develop an eye-safe lidar (laser radar) for wind sensing from space.
- (U) Conducted aerosol backscatter measurements in support of space-based lidar development.

(U) FY 1990 Planned Program:
- (U) Complete path characterization for atmospheric transmission at specified sensor wavelengths and input to Tactical Decision Aids models used for smart weapons.
- (U) Complete global aerosol background measurement studies for input to the Defense Meteorological Satellite System.

(U) FY 1991 Planned Program:
- (U) Validate atmospheric path characterization models used as technology insertion to Tactical Decision Aids in order to improve prediction of atmospheric effects on electroptical weapon systems performance.
- (U) Assemble aerosol backscatter data base for remote regions and prepare global aerosol specifications including definition of sensitivity threshold for designing DMSP lidar systems for determining worldwide weather conditions.

(U) Work Performed By: GL, Hanscom AFB MA manages and performs work in this project. Contractors are: Visidyne, Burlington MA; Utah State University, Logan UT; Sparta Inc., Laguna Hills CA; Rockwell International, Anaheim CA; Optimetrics, Inc., Ann Arbor MI.

(U) Related Activities
- (U) Program Element #0601102F, Defense Research Sciences.
- (U) Program Element #0603707F, Weather Systems.
- (U) Program Element #0603402F, Space Test Program.
- (U) Program Element #0305160F, DMSP.
- (U) There is no unnecessary duplication of effort within the Air Force or the DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06ML Laboratory Operations	20,089	20,258	20,338	Cont	TBD
2417 Thermal Protection Materials and Structures	3,552	3,444	3,728	Cont	TBD
2418 Metallic Structural Materials	14,569	14,128	15,289	Cont	TBD
2419 Nonmetallic Structural Materials	6,222	6,033	6,529	Cont	TBD
2420 Aerospace Propulsion Materials	3,624	3,514	3,803	Cont	TBD
2421 Fluids, Lubricants and Elastomeric Materials	2,589	2,511	2,717	Cont	TBD
2422 Protective Coatings and Materials	3,472	3,367	3,644	Cont	TBD
2423 Electromagnetic Windows and Electronic Materials	4,573	4,434	4,799	Cont	TBD
TOTAL	58,690	57,689	60,847	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element contains the entire Air Force Exploratory Development program in materials and related technologies. It is the primary source of advanced materials to reduce life cycle costs and increase performance, supportability, reliability, and survivability of current and future Air Force systems and support equipment. It develops new and improved structural and non-structural materials, the processes for making them, repair techniques, and elements of a prospective unified computer system/data base that will reduce production costs by half. Specific unified system elements include design-for-producibility, design-for-inspectibility, and in the future single-step production tooling design. The capability to predict materials behavior during manufacturing processes must be developed before the single-step production tooling design module can be completed. These efforts are necessary because industry funded research and development programs do not totally satisfy Air Force needs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06ML, Laboratory Operations: Provides management and operational support for the Materials Laboratory, Wright-Patterson Air Force Base OH. Includes pay and benefits for civilian scientists, engineers and support personnel, travel, transportation, rents, communications, utilities, supplies and equipment, contractor support services, and salaries, travel, and equipment for laboratory contracting support personnel at the Aeronautical Systems Division.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

2. (U) Project 2417, Thermal Protection Materials and Structures: Develops carbon-carbon composites (CCCs) and constituent fibers/matrix resins for structural and thermal protection applications in advanced Air Force aerospace systems and components, which are exposed to intense operating conditions (oxidizing environments of 2800°-4000°F, high Mach erosion, high stress levels). Develops processes for making these materials and coatings to extend operational life.

(U) FY 1989 Accomplishments:
- (U) Developed CCC construction/processing techniques that increase mechanical properties 50 to 90%.
- (U) Demonstrated CCCs that last 300 hours under cyclical oxidizing conditions, a 25-40% improvement in performance.
- (U) Increased strength of reentry vehicle antenna windows 50%.

(U) FY 1990 Planned Program:
- (U) Begin developing low cost, thermally stable, structurally efficient CCCs for spacecraft.
- (U) Transition advanced matrix resins, strengthening mechanisms for two-dimensional CCCs, and oxidation protection techniques into ongoing manufacturing science effort on CCCs.

(U) FY 1991 Planned Program:
- (U) Continue developing oxidation resistant CCCs for military gas turbine engines and spacecraft systems.
- (U) Continue developing nondestructive evaluation techniques and life limiting parameter evaluations for the oxidation resistant CCCs under development.
- (U) Continue developing improved coated carbon fibers to further improve high temperature oxidation resistance of CCCs and begin transitioning improved fiber technologies to the manufacturing technology program in FY 1992.
- (U) Continue developing advanced shrouds, nosetips, and heat shields for advanced reentry vehicles.

(U) Work Performed By: Major contractors are Textron Inc/AVCO Specialty Materials, Lowell MA; General Electric, Cincinnati OH; Nichols Research Corp, Huntsville AL; Aerojet Corp, Sacramento CA; and MSNW Inc, San Marcos CA. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (U) Program Element #0603112F, Advanced Materials for Weapon Systems (FY 1990/1991).
- (U) Program Element #0603211F, Aerospace Structures.
- (U) Program Element #0708011F, Industrial Base Program.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

3. (U) Project 2418, Metallic Structural Materials: Develops advanced metallic materials for aerospace structural applications at cryogenic temperatures to 1800°F (a 600°F increase in capability). Also develops processes for making the materials, engineering properties, repair and advanced nondestructive inspection/evaluation (NDI/E) technologies, and elements of a prospective unified computer system and data base that will reduce weapon production costs by half.

(U) FY 1989 Accomplishments:
- (U) Developed an aluminum alloy that retains strength after 1000 hours at 900°F and a generic computer simulation of casting unidirectionally solidified turbine engine blades to achieve a reproducible manufacturing process.
- (U) Demonstrated new ultrasonic NDI/E method that images damage in composites layer by layer.

(U) FY 1990 Planned Program:
- (U) Develop environmental protection coatings for titanium aluminide materials.
- (U) Start developing a feature-based design system to enable simultaneous design-for-producibility-and-inspectibility.
- (U) Develop nuclear magnetic resonance NDI/E technology for advanced turbine engine materials and continue efforts in other areas.

(U) FY 1991 Planned Program:
- (U) Continue to develop NDI/E technology for use in the field to evaluate the quality of adhesive bonds between metal parts.
- (U) Continue developing 900°F aluminum and 1800°F titanium alloys and metal matrix composites.
- (U) Continue to develop joining/repair technologies for high temperature organic matrix composites.
- (U) Complete developing a method to eliminate the casting factor for titanium castings to reduce the weight of cast parts.

(U) Work Performed By: Major contractors are University of Dayton, Dayton OH; SYSTRAN Corp, Dayton OH; System Research Laboratories, Dayton OH; United Technologies Corp, West Palm Beach FL; and Universal Technology Corp, Dayton OH. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (U) Program Element #0603112F, Advanced Materials for Weapon Systems (FY 1990/1991).
- (U) Program Element #0603211F, Aerospace Structures.
- (U) Program Element #0708011F, Industrial Base Program.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

4. (U) Project 2419, Nonmetallic Structural Materials: Develops advanced organic matrix composite materials, and the processes for making them, for use in aerospace structural applications at cryogenic temperatures to 3000°F. Emphasis is on increasing strength, stiffness, temperature capability, and durability along with reducing weight and cost. Includes development of signature reduction materials, ordered polymer films and molecular composites (composite materials reinforced with rigid rod molecules).

(U) FY 1989 Accomplishments:
- (U) Developed 350°F thermoplastic matrix materials for carbon fiber reinforced composites, a 100°F increase in capability.
- (U) Developed advanced procedures and computer models to automatically cure thermosetting composites, a new capability.

(U) FY 1990 Planned Program:
- (U) Initiate artificial intelligence approaches to automatically process thermoplastic composite parts.
- (U) Begin to scale-up preparation of molecular composite precursor materials to 100 pound lots and increase the size and rate of fabricating molecular composite final forms.
- (U) Complete initial study of nonlinear optical (NLO) films to identify compositions that have high potential for superior NLO behavior.

(U) FY 1991 Planned Program:
- (U) Initiate development of advanced processing techniques to reduce weight and cost of molecular composite materials.
- (U) Begin effort to develop new resin materials and processing techniques for use in advanced structural composites.
- (U) Define promising chemical processes to make thermally stable conductive polymers for use as "smart" composite materials.
- (U) Complete development of first generation ultra lightweight composites which are 40% lighter than current composites.

(U) Work Performed By: The major contractors are University of Dayton, Dayton OH; Systems Research Laboratories, Dayton Ohio; Dow Chemical, Midland MI; General Dynamics Corp, Fort Worth TX; and McDonnell Douglas Corp, St Louis MO. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (U) Program Element #0603112F, Advanced Materials for Weapon Systems (FY 1990/1991).
- (U) Program Element #0603211F, Aerospace Structures.
- (U) Program Element #0708011F, Industrial Base Program.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

5. (U) Project 2420, Aerospace Propulsion Materials: Develops new materials and processes for making them to provide lightweight uncooled turbine engine components for use at extremely high operating temperatures. Supports the DOD/NASA Integrated High Performance Turbine Engine Technology (IHPTET) initiative. Improves engine producibility, durability, thrust-to-weight capability, life cycle costs, and fuel consumption.

(U) FY 1989 Accomplishments:
- (U) Developed ultra high temperature ceramic matrix composites (CMCs) and the techniques to test them at 3000°F and above.
- (U) Completed developing the capability to predict the life of titanium aluminide composite materials.

(U) FY 1990 Planned Program:
- (U) Initiate effort to develop CMCs for use at intermediate temperatures (2000°-3000°F) in the IHPTET program.
- (U) Begin effort to develop protective coatings and/or surface modifications for titanium aluminide alloys and metal matrix composites (MMCs) for use in turbine engine components.

(U) FY 1991 Planned Program:
- (U) Develop ultra-high temperature capable CMCs for use in the IHPTET program and assess their mechanical behavior.
- (U) Begin effort to design titanium aluminide alloys specifically for use as MMC matrix materials, make MMC evaluation panels from the alloys using various processing techniques, and measure the mechanical properties under long time exposure to high temperatures to assure durable IHPTET materials.
- (U) Begin to develop improved intermetallic matrix materials for IHPTET-usable MMCs that will have a useful balance of room temperature damage tolerance and high temperature strength.

(U) Work Performed By: The major contractors are United Technologies Corp, West Palm Beach FL; Southern Research Institute, Birmingham AL; Allied Signal Garrett Engine Division, Phoenix AZ; General Motors Corporation, Indianapolis IN; and General Electric Company, Cincinnati OH. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (U) Program Element (PE) #0602203F, Aerospace Propulsion.
- (U) PE #0603112F, Advanced Materials for Weapon Systems (FY 1990/1991).
- (U) PE #0603202F, Aerospace Propulsion Subsystem Integration.
- (U) PE #0603216F, Aerospace Propulsion and Power Technology
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

6. (U) Project 2421 Fluids, Lubricants, and Elastomeric Materials: Develops advanced fluids, lubricants, seals, sealants, and fluid containment systems, together with an understanding of their behavior and performance, for application to aircraft, spacecraft, and missile systems. Improves nonflammability and low temperature fluidity of fluids and lubricants.

(U) FY 1989 Accomplishments:
- (U) Demonstrated superiority of synthetic hydrocarbon coolant in B-1 avionics systems; planned use also yields $947M savings.
- (U) Completed development of 300°F conductive explosion-suppression foam for aircraft fuel cells (a 100°F increase in capability) and -65 to 275°F fire resistant hydraulic fluid.

(U) FY 1990 Planned Program:
- (U) Begin to develop 700°F capable liquid lubricant base fluids-/additives and associated theoretical models for predicting liquid lubricant behavior and lowering development costs.
- (U) Transition a halocarbon based 350°F/8000 psi nonflammable hydraulic fluid to the product division for use in aircraft.
- (U) Begin effort to improve solid lubricant performance at temperatures up to 1200°F and repeated high temperature use.

(U) FY 1991 Planned Program:
- (U) Develop candidate 700°F engine oils (+300°F in capability.)
- (U) Identify/synthesize candidate 700°F liquid lubricant seals.
- (U) Begin to develop improved methods to obtain critical thermophysical and tribological properties for liquid lubricant base fluids/additives to improve lubrication behavior prediction capabilities and lower development costs.
- (U) Begin to develop solid lubricants for wide temperature application (-60°F to 1500°F) and methods for applying these materials as films, free-flowing powders, and self-lubricating compacts.

(U) Work Performed By: The major contractors are University of Dayton, Dayton OH; Ultrasystems, Inc., Irvine CA; Honeywell/Satellite Systems Division, Phoenix AZ; Signal Research Corp, Plaines IL; and Foamex Corp, Eddystone PA. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (U) Program Element (PE) #0603202F, Aerospace Propulsion Subsystem Integration.
- (U) PE #0603216F, Aerospace Propulsion and Power Technology
- (U) PE #0708011F, Industrial Base Program.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602102F Budget Activity: #1 - Techology Base
PE Title: Materials

7. (U) Project 2422, Protective Coatings and Materials: Develops materials and protective concepts to increase the survivability of aircrews and vital components of aircraft, missile and space systems in natural and threat environments.

(U) FY 1989 Accomplishments:
- (U) Demonstrated the first three-line analog rugate filter for protecting aircrew eyes against laser threats.
- (U) Developed advanced thermal flash protective camouflage coatings for aerospace systems.
- (U) Flight tested new signature control aircraft coating.

(U) FY 1990 Planned Program:
- (U) Begin to synthesize/characterize bio-organic materials for prototype devices to protect against agile laser threats.
- (U) Complete development of multi-threat survivable spacecraft coatings and multi-layer insulation blanket materials.
- (U) Transition multiline narrow band rejection laser hardening filter materials to component validation programs.

(U) FY 1991 Planned Program:
- (U) Begin developing bio-organic synthesis techniques to apply optical filters on large area optics.
- (U) Bring unique materials optical properties measurements facility to full operational status.
- (U) Start making prototype devices using bio-organic materials developed in FY 1990 to protect against agile laser threats.
- (U) Begin effort to identify and evaluate advanced laser protection concepts, materials, and device constructs for next generation protection of optical components, sensors, and aircrews in response to the evolving laser threat.

(U) Work Performed By: The major contractors are Science Applications International Corp, Dayton OH; Rockwell International Corp, Thousand Oaks CA; TRW, Inc., Redondo Beach CA; Celanese Corp, Summit NJ; and Honeywell, Inc., Minneapolis MN. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (U) Program Element (PE) #0603112F, Advanced Materials for Weapon Systems (FY 1990/1991).
- (U) PE #0603202F, Aerospace Propulsion Subsystem Integration.
- (U) PE #0603211F, Aerospace Structures.
- (U) PE #0603216F, Aerospace Propulsion and Power Technology
- (U) Program Element #0708011F, Industrial Base Program
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

8. (U) Project 2423, Electromagnetic Windows and Electronic Materials: Develops materials for optical, electromagnetic, and electronic subsystems for aircraft, missile and space systems. Also develops materials processing techniques and solder/packaging technologies.

(U) FY 1989 Accomplishments:
- (U) Grew state-of-the-art high temperature superconducting films for making advanced infrared detectors and microelectronics.
- (U) Demonstrated production rate fabrication of wafers by metal-organic chemical vapor deposition techniques for use in making advanced monolithic microwave integrated circuits.

(U) FY 1990 Planned Program:
- (U) Complete initial development of electronic packaging materials to remove more heat from high density electronic parts.
- (U) Conduct assessment and initiate efforts to develop/exploit hard coatings for infrared window and dome applications.
- (U) Initiate efforts to develop lattice matched substrates (at the atomic level) and processing techniques for making advanced microwave, microelectronic, and photonic devices.

(U) FY 1991 Planned Program:
- (U) Complete feasibility demonstration of photo assisted and metal-organic molecular beam epitaxial processing techniques for producing infrared detectors and microwave devices.
- (U) Continue developing and evaluating one of three materials completed in mid FY 1991 for making tunable/agile lasers.
- (U) Initiate effort to optimize superlattice infrared detectors.
- (U) Begin effort to develop techniques and models for growing phosphorus containing electronic device materials to enable a new generation of devices that operate at higher frequencies with more power or lower noise than currently possible.

(U) Work Performed By: The major contractors are University of Dayton, Dayton OH; Canadian Commercial Corp, Ottawa, Ontario Canada; Westinghouse, Pittsburgh PA; Santa Barbara Research Center, Goleta CA, and Rockwell International, Thousand Oaks CA. The Materials Laboratory, Wright-Patterson AFB OH, manages this work.

(U) Related Activities:
- (U) Program Element #0602204F, Aerospace Avionics.
- (U) Program Element #0708011F, Industrial Base Program
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: A new FY 1990 contractual effort (two years, $350 thousand) will be performed cooperatively with Canada under the Canada-US Defense Cost Sharing Program. Costs will be shared equally by the two countries.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06FF Laboratory Operations	34,564	35,084	35,613	Cont	TBD
2401 Structures and Dynamics	9,603	8,323	8,576	Cont	TBD
2402 Vehicle Equipment	5,658	4,624	4,765	Cont	TBD
2403 Flight Control	8,170	6,782	6,988	Cont	TBD
2404 Aeromechanics	7,732	6,474	6,671	Cont	TBD
3038 Technology Integration and Assessment	5,572	4,624	4,765	Cont	TBD
TOTAL	71,479	65,911	67,378	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program provides the flight vehicle technologies to improve current aerospace vehicles and to design and develop future aerospace vehicles such as aircraft, missiles, and spacecraft. This program includes the technical areas of structures, aerodynamics, performance analysis, vehicle dynamics, environmental control, mechanical subsystems, survivability, vulnerability, and technology assessment.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06FF, Laboratory Operations: This project provides for the management and support of the Flight Dynamics Laboratory and the Cockpit Integration Directorate, Wright-Patterson AFB, OH. It includes pay and benefits for civilian personnel; travel, rents, and utilities costs; and procurement of supplies and support services. This project supports and compliments all the other projects in this program element and other Flight Dynamics Laboratory program elements.

2. (U) Project 2401, Structures and Dynamics: This project creates more supportable and survivable aerospace structures, investigates new structural concepts, and exploits new materials and processes to increase the structural integrity and performance of aerospace vehicles while minimizing weight and cost. This effort also sustains the Air Force in-house technology base of structural analysis, design, and test methods.

(U) FY 1989 Accomplishments:
- (U) Performed zero-gravity flight test in a KC-135 on 6 meter space trusses that incorporate integral damping to increase pointing and tracking accuracy.
- (U) Developed methods for predicting the structural life of flight vehicles simultaneously subjected to load and temperature profiles.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

- (U) Completed flight test of integrally damped structure which reduced structural noise and vibration in aircraft aft equipment bays.
- (U) Evaluated the structural benefits of integrating aircraft antennas, sensors, preprocessors, and electrical control cables in the aircraft skin.

(U) FY 1990 Planned Program:
- (U) Test 12 meter space structural truss with active and passive damping techniques to increase pointing and tracking accuracy.
- (U) Demonstrate improvements in the performance, reliability, and maintainability of aerospace structures through design trade studies, advanced structural concepts and new manufacturing technologies.
- (U) Complete survivability and vulnerability analysis of laser effects on aircraft structure.
- (U) Activate a facility for testing structural components under structural load at extreme temperatures, cryogenic to hot. Modular graphite heaters previously developed by this project will be used to test large carbon-carbon structures to 4000°F.
- (U) Develop techniques for assessing the structural risks associated with aging of Air Force aircraft.

(U) FY 1991 Planned Program:
- (U) Identify new structural concepts, emerging materials, and innovative manufacturing processes to provide a new generation of aircraft structures offering weight savings as high as 50% over current structures.
- (U) Develop and demonstrate mechanical and electrical inspection and repair concepts of critical composite structures to increase the supportability of tactical aircraft.
- (U) Demonstrate through a full scale F-15 fatigue test the viability of new aircraft fuel tank sealing concepts.
- (U) Develop high temperature, high acoustic level test methods for hypersonic vehicles to verify structural component life and capability in a hypersonic environment.
- (U) Develop and demonstrate the integration of avionics hardware into load-bearing airframe structure to reduce weight and volume and increase reliability and maintainability.

(U) Work Performed By: This project is managed by the Flight Dynamic Laboratory, Wright-Patterson AFB OH. The top five contractors are: General Dynamics, Ft Worth TX; LTV Aerospace, Dallas TX; Northrop Corp, Hawthorne CA; Martin Marietta Corp, Denver CO; and Boeing Military Airplane Co, Wichita KS.

(U) Related Activities:
- (U) PE 0601101F, In-house Laboratory Independent Research.
- (U) PE 0601102F, Defense Research Sciences.
- (U) PE 0602102F, Materials.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603205F, Flight Vehicle Technology.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

- (U) PE 0603211F, Aerospace Structures.
- (U) PE 0603224C, Survivability, Lethality, and Key Technologies.
- (U) PE 0603269F, National Aerospace Plane.
- (U) PE 0605502F, Small Business Innovative Research.
- (U) PE 0708026F, Product Reliability and Maintainability (PRAM).
- (U) No duplication occurs within the Air Force or the DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 2402, Vehicle Equipment: This project reduces the life cycle cost of subsystems and equipment, increases the probability of crew member and flight vehicle survival, and improves operational flight vehicle capabilities.

(U) FY 1989 Accomplishments:
- (U) Developed a prototype 350 mph tire for hypersonic aerospace vehicle applications.
- (U) Completed ground tests which verified the predicted 10% fuel savings potential of a closed vapor cycle environmental control system (ECS) for aircraft. Integrated closed loop ECS systems will also reduce maintenance requirements over current open loop systems.

(U) FY 1990 Planned Program:
- (U) Devise and evaluate concepts for loading and unloading of cargo from tactical transport aircraft without ground support equipment.
- (U) Develop a core computer program for the reliability assessment of electronics and avionics subsystems at the preliminary and critical design stages of the acquisition process. This will allow reduced life cycle costs and increased reliability of future aircraft electronics and avionics.

(U) FY 1991 Planned Program:
- (U) Fabricate a full-scale injection molded frameless canopy and initiate testing. The high cost and short service life of the present canopy make it a primary driver of the cost of ownership of the F-16. Injection molding has the potential to reduce the cost of a new F-16 canopy from $30,000 to less than $3,000 while doubling the current 18-month service life.
- (U) Investigate concepts for propulsion and flight control systems of an advanced crew escape capsule.
- (U) Design, fabricate, and test survivable tires that allow aircraft to operate from rough, soft, and debris covered surfaces. Evaluate enhancement of aircraft readiness.

(U) Work Performed By: This project is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB OH. The top five contractors are Garrett Corp, Torrance CA; Canadian Commercial Corp, Ottawa, Ontario CN; General Dynamics, Ft Worth TX; Boeing Co, Seattle WA; McDonnell Douglas Corp, St Louis MO.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

(U) Related Activities:
- (U) PE 0601101F, In-house Laboratory Independent Research.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603220C, Strategic Defense Initiative.
- (U) PE 0603231F, Crew Systems Technology.
- (U) PE 0603244F, Aircraft Non-Nuclear Survivability.
- (U) PE 0604212F, Aircraft Equipment Development.
- (U) PE 0604609F, Reliability and Maintainability Technology Insertion Program (RAMTIP).
- (U) PE 0605502F, Small Business Innovative Research.
- (U) PE 0605804D, Test and Evaluation.
- (U) OSD Joint Technical Coordinating Group on Aircraft Survivability.
- (U) No duplication occurs within the Air Force or DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: A joint USAF/Canadian government project agreement to develop an integrated closed-loop ECS was signed in 1983. Funding is split 50/50.

4. (U) Project 2403, Flight Control: This project develops the control technology that: a. enables the pilot to get the maximum performance from his aircraft under all flight conditions and gives him a competitive edge in combat; b. provides robustness and survivability in the event of combat damage; and c. integrates flight, vehicle management, and cockpit information for maximum pilot situational awareness and combined effectiveness.

(U) FY 1989 Accomplishments:
- (U) Direct drive actuator valves developed in-house by this project transitioned to the F-15E. These valves make performance improvements possible while lowering costs and improving reliability because of their simplicity.
- (U) Designed and fabricated a low cost integrated actuator package for transport aircraft.
- (U) Improved the speed and reliability of Ada compilers to meet digital flight control requirements and provide cost effective yet fault tolerant code. Flight demonstrated on an unmanned research vehicle.
- (U) Completed Heads-Up Display symbology experiments and flight tests that will reduce pilot disorientation.

(U) FY 1990 Planned Program:
- (U) Upgrade in-house simulation capability for the air combat environment incorporating up to six pilots and ten aircraft.
- (U) Ground test the low cost integrated actuator package for transport aircraft fabricated in FY89.
- (U) Initiate studies of assault transport cockpit requirements for operation in high density threat environments.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

- (U) Perform free-flight tests of nose vortex control devices that increase fighter aircraft agility at high angles-of-attack.
- (U) Complete design studies for a passive autonomous landing guidance demonstration that will allow aircraft to land in weather with no emanations from the ground or the aircraft.

(U) FY 1991 Planned Program:
- (U) Develop enhanced pilot decision aiding controls and displays for DARPA/USAF Pilot's Associate program developed in FY89.
- (U) Complete requirements study on the impact of Ada implementation on flight control hardware. Flight test the Ada programmed fault tolerant flight control system on an A-7 test aircraft.
- (U) Conduct the first ever computer demonstrations of agile aircraft robust control. Robust control will increase the flight envelope of aircraft while reducing the time and cost of testing an aircraft prior to operational deployment.

(U) Work Performed By: The project is managed by the Flight Dynamics Laboratory and the Cockpit Integration Directorate, Wright-Patterson AFB OH. The top five contractors are CALSPAN Corp, Buffalo NY; Honeywell Inc, Minneapolis MN; Dynamic Controls, Inc., Dayton OH; General Electric Co, Schenectedy NY; and Lockheed Corp, Burbank CA.

(U) Related Activities:
- (U) PE 0601101F, In-house Laboratory Independent Research.
- (U) PE 0601102F, Defense Research Sciences.
- (U) PE 0602202F, Human Systems Technology.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0602301E, DARPA.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603231F, Crew Systems Technology.
- (U) PE 0603245F, Advanced Flight Technology Integration.
- (U) PE 0603269F, National Aerospace Plane.
- (U) PE 0604237F, Variable Stability In-Flight Simulator Test Aircraft.
- (U) PE 0605502F, Small Business Innovative Research.
- (U) No duplication occurs within the Air Force and the DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 2404, Aeromechanics: This project develops aeromechanics (i.e. airflow-vehicle interactions) technology to obtain improved mission capability, increased survivability, and reduced cost of aircraft, missiles and space vehicles. This project is also the primary developer of Computation Fluid Dynamics (CFD), a DoD Critical Technology.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

(U) FY 1989 Accomplishments:
- (U) Transitioned to the NASP program a laser velocimetry method, developed in-house, for simultaneous measurements in wind turnels tests.
- (U) Validated high performance supersonic low observable fighter inlets for highly integrated aircraft designs.
- (U) Defined, analyzed, and tested a survivable, low observable, aero-configured missile with a 115% range improvement.
- (U) Demonstrated in a wind tunnel pneumatic vortex flow control for maneuvering enhancement.

(U) FY 1990 Planned Program:
- (U) Validate Computational Fluid Dynamics (CFD) methods for flight regimes where real gas effects are important for performance predictions of hypersonic vehicles.
- (U) Develop a CFD method that can accurately model the non-linear flow characteristics that alter the behavior and flight capability of aircraft at high angles-of-attack or in very rapid maneuvers. This will increase the agility and combat effectiveness of current and future advanced fighters.
- (U) Develop a rapid (days vice months) method to accurately predict supersonic and hypersonic boundary layer transition and confirm the method through selected in-house experiments. This will permit a reduction in the thermal protection system weight for hypersonic vehicles, thereby increasing performance.

(U) FY 1991 Planned Program:
- (U) Develop and validate a rapid (days vice months) prediction method that provides an accurate aerodynamic analysis of supersonic and hypersonic missiles that fly at high angles-of-attack.
- (U) Develop methods to permit rapid (days vice months) aerothermodynamic evaluation of hypersonic vehicles.
- (U) Formulate a three dimensional Navier-Stokes CFD code to evaluate airframe propulsion integration for hypersonic air vehicles.

(U) Work Performed By: The project is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB OH. The top five contractors are McDonnell Douglas Corp, St Louis MO; Boeing Corp, Seattle WA; Lockheed Corp, Burbank CA; General Dynamics, Ft Worth TX; and Grumman Aerospace, Bethpage NY.

(U) Related Activities:
- (U) PE 0601101F, In-house Laboratory Independent Research.
- (U) PE 0601102F, Defense Research Sciences.
- (U) PE 0603202F, Aerospace Propulsion Subsystem Integration.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603245F, Advanced Flight Technology Integration.
- (U) PE 0603269F, National Aerospace Plane.
- (U) PE 0605502F, Small Business Innovative Research.
- (U) No duplication occurs within the Air Force DoD.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 3038, Technology Integration and Assessment: This project performs advanced technology assessment and vehicle concept synthesis to identify future military options available with new technologies. Analysis of concepts, requirements, and technology tradeoffs yields advanced design concepts and technology application opportunities.

(U) FY 1989 Accomplishments:
- (U) Identified requirements and concepts for a future lightweight, low cost fighter aircraft.
- (U) Defined specific concepts for a Special Operations Forces (SOF) aircraft and conducted trade-off studies to determine mission effectiveness.

(U) FY 1990 Planned Program:
- (U) Develop software to incorporate advanced inlet and exhaust nozzle designs into current laboratory concept studies.
- (U) Identify operational opportunities suitable for application of unmanned air vehicles to determine design concepts, exploitable technologies, and technology effectiveness.

(U) FY 1991 Planned Program:
- (U) Project scenarios, threats, and weapon inventories of a post-2000 long range precision attack mission in order to identify technologies and system concepts required for this mission.
- (U) Refine SOF concepts previously defined into preliminary designs and quantify their required technologies so that assessments of technology maturity can be made.

(U) Work Performed By: This project is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB OH. The top five contractors are Midwest Systems Research Inc, Dayton OH; McDonnell Douglas Corp, St Louis MO; North Carolina A&T Univ, Greensboro NC; Astronics Research Engineering, Sunneyvale CA; TAU Corp, Los Gatos CA.

(U) Related Activities:
- (U) PE 0602102F, Materials.
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603211F, Aerospace Structures and Materials.
- (U) No duplication occurs within the Air Force DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06MD Human Systems Division Laboratory Operations	28,214	26,797	28,176	Cont	TBD
2729 Nuclear, Biological and Chemical (NBC) Defense	2,646	2,450	2,565	Cont	TBD
6302 Occupational & Environmental Toxic Hazards in AF Operations	4,246	2,650	2,715	Cont	TBD
6770 Biotechnology Studies in Advanced Systems	776	381	1,050	Cont	TBD
6893 Manned Weapon Systems Effectiveness	1,417	1,200	1,243	Cont	TBD
7184 Man-Machine Integration Technology	5,855	6,450	6,306	Cont	TBD
7231 Safety & Aircrew Effectiveness in Mechanical Force Environments	2,807	2,700	2,762	Cont	TBD
7755 Aerospace Medicine	681	800	770	Cont	TBD
7757 Radiation Hazards in Aerospace Operations	4,303	3,660	3,702	Cont	TBD
7930 Advanced Crew Technology	1,880	1,840	1,853	Cont	TBD
Total	52,825	48,928	51,142	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program focuses on human aspects of the man interface with weapons systems. The four key thrusts are: (1) improve the performance of the human component of weapon system operations by refining crew selection, crew protection, and man-machine integration; (2) improve safety and protect Air Force personnel from radiation, chemical, and mechanical forces; (3) use our understanding of human factors to invent threats and countermeasures effective against enemy weapon system operators; and (4) develop defense measures for air base operations, casualty care evacuation, and personal protective equipment. Coordination is done through the Tri-service Aeromedical Research Panel, the DoD Human Factors Engineering Technical Advisory Group, and the Armed Services Biomedical Research Evaluation and Management (ASBREM) Program. In addition, USAF positions have been established with the US Army Medical Research and Development Command, Ft Detrick, MD; the Naval Medical Research Institute, Bethesda, MD; and NASA, Langley, VA. Data Exchange Agreements (DEAs) on testing of air and ground crew equipment are used to facilitate international cooperation.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project: 06MD, Human Systems Division Laboratory Operations: This project supports and complements all other projects in this program element and provides for management, support and operation of the USAF Human Systems Division (HSD). It provides for the pay and related costs of civilian physicians, scientists, engineers, and support personnel; travel, transportation of equipment, rents, communications, utilities, laboratory supplies, unique equipment, and other related costs needed to conduct human systems technology research and exploratory development. It also funds salary, travel and equipment for HSD personnel located at Wright-Patterson AFB, OH.

2. (U) Project 2729, Nuclear, Biological & Chemical (NBC) Defense: This project provides the technology to address Air Force unique requirements to ensure continued air operations and aeromedical care in an NBC attack. Goals are to address Air Force unique needs in the functional areas: individual/collective protection; detection, identification and warning; contamination control; medical operations; operations analysis for NBC defense; and aircrew performance effects of NBC pretreatment or treatment drugs (in conjunction with NBC agent exposure). It is coordinated with the Army, the lead agency for NBC defense, via the Joint Service Agreement on Chemical Warfare (CW) Defense and the ASBREM.

(U) FY 1989 Accomplishments:
- (U) Developed a concept for firefighters and explosive ordnance disposal personnel to enter and exit collective shelters, saving $120K per shelter in renovation costs.
- (U) Developed NATO-approved chemical attack challenge standards for air bases, leading to equipment design criteria with less adverse impact on performance.
- (U) Tested effects of the drug Diazepam against the nerve agent soman, to significantly improved protection against this agent.

(U) FY 1990 Planned Program:
- (U) Research the impact on sortie generation of CW ensemble heat stress by developing estimates of thermal casualties through modeling sensitivity analyses.
- (U) Determine which available CW detectors can best provide information on the status of agent exposure level for aircrew.
- (U) Determine impact of climate on CW vulnerability as it effects a Southwest Asia scenario.

(U) FY 1991 Planned Program:
- (U) Develop NATO Standardization Agreement on cockpit (F-15 and F-16) thermal stress to provide guidance on the effects of aircrew heat stress on sortie generation.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

- (U) Develop methods to judge the impact of new chemical agents for better future equipment design criteria.
- (U) Test drugs for protecting human brain regions against nerve agents.

(U) Work Performed By: Managed by the United States Air Force School of Aerospace Medicine (USAFSAM), and the Harry G. Armstrong Aerospace Medical Research Laboratory (AAMRL). Contractors are Jaycor, San Diego, CA; Systems Research Laboratory, Dayton, OH; Krug International, Dayton, OH; Rothe Development Inc, San Antonio, TX; and Transducer Research Inc, Napierville, IL.

(U) Related Activities:
- (U) Army is DoD lead for chemical/biological warfare (CBW) defense; this project addresses USAF unique requirements.
- (U) Program Element (PE) #0602205F, Training/Simulation Tech.
- (U) PE #0603231F, Crew Systems and Personnel Protection Tech.
- (U) PE #0604703F, Aeromedical/Chemical Defense Systems Dev.
- (U) PE #0604706F, Life Support Systems.
- (U) PE #0604601F, CBW Defense Equipment.
- (U) PE #0702986F, Clothing Development.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

3. (U) Project 6302, Occupational and Environmental Toxic Hazards in Air Force Operations: This project has the Air Force responsibility for the toxicological assessment of Air Force materials and processes. Assessment of human tolerance levels for Air Force chemicals, fuels and materials is required to establish exposure criteria for engineering design of new systems as well as to perform trade-off analyses between weapon systems performance and occupational health and environmental support requirements.

(U) FY 1989 Accomplishments:
- (U) Expanded the development of mathematical predictors of human toxicity from hazardous compounds resulting in improved estimate of safe levels of exposure to toxic substances.
- (U) Assessed liver toxicity from new noncombustible hydraulic fluid intended for ATF use.

(U) FY 1990 Planned Program:
- (U) Develop a model based upon physiological principles to assess the risk of illness such as cancer associated with exposure to hazardous materials.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

- (U) Improve methodology for assessing the hazards of AF chemicals by using in vitro alternatives such as cell cultures.

(U) FY 1991 Planned Program:
- (U) Evaluate potential toxicological hazards of materials being considered as replacements for halons (fire suppression).
- (U) Develop improved methods to estimate risk when several routes of exposure are possible.
- (U) Improve risk assessment methodology for exposure to mixtures of chemicals.

(U) Work Performed By: Managed by AAMRL. The contractors are NSI Technology Services Corporation, Research Triangle Park, NC; Fred Hutchinson Cancer Research Center, Seattle, WA; ICF Inc, Fairfax, VA; Technolube Products Co, Los Angeles, CA; Operational Technologies Corp, San Antonio, TX.

(U) Related Activities:
- (U) PE #0602720A, Environmental Quality Technology.
- (U) PE #0602777A, Systems Health Hazard Prevention Technology.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

4. (U) Project 6770, Biotechnology Studies in Advanced Systems: This project provides scientific and technical support from national scientific and technical organizations, committees and tri-service groups to provide advice to in-house scientists supported by this program element, thereby ensuring high quality, meaningful, coordinated, exploratory development efforts. This includes: (1) support to coordinating agencies and national and international resources for compiling and disseminating information on laboratory animals; (2) the National Academy of Sciences and (3) advisory groups for tri-service coordination and review of programs and semiannual reporting to the Office of the Under Secretary of Defense for Research and Engineering on tri-service research, development and applications of human factors.

(U) FY 1989 Accomplishments:
- (U) Established working groups to evaluate technologies for wrap-around visual displays and visual enhancement for advanced aerospace systems functions.
- (U) Continued support of other technical advisory groups such as DOD Human Factors Engineering Technical Advisory Group.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

(U) FY 1990 Planned Program:
- (U) Enhance the tri-service coordination of CBW defense programs to address the rapidly evolving threat of CBW in coordination with those programs of the other services.

(U) FY 1991 Planned Program:
- (U) Establish study group on high power microwaves (HPM).
- (U) Enhance the postdoctoral program to include positions in visual sciences and human physiology.
- (U) Study applications of artificial intelligence for training, voice communications and radiofrequency bioeffects.
- (U) Institute an HSD Research Fellows program.

(U) Work Performed By: Managed by USAFSAM and AAMRL.

(U) Related Activities: No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

5. (U) Project 6893, Manned Weapon Systems Effectiveness: This project develops mission effective techniques to deceive the operators of enemy air-to-ground and ground-to-air systems. Visual camouflage, optical countermeasures and techniques to defeat infrared and radar sensors are developed, simulated in the laboratory, and field tested. A variety of studies of human perception are performed. Measurement of enemy anti-aircraft operator performance is accomplished with simulation and flight test. Countermeasures are developed and delivered to Tactical Air Command, and USAF Europe.

(U) FY 1989 Accomplishments:
- (U) Developed a special telescope to determine human pointing, tracking and visual performance in space.

(U) FY 1990 Planned Program:
- (U) Determine the effectiveness of optical countermeasures associated with F-15 and F-16 decoy flight tests.
- (U) Assess the threat from manned enemy systems to aircraft penetrating air base defenses.

(U) FY 1991 Planned Program:
- (U) Assess methodology to deceive infrared sensors and high resolution detection techniques of new radar systems.
- (U) Test man's capability to perform operationally-oriented visual tasks while on orbit.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

(U) Work Performed By: Managed by AAMRL. The contractors are Charles River Analytics, Inc., Cambridge, MA and Alphatech, Inc, Burlington, MA.

(U) Related Activities:
- (U) PE #0602205F, Training/Simulation Technology.
- (U) PE #0603227F, Advanced Simulator Technology.
- (U) PE #0603231F, Crew Systems and Personnel Protection Tech.
- (U) PE #0602204F, Aerospace Avionics.
- (U) PE #0602702F, Command, Control, Communications.
- (U) PE #0602201F, Aerospace Flight Dynamics.
- (U) PE #0603205F, Flight Vehicle Technology.
- (U) PE #0603245F, Advanced Fighter Technology Integration.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: See para B.

6. (U) Project 7184, Man-Machine Integration Technology: This project develops procedures and technologies to optimize the interface between Air Force personnel and the weapon systems they operate. Information about the characteristics of human operators is gathered and analyzed to provide design data for system control and display development. Methods for simulating man's interface to machines are developed to measure the changes in weapon effectiveness as a result of changes in man-machine coupling.

(U) FY 1989 Accomplishments:
- (U) Completed an image-generating terminal for simulating air-to-air combat in a 3-dimensional viewing field.
- (U) Completed brassboard helmet-mounted display with wide field-of-view.

(U) FY 1990 Planned Program:
- (U) Design the display requirements for the first ejection-compatible tactical night vision system to improve night combat effectivess.
- (U) Evaluate design of a strategic crew station intended to enhance information displays to crew members during combat.

(U) FY 1991 Planned Program:
- (U) Specify design for the second generation of the Super Cockpit initiative, including 3-dimensional imaging and vision and voice-actuated systems.
- (U) Develop a miniaturized helmet-mounted cathode ray tube display with full color imaging.
- (U) Produce a model of the human interface to various display systems to assess criteria such as speed of comprehension and time to target recognition.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

(U) Work Performed By: Managed by AAMRL. The major contractors are Logicon, Torance, CA; U. of Dayton, Dayton, OH; Science Applications International Corp, San Diego, CA; Macaulay-Brown Inc, Dayton, OH; and Search Technology, Inc. Norcross, GA.

(U) Related Activities:
- (U) PE #0602205F, Training/Simulation Technology.
- (U) PE #0603227F, Advanced Simulator Technology.
- (U) PE #0603231F, Crew Systems and Personnel Protection Tech.
- (U) PE #0602204F, Aerospace Avionics.
- (U) PE #0602702F, Command, Control, Communications.
- (U) PE #0602201F, Aerospace Flight Dynamics.
- (U) PE #0603205F, Flight Vehicle Technology.
- (U) PE #0603245F, Advanced Fighter Technology Integration.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

7. (U) Project 7231, Safety and Aircrew Effectiveness in Mechanical Force Environments: This project determines human response to various mechanical forces including noise, impact, vibration, and hostile fire. This information is then used to develop safe, effective escape/ejection systems, acceleration protection equipment restraint devices for aircrews, and to reduce vulnerability of the crew station. This project also develops data for operator-centered communications, jamming, and noise exposure criteria, as well as concepts for operator control of robotic systems using telepresence techniques.

(U) FY 1989 Accomplishments:
- (U) Transitioned active noise reduction (ANR) earphone technology for improved noise protection and communication effectiveness.
- (U) Selected separable forebody concept for development as preferred hypersonic escape system providing safe escape throughout a transatmospheric flight envelope.
- (U) Transferred anti-G valve technology for high-onset acceleration to industry through Stevenson-Wydler Act.

(U) FY 1990 Planned Program:
- (U) Develop cost-effective manikins for aircrew injury assessment.
- (U) Initiate crew station live fire testing to assess and reduce aircrew vulnerability.

(U) FY 1991 Planned Program:
- (U) Develop countermeasures against voice communication for deception and jamming of enemy command and control systems.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

- (U) Complete a mathematical model of noise levels from the takeoff ground roll profile of current inventory aircraft to reduce environmental/community impact of Air Force operations.
- (U) Develop a draft hypersonic escape system design specification to assure safe escape throughout the flight envelope of a NASP or NASP-derived vehicle.

(U) Work Performed By: Managed by AAMRL. The major contractors are Systems Research Lab., Inc., Dayton, OH; Dyncorp, McLean, VA; Myle Lab., El Segundo, CA; U. of Dayton Research Inst., Dayton, OH; and Indiana U. Foundation, Bloomington, IN.

(U) Related Activities:
- (U) PE #0603231F, Crew Systems and Personnel Protection Tech.
- (U) PE #0604703F, Aeromedical/Chemical Defense Systems Dev.
- (U) PE #0604706F, Life Support System.
- (U) PE #0604601F, CBW Defense Equipment.
- (U) PE #0602204F, Aerospace Avionics.
- (U) PE #0602702F, Command, Control, Communications.
- (U) PE #0602201F, Aerospace Flight Dynamics.
- (U) PE #0603205F, Flight Vehicle Technology.
- (U) PE #0603245F, Advanced Fighter Technology Integration.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

8. (U) Project 7755, Aerospace Medicine: The objectives of this project are to: (1) conduct research on medical conditions affecting aircrew selection and retention; (2) investigate methods of early disease detection, and determine the impact of disease on aircrew performance; and (3) examine therapeutic drug effects on flight safety.

(U) FY 1989 Accomplishments:
- (U) Determined that fighter aircrews can use contact lenses during flight for enhancing aerial combat capability.
- (U) Produced a field training package for flight surgeons to prevent, recognize, and treat laser injuries.

(U) FY 1990 Planned Program:
- (U) Use Artificial Intelligence to search repositories of medical data for more rapid and accurate diagnoses.
- (U) Evaluate effects of cholesterol-lowering drugs and blood-pressure medication on aircrew flight safety.
- (U) Complete follow-on test and evaluation of cycle ergometry fitness testing at Edwards AFB.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

- (U) Test characteristics of available off-the-shelf spectacles to meet specific aircrew vision correction/protection needs.

(U) FY 1991 Planned Program:
- (U) Conduct evaluation of the SAM Cardiovascular Risk Index in TAC, SAC, and MAC as the next generation mechanism for medical aspects of force readiness.
- (U) Implement cycle ergometry in all commands as a replacement of current fitness programs.
- (U) Determine the compatibility of contact lenses with new aircraft protective masks.
- (U) Complete evaluations on cardiac disease history as part of a large study done collaboratively with the Army on Class of '56 West Point graduates.

(U) Work Performed By: Managed by USAFSAM. The contractors are GSA contractors (OAO, Inc.) and SCEEE Services, Inc., St Cloud, FL.

(U) Related Activities:
- (U) PE #0603231F, Crew Systems and Personnel Protection Tech.
- (U) PE #0604703F, Aeromedical/Chemical Defense Systems Dev.
- (U) PE #0604706F, Life Support System.
- (U) PE #0604601F, CBW Defense Equipment.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

9. (U) Project 7757, Radiation Hazards in Aerospace Operations: This project conducts research on the effects and applications of electromagnetic and particulate radiation in aerospace operations. Research concerns safety, environmental impact, mission success and countermeasures in combat, and biologic effects of exposure to radiofrequency/microwave radiation, lasers, and ionizing radiation. Provides support to other DOD programs by using unique USAF resources to extend radiation applications, behavioral research, and operations analysis.

(U) FY 1989 Accomplishments:
- (U) Expanded studies on bioeffects of High Power Microwaves (HPM) to define safety requirements and assess weapon system feasibility.
- (U) Developed a new aircrew safety handbook for laser operations.

(U) FY 1990 Planned Program:
- (U) Measure performance decrements on man following exposure to low intensity laser radiation.
- (U) Develop a model to predict injury following exposure to high power short pulse radiofrequency radiation.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

(U) FY 1991 Planned Program:
- (U) Expand use of laser biological information effects in the worldwide computer simulation network used for force-on-force training.
- (U) Develop a database containing information about biological effects from new HPM systems.

(U) Work Performed By: Managed by USAFSAM. The major contractors are Krug International, San Antonio, TX; Systems Research Laboratories, San Antonio, TX; University of Texas at San Antonio, TX; John B. Pierce Foundation, New Haven, CT; and Georgia Institute of Technology, Atlanta, GA.

(U) Related Activities:
- (U) PE #0603231F, Crew Systems and Personnel Protection Tech.
- (U) PE #0604706F, Life Support System.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

10. (U) Project 7930, Advanced Crew Technology: This project studies human response to physiological stressors such as rapid onset sustained acceleration, spatial disorientation, altitude and thermal stress, workload, and sustained operations. Design criteria and prototype protective systems and procedures are developed. Additional tasks involve the evaluation of aeromedical evacuation equipment; the evaluation, cockpit integration, and man-rating of aircrew life support equipment.

(U) FY 1989 Accomplishments:
- (U) Developed a combined anti-G valve and breathing regulator to improve assisted positive pressure breathing systems for anti-G and altitude protection.
- (U) Assessed crew performance in Peacekeeper Rail Garrison design to assure suitability for extended operations.
- (U) Transitioned an advanced technology anti-G suit which will provide significant improvement in anti-G protection.

(U) FY 1990 Planned Program:
- (U) Develop in-flight countermeasures against spatial disorientation (SD), such as improved audio and visual cueing to reduce accidents during complex aerial maneuvers.
- (U) Study effects of the new performance enhancement drug Modafinil and non-sedating antihistamine on performance.
- (U) Complete initial study of hybrid oxygen system to store onboard-generated breathing gas on aircraft.
- (U) Man-rate the new COMBAT EDGE G-protection ensemble.

Program Element: #0602202F Budget Activity: #1 - Technology Base
PE Title: Human Systems Technology

(U) FY 1991 Planned Program:
- (U) Study the feasibility of in-flight laboratory to perform medical tests during air evacuation.
- (U) Initiate development of a bends-prediction model for screening of high altitude flight crews and reduced bends incidence.
- (U) Develop a G-sensitivity test to predict operational capability of aircrew.
- (U) Develop in-flight SD demonstration methods for pilot training to reduce SD flight accidents.
- (U) Validate best symbology to standardize head-up displays to reduce possibility of SD.

(U) Work Performed By: Managed by USAFSAM. Contractors are Krug International, San Antonio, TX; Arthur D. Little, Cambridge, MA; Washington U., St Louis, MO; MOOG, Inc, East Aurora, NY.

(U) Related Activities:
- (U) PE #0603231F, Crew Systems and Personnel Protection Tech.
- (U) PE #0604706F, Life Support System.
- (U) PE #0604601F, CBW Defense Equipment.
- (U) PE #0602201F, Aerospace Flight Dynamics.
- (U) PE #0603205F, Flight Vehicle Technology.
- (U) PE #0603245F, Advanced Fighter Technology Integration.
- (U) No unnecessary duplication of effort within USAF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: See para B.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602203F Budget Activity: #1 - Technology Base
PE Title: Aerospace Propulsion

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06PP Laboratory Operations	23,811	21,617	20,254	Cont	TBD
3012 Ramjet Technology	5,062	5,648	5,615	Cont	TBD
3048 Fuels, Lubrication and Fire Protection	7,749	9,370*	7,640*	Cont	TBD
3066 Turbine Engine Technology	23,333	22,973	22,124	Cont	TBD
3145 Aerospace Power Technology	6,503	6,520	6,950	Cont	TBD
TOTAL	66,458	66,128	62,583	Cont	TBD

*Additional funding is being allocated to perform research on high thermal stability fuels, including endothermic and coal based fuels. Project 3048 now includes $3M in FY 90 and $1M in FY 91 for this effort. PE 0603216 also has $1M set aside in FY 91 to demonstrate high thermal stability fuel technology.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element develops air-breathing propulsion and aerospace power technology in support of current and future aerospace vehicles and weapon systems. Evaluations are performed at the laboratory exploratory development level. The prime areas of focus are turbine engine technology, ramjet technology, fuels, lubrication and fire protection, and advanced power technology. Anticipated technology advances from these projects are component/subsystems which include turbine engine fans, compressors, combustors, turbines, and lubrication systems which when integrated and tested will provide a 60% increase in engine thrust/weight and a 25-30% reduction in specific fuel consumption by 1995. Advanced air-breathing propulsion concepts like ramjets will reduce by 50% the time to target for future air-to-ground missiles or provide high Mach propulsion for manned aircraft. Advanced fuels efforts support all weapon systems providing double the heat sink capability over current fuels. Hydraulic power and electrical power systems will be required to produce twice the energy with half the weight. Development of power conditioning, thermal management, and aircraft batteries for the more-electric aircraft concept will provide up to 400% aircraft reliability improvement with substantial weight saving potential. Laboratory operations provide the technical support to advanced systems programs and undertakes operational support projects in this mission area.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06PP, Laboratory Operations: Provides management and

Program Element: #0602203F Budget Activity: #1 - Technology Base
PE Title: Aerospace Propulsion

operational support for the Aero Propulsion and Power Laboratory, Wright-Patterson Air Force Base OH. Includes pay and benefits for civilian scientists, engineers, and support personnel, travel, transportation, rents, communications, utilities, and procurement of supplies and equipment.

2.(U) Project 3012, Ramjet Technology: Develops advanced propulsion concepts in the area of ducted ramjets and solid fueled ramjets for missile propulsion; air turborockets (ATR), turboramjets and air turboramjets for high Mach aircraft; and supersonic combustion ramjets (scramjets) for hypersonic vehicles.

(U) FY 1989 Accomplishments:
- (U) Demonstrated a low signature diamond shaped inlet to Mach 4.5.
- (U) Initiated a US/Germany, Nunn amendment program for ducted rocket ramjet gas generator technology. Concepts to improve missile weight, size, and range will be explored.

(U) FY 1990 Planned Program:
- (U) Demonstrate an advanced turboramjet combustor to provide initial experimental data for further Air Force/NASA development work.
- (U) Initiate a joint Air Force/NASA turboramjet study to define mach 5-6 military/commercial aircraft concepts prior to joint component development.
- (U) Initiate a US/France, Nunn amendment program for passively throttled ducted rocket ramjets. Concepts to reduce missile control system complexity will be explored.

(U) FY 1991 Planned Program:
- (U) Complete solid boron fuel ramjet component development and rig test. This will be the first solid fueled ramjet design capable of exceeding conventional liquid fueled designs.
- (U) Initiate development of Air Force/NASA turboramjet components for future rig testing.
- (U) Initiate ATR research to eliminate need for a ramjet booster rocket and improve system safety and reliability.
- (U) Initiate development on a hydrocarbon fueled, supersonic combustion ramjet with a Mach 6-7 missile application.

(U) Work Performed By: Work is managed by laboratory personnel at the Aero Propulsion and Power Laboratory, Wright-Patterson AFB OH. The five major contractors for this project are: Atlantic Research Corp, Gainesville VA; Chemical Systems Division, San Jose CA; Pratt and Whitney Aircraft, West Palm Beach FL; Hughes Aircraft, Canoga Park CA; and Boeing Aerospace Co, Seattle WA.

Program Element: #0602203F Budget Activity: #1 - Technology Base
PE Title: Aerospace Propulsion

(U) Related Activities:
- (U) Technology outputs from this program are provided to PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) Coordination is accomplished by joint projects, information exchanges, and the Joint Army-Navy-Air Force (JANNAF) Interagency Propulsion Committee.
- (U) This is a well-coordinated initiative and there is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: French DEA-75-F-7334 and German DEA AF-71-G-7426.

3. (U) Project 3048, Fuels, Lubrication and Fire Protection: This project develops (a) improved Air Force fuels and the understanding of fuel/system capabilities; (b) lubricants, lubrication components and techniques; and (c) fire protection technology. The lubrication effort is 100% committed to the Integrated High Performance Turbine Engine Technology (IHPTET) program. IHPTET is a three-phase, totally integrated DOD, DARPA, NASA, and Industry effort aimed at doubling propulsion capability by the year 2003. The fire protection effort has been deemphasized due to funding reductions.

(U) FY 1989 Accomplishments:
- (U) Transitioned 400°F (+75°F capability) high temperature liquid lubricant to Advanced Tactical Fighter engine program.
- (U) Demonstrated a new ramjet missile fuel that offers an 80% cost reduction and is domestically produced.

(U) FY 1990 Planned Program:
- (U) Complete development of ceramic, solid lubricated bearings for expendable engines (i.e., for cruise missiles).
- (U) Demonstrate a 600°F solid lubricant for man rated, Phase I IHPTET engines.
- (U) Identify and characterize additives to increase JP-8 fuel high temperature capability by 100°F.
- (U) Continue research and studies on high thermally stable fuels, including endothermic and alternate coal based fuels.

(U) FY 1991 Planned Program:
- (U) Demonstrate high speed counter-rotating, intershaft bearings and seals for Phase II IHPTET Engines.
- (U) Produce candidate thermally stable hydrocarbon fuels for high Mach application and determine heat sink capability.
- (U) Demonstrate a second generation endothermic fuel concept and transition to advanced development PE 0603216F.

Program Element: #0602203F Budget Activity: #1 - Technology Base
PE Title: Aerospace Propulsion

(U) Work Performed By: Work is performed both in-house and with contracts managed by the Aero Propulsion and Power Laboratory personnel. The four major contractors for this project are: General Electric, Evendale OH; United Technologies, East Hartford CT, and West Palm Beach FL; University of Dayton Research Institute, Dayton OH; and Allied Signal, Energy and Materials Research Center, Chicago IL.

(U) Related Activities:
- (U) Technology outputs from this program are provided to PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) Coordination with Army, Navy, DARPA, NASA, Department of Energy, industry, and academia is accomplished by joint projects, the DOD Mobility Fuels Committee, and through the DOD/NASA IHPTET program.
- (U) This is a well-coordinated initiative and there is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 3066, Turbine Engine Technology: Turbine engine technology is developed to increase propulsion capability, system operational reliability, mission flexibility, and performance while reducing fuel consumption. This is principally done by improved aerothermodynamics and innovative engine structures, reduced weight, and new materials. This project is 100% committed to the support of the Integrated High Performance Turbine Engine Technology (IHPTET) program. IHPTET is a three phase, totally integrated DOD, DARPA, NASA, and Industry effort aimed at doubling propulsion capability by the year 2003.

(U) FY 1989 Accomplishments:
- (U) Fabricated brush seal system which reduces air leakage tenfold and improves compressor efficiency.
- (U) Casted a new turbine blade with the most complex internal cooling scheme ever attempted. This "super blade" has excellent cooling capability and is key to IHPTET Phase II.
- (U) Demonstrated advanced high temperature titanium-aluminide turbine blades with reduced blade weight of 50%.

(U) FY 1990 Planned Program:
- (U) Demonstrate a new lightweight metal-matrix composite compressor rotor. The design will produce a 70% weight reduction.
- (U) Rig test a high stability, high temperature rise, compact combustor that is 25% smaller and requires minimal cooling.

Program Element: #0602203F Budget Activity: #1 - Technology Base
PE Title: Aerospace Propulsion

- (U) Engine test the first US-produced Ceramic Matrix Composite turbine vane. The vane will improve weight savings by 40% with a 250°F increased temperature capability.

(U) FY 1991 Planned Program:
- (U) Demonstrate an enhanced flow compressor design that will greatly expand the engine flight envelope and provide a basis for IHPTET Phase II design.
- (U) Evaluate structural rod (STROD) support designs that will provide a 10% weight reduction to the overall engine frame and bearing support system.
- (U) Demonstrate the new in-house Advanced Turbine Aerothermodynamic Research Rig (ATARR). This unique research facility will validate IHPTET aerodynamic, heat transfer, and cooling effectiveness goals.

(U) Work Performed By: Work is performed both in-house and with contracts managed by the Aero Propulsion and Power Laboratory personnel. The major contractors for this project are: General Electric, Evendale OH; Pratt & Whitney, West Palm Beach FL and East Hartford CT; Garrett Engine Division, Phoenix AZ; Allison, Indianapolis IN; Williams International, Walled Lake MI; and Teledyne/CAE, Toledo OH.

(U) Related Activities:
- (U) Receives technology inputs from PE 0601102F, Defense Research Sciences and PE 0602102F, Materials.
- (U) Technology output from this program is provided to PE 0603202F, Aircraft Propulsion Subsystem Integration (APSI); PE 0603211F, Aerospace Structures and Materials; and PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) This project is part of the DOD/NASA Integrated High Performance Turbine Engine Technology (IHPTET) initiative. The IHPTET initiative is also funded by PEs 0602102F, 0603202F, 0602234N, and 0603210N.
- (U) This is a well-coordinated initiative and there is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 3145, Aerospace Power Technology: Aerospace vehicles and satellites require the development of solar power, fuel cells, batteries, hydraulics, power generation, power conversion and transmission, as well as thermal management technology. A major initiative of this project is the more-electric aircraft concept aimed at improving reliability and reducing the weight of aircraft electrical power systems.

Program Element: #0602203F Budget Activity: #1 - Technology Base
PE Title: Aerospace Propulsion

(U) FY 1989 Accomplishments:
- (U) Bench tested a power system for the more-electric aircraft concept with a threefold improvement in fault tolerance and 100% improvement in reliability.
- (U) Demonstrated a multi-layered Gallium Arsenide on Germanium solar cell with a 50% increase in efficiency.
- (U) Designed, fabricated, and rig tested an advanced combustor for an Aircraft Auxiliary Power Unit (APU).

(U) FY 1990 Planned Program:
- (U) Initiate starter generator development program for future more-electric aircraft applications.
- (U) Validate a radiation hardened and high efficiency cascade solar cell that has three times the present survivability.
- (U) Integrate and rig test an advanced combustor with proven APU components.

(U) FY 1991 Planned Program:
- (U) Complete integral starter design and initiate fabrication of ground test unit for more-electric aircraft concept.
- (U) Initiate development of a rechargeable lithium missile silo battery. This technology is projected to save $25 million annually in operational costs.
- (U) Design, fabricate and test a APU/Chemical-Biological-Radiological (CBR) purification concept. The APU/CBR will decontaminate air for an aircraft environmental control system.

(U) Work Performed By: Work is performed both in-house and with contracts managed by the Aero Propulsion and Power Laboratory personnel. The major contractors for this project are: General Electric, Schenectody NY; Boeing Aerospace, Seattle WA; Eagle-Picher Ind, Joplin MO; Research Triangle Institute, Research Triangle Park NC; and Loral EOS Inc, Pasadena CA.

(U) Related Activities:
- (U) Programs are coordinated with the Interagency Power Group, an Air Force, Army, Navy, NASA, and DoE committee.
- (U) Technology output from this program is provided to PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) This is a well-coordinated initiative and there is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06AA Air Force Avionics Laboratory Operations	33,755	34,685	35,610	Cont	TBD
2000 Active Electronic Countermeasures	3,226	3,082	3,419	Cont	TBD
2001 Electro-Optical Technology	2,170	2,073	2,300	Cont	TBD
2002 Microwave Technology	5,453	5,209	5,780	Cont	TBD
2003 Avionics System Design Technology	3,748	3,582	3,973	Cont	TBD
2004 Reconnaissance/Strike Electro-Optical Sensors	1,565	1,495	1,659	Cont	TBD
6095 Inertial Reference and Guidance Technology	1,670	1,595	1,770	Cont	TBD
6096 Microelectronics Technology	3,522	3,364	3,732	Cont	TBD
7622 Reconnaissance/Strike RF Sensors	2,684	2,563	2,845	Cont	TBD
7629 Fire Control Avionics	3,204	3,060	3,396	Cont	TBD
7633 Passive Electronic Countermeasures	2,959	2,827	3,137	Cont	TBD
7662 Avionics Data Transmission and Reception	937	893	993	Cont	TBD
Total	64,893	64,428	68,614	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is the primary source of new concepts, feasibility demonstrations, and advanced technology for Air Force avionics system needs. It develops advanced avionics technology for target detection and classification, fire control, navigation, communication, jamming and deception of hostile defenses as well as integration, system architectures, signal/data processing and electronic devices. Avionics advances are needed to multiply weapon system effectiveness, enhance reliability, and reduce life cycle costs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS

1. (U) Project 06AA, Air Force Avionics Laboratory Operations: This project provides for the management and support of the Avionics Laboratory and the Electronic Laboratory, Wright-Patterson AFB OH. It provides for pay and related costs of the civilian scientists, engineers, and support personnel; transportation of equipment; rental equipment; and contractor support services for maintenance and modification of facilities. This project supports and complements all other projects in the program element.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

A. (U) RESOURCES ($ in Thousands)

Project Number & Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06AA	Air Force Avionics Laboratory Operations	33,755	34,685	35,610	Cont	TBD
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2001	Electro-Optical Technology	2,170	2,073	2,300	Cont	TBD
2002	Microwave Technology	5,453	5,209	5,780	Cont	TBD
2003	Avionics System Design Technology	3,748	3,582	3,973	Cont	TBD
2004	Reconnaissance/Strike Electro-Optical Sensors	1,565	1,495	1,659	Cont	TBD
6095	Inertial Reference and Guidance Technology	1,670	1,595	1,770	Cont	TBD
6096	Microelectronics Technology	3,522	3,364	3,732	Cont	TBD
7622	Reconnaissance/Strike RF Sensors	2,684	2,563	2,845	Cont	TBD
7629	Fire Control Avionics	3,204	3,060	3,396	Cont	TBD
7633	Passive Electronic Countermeasures	2,959	2,827	3,137	Cont	TBD
7662	Avionics Data Transmission and Reception	937	893	993	Cont	TBD
Total		64,893	64,428	68,614	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is the primary source of new concepts, feasibility demonstrations, and advanced technology for Air Force avionics system needs. It develops advanced avionics technology for target detection and classification, fire control, navigation, communication, jamming and deception of hostile defenses as well as integration, system architectures, signal/data processing and electronic devices. Avionics advances are needed to multiply weapon system effectiveness, enhance reliability, and reduce life cycle costs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS

1. (U) Project 06AA, Air Force Avionics Laboratory Operations: This project provides for the management and support of the Avionics Laboratory and the Electronic Laboratory, Wright-Patterson AFB OH. It provides for pay and related costs of the civilian scientists, engineers, and support personnel; transportation of equipment; rental equipment; and contractor support services for maintenance and modification of facilities. This project supports and complements all other projects in the program element.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

2. (U) Project 2000, Active Electronic Countermeasures: A formidable enemy air defense threat capability requires new countermeasures which will degrade or deny the enemy air defense capability. This project develops technology to jam, deceive, or disable hostile electronic threats throughout the electromagnetic spectrum.

(U) FY 1989 Accomplishments:
- (U) Demonstrated effectiveness of multi-bit digital radio frequency memory based jamming against coherent radar threats.
- (U) Evaluated non-adaptive polarization jamming as a better approach to counter monopulse tracking missile seekers.

(U) FY 1990 Planned Program:
- (U) Apply high speed signal processing technology to improve spread spectrum jamming.
- (U) Demonstrate new techniques to defeat air-to-air radiation seeking missiles which threaten USAF tactical aircraft.
- (U) Enhance radio frequency decoy effectiveness against missiles by determining optimum deployment timing.

(U) FY 1991 Planned Program:
- (U) Deny early detection of low cross-section vehicles by developing techniques to counter new threat radars that use low frequencies and coherent processing.
- (U) Determine ways of using short pulse lasers in infrared countermeasures systems, reducing size, weight, and cost.
- (U) Define concepts and technology needed to jam early warning and acquisition radars operating below 1000 Mhz.
- (U) Complete fabrication and begin assessing spread spectrum jamming enhancement techniques.
- (U) Investigate the use of Kalman filtering in an infrared jamming environment.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB, OH, manages the work performed under this project. The contractors include: Raytheon ESD, Santa Barbara, CA; Texas Instruments, Dallas TX; Tricor Corporation, Chicago IL.

(U) Related Activities:
- (U) Joint Director of Laboratories, Technology Program for Electronic Warfare, Tri-Service Coordinating Body.
- (U) PE 0603270F, Electronic Combat Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Work is coordinated with Subgroup Q of the Technology Coordinating Panel for U.K., Canada, and Australia. Selected work is coordinated with France through Data Exchange Agreement #AF-74-F-7333.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

3. (U) Project 2001, Electro-Optical Technology: The Air Force needs to improve performance of electro-optical systems to increase engagement ranges and detect an increasing variety of targets. This project develops low and medium power laser technology, optical preprocessing technology, and detector and focal plane array technology for incorporation into imaging, warning, and weapon delivery sensors.

(U) FY 1989 Accomplishments:
- (U) Developed high power density 2-dimensional semiconductor arrays for pumping-solid state lasers.
- (U) Demonstrated diode pumped neodymium glass laser compatible with laser radar applications.

(U) FY 1990 Planned Program:
- (U) Develop uncooled infrared detectors in the 8-12 micron Spectral region for use in active laser radars as well as passive FLIR-type sensors.
- (U) Develop efficient photoluminescent materials for a new approach to two dimensional spatial light modulation.
- (U) Demonstrate wideband organic film interconnects compatible with gallium arsenide integrated optical circuits.

(U) FY 1991 Planned Program:
- (U) Improve quantum efficiency of detector arrays for near- to mid-infrared targeting sensor applications.
- (U) Develop energy storage drivers for phase locked mid-infrared lasers to improve efficiency and decrease size and cooling requirements.
- (U) Develop optical networks for correlators, image processing, and signal analysis for application to automatic target recognition.

(U) Work Performed By: The Electronic Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: AT&T, Holmdell, NJ; Honeywell, Minneapolis, MN; Westinghouse, Pittsburg, PA; and Lockheed-Sanders, Nashua, NH.

(U) Related Activities:
- (U) Advisory Group on Electron Devices, Tri-Service Coordinating Body.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: The Technology Coordinating Panel Subgroup JP-10 and the NATO Panel Group RSG-13 establish common efforts.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

4. (U) Project 2002, Microwave Technology: Conducts research on Air Force technology needs for microwave and millimeter wave devices, integrated circuits, components and subsystems. Areas of interest include solid state and thermionic devices, monolithic integrated circuits, power and low noise amplifiers, signal control components, broadband transmit/receive (T/R) modules, and advanced active aperture concepts. Establishes and maintains centers of excellence for promoting microwave and millimeter wave technology.

(U) FY 1989 Accomplishments:
- (U) Demonstrated sensors for non-destructive inspection of TWTs.
- (U) Developed a pulsed 100 watt 40-55 Ghz TWT for communications.

(U) FY 1990 Planned Program:
- (U) Demonstrate 10 Kilowatt CW output power UHF amplifiers.
- (U) Demonstrate broadband (7-11 GHz) 5 Watt T/R modules for advanced multimode radar phased array antenna.
- (U) Develop economical traveling wave tubes in the 40-55 GHz range for electronic warfare.
- (U) Develop microwave/optical circuits for data transmission.

(U) FY 1991 Planned Program:
- (U) Demonstrate high junction temperature microwave integrated circuits to decrease cooling requirements.
- (U) Improve the efficiency of broadband T/R modules.
- (U) Demonstrate improved microwave sources for Electronic Combat.
- (U) Miniaturize electronic filters for radar applications.
- (U) Complete a trade study of using existing x-band phased array antennas passively as radiometers.
- (U) Develop real-time techniques to reconfigure radar phased array antennas.

(U) Work Performed By: The Electronic Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: Hughes Aircraft Corporation, Los Angeles CA; General Electric Corporation, Syracuse NY; and Raytheon Company, Lexington MA.

(U) Related Activities:
- (U) Advisory Group on Electron Devices, Tri-Service Coordinating Body.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603270F, Electronic Combat Technology.
- (U) PE 0603706E, Microwave/Millimeter Wave Monolithic Integrated Circuits.
- (U) PE 0603220C, SDI/Large Array Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

5. (U) Project 2003, Avionics System Design Technology: Future air warfare will require improved avionics availability, performance, and crew situational awareness. This project advances technology in avionics system architectures, integration, data/signal processing, displays, and machine intelligence to improve total weapon system performance.

(U) FY 1989 Accomplishments:
- (U) Completed preliminary definition of hardware and control software requirements for a modular parallel processor family.
- (U) Applyed neural network drive reinforcement learning systems to adaptive robotics control.
- (U) Expanded research in cockpit display technology to develop three dimensional dynamic holographic cockpit displays.

(U) FY 1990 Planned Program:
- (U) Design neural network algorithms to be used in target recognition applications.
- (U) Validate design techniques for reusable real-time software.
- (U) Investigate airborne missile warning packages that leverage the massively parallel processor technology developed by SDI.
- (U) Define data and signal processor architectures that can employ the increased throughput available from wafer scale integration technology.

(U) FY 1991 Planned Program:
- (U) Evaluate pilot workload using brain measured data.
- (U) Develop breadboard 32-bit Ada-efficient computer.
- (U) Apply neural network learning systems to pattern recognition and signal processing.
- (U) Demonstrate a breadboard very high speed optical network for sensor data fusion.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: IBM, Owego NY; General Electric, Syracuse NY; Honeywell, Minneapolis, MN; Westinghouse, Baltimore, MD; and TRW, Los Angeles, CA.

(U) Related Activities:
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) PE 0603109F, INEWS/ICNIA.
- (U) PE 0601102F, Defense Research Sciences.
- (U) PE 0602301E, Intelligence Systems Program.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: This is coordinated with the United Kingdom through data exchange agreement, IEP-UK-AF-17.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

6. (U) Project 2004, Reconnaissance/Strike Electro-Optical Sensors: This project develops technologies needed to improve performance, supportability, and cost of passive and active electro-optical (EO) sensor systems for reconnaissance, target acquisition, and pilotage. Advanced technology is required to improve target discrimination, increase target kill probability, decrease pilot workload, and increase survivability, while maintaining low probability of detection by hostile forces.

(U) FY 1989 Accomplishments:
- (U) Developed target detection concepts using unexploited observables to detect and classify targets protected by camouflage, concealment, and deception (CCD) techniques.
- (U) A two year test program was completed comparing performance of many Forward Looking Infrared (FLIR) sensors in varying weather conditions.

(U) FY 1990 Planned Program:
- (U) Develop advanced counter-countermeasure techniques for new FLIR systems and laser radars.
- (U) Develop performance models to design next generation FLIRs.
- (U) Analyze, test, and compare 3-5 micron Platinum Silicide sensors and 8-12 micron Mercury Cadmium Telluride sensors.

(U) FY 1991 Planned Program:
- (U) Develop advanced techniques against adversary CCD techniques.
- (U) Develop and test new concepts for higher spatial resolution longer range laser radars.
- (U) Develop a testbed FLIR for evaluating sensor components, FLIR system concepts and design performance models.
- (U) Evaluate a new variable sampling FLIR that has a sub-pixel resolution capability.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: Georgia Tech Research Institute, Atlanta GA; Optimetrics Inc., Ann Arbor MI and Dayton OH; Battelle Labs, Columbus OH;

(U) Related Activities:
- (U) Joint Director of Laboratories; Tri-Service Coordinating Body.
- (U) PE 0603707F, Weather Systems.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603227E, Strategic Relocatable Target Detection.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Memorandum of Agreement with the German Ministry of Defense on International CCD program.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

7. (U) Project 6095, Inertial Reference and Guidance Technology: Improvements in the accuracy of inertial navigation systems/sensors for aerospace vehicles will be needed for future precise strike and reconnaissance missions. This project advances the technologies for navigation, including both sensors and systems. Included are the integrated antenna design requirements for communication, navigation, identification and electronic warfare (CNI/EW).

(U) FY 1989 Accomplishments:
- (U) Developed automatic fix taking management techniques to reduce crew workload.
- (U) Demonstrated new Kalman filter design to reduce navigation system procurement costs.
- (U) Researched ultra-high reliability inertial components to improve aircraft availability.

(U) FY 1990 Planned Program:
- (U) Develop embedded antennas for integrated CNI/EW functions to reduce the aircraft integration costs of these systems.
- (U) Complete critical technology plasma shock effects work for hypervelocity navigation.
- (U) Develop solid state inertial sensors providing a three fold increase in reliability.

(U) FY 1991 Planned Program:
- (U) Demonstrate resonant fiber optic gyros to reduce sensor cost.
- (U) Demonstrate solid state accelerometers.
- (U) Develop breadboard superconducting inertial sensor for strategic weapons applications.
- (U) Demonstrate automatic fix taking management technologies to reduce crew workload.
- (U) Determine the effects of plasma shock on the navigation function of hypervelocity vehicles.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: The Analytical Sciences Corporation (TASC), Reading MA; and TRW, San Diego CA.

(U) Related Activities:
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

8. (U) Project 6096, Microelectronics Technology: This project develops advanced devices, logic and integration techniques to provide high performance electronics for signal processing applications. Technical areas of consideration include novel device structures and fabrication techniques, high speed memories, packaging interconnect and integration technologies.

(U) FY 1989 Accomplishments:
- (U) Demonstrated subnanosecond GaAs integrated logic.
- (U) Developed Indium Phosphide (InP) hybrid bipolar technology for high frequency application.
- (U) Implemented revolutionary logic using resonant tunneling transistor for high throughput signal processing.

(U) FY 1990 Planned Program:
- (U) Demonstrate quantum coupled interconnect schemes based on 0.1 micron device size and spacing.
- (U) Develop selective growth techniques for multiple semiconductor materials on a common substrate.
- (U) Demonstrate integrated circuit technology which collects processes, information on environmental and operating conditions of aerospace vehicles.

(U) FY 1991 Planned Program:
- (U) Demonstrate 0.1 micron arrays for advanced processors.
- (U) Develop wafer level integration concepts based on multiple materials and advanced processor architectures.
- (U) Explore development of the III-V family of materials for innovative infrared detection schemes.
- (U) Develop selective growth techniques for multiple semiconductor materials on a common substrate.

(U) Work Performed By: The Electronic Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: Rockwell International, Thousand Oaks CA; AT&T, Murray Hill NJ; TRW, Los Angeles CA; and Honeywell, Minneapolis MN.

(U) Related Activities:
- (U) Advisory Group on Electron Devices, Tri-Service Coordinating Body.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603452F, VHSIC.
- (U) PE 0602102F, Materials.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

9. (U) Project 7622, Reconnaissance/Strike RF Sensors: This project develops the radar technology for sensor concepts compatible with low radar cross section airframes. It also emphasizes advanced synthetic aperature radar (SAR) techniques which provide very high resolution images for precise targeting.

(U) FY 1989 Accomplishments:
- (U) Fabricated hardware for dual band SAR measurements to study detection of camouflaged targets using polarization.

(U) FY 1990 Planned Program:
- (U) Model foliage penetration capabilities using SAR systems to develop key radar technology for concealed target detection.
- (U) Develop airborne radar reciever and processing techniques for joint NASA Space Shuttle Imaging Radar bistatic surface target imaging experiments.
- (U) Investigate Ultra High Resolution SAR processing, detection, and autofocus technologies for air-to-ground target detection.
- (U) Analyze advanced adaptive processing algorithms for extracting small signature airborne targets from high clutter and jamming environments.

(U) FY 1991 Planned Program:
- (U) Fabricate test receiver hardware and test processing algorithms for Space Shuttle bistatic radar surface imaging experiment.
- (U) Develop raid assessment modeling techniques for difficult to detect airborne targets.
- (U) Investigate wide bandwidth adaptive waveform techniques for automatic detection of small mobile targets.

(U) Work Performed By: The Avionics Laboratory, Wright Patterson AFB, OH, manages this project. The contractors include: Environmental Research Institute of Michigan, Ann Arbor MI; Hughes, El Segundo, CA; Grumman, Bethpage NY; Technology Services Corporation, Los Angeles CA; and Loral, Phoenix AZ.

(U) Related Activities:
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) PE 0603369D, Air Defense Initiative.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: The Technology Cooperation Program (TTCP) with Australia and the United Kingdom will share responsibility for the Space Imaging Radar (SIR-C) shuttle experiments.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

10. (U) Project 7629, Fire Control Avionics: Future air-to-air and surface strike scenarios rely on covert techniques (stealth technology) on both sides for their successful accomplishment. This project develops fire control system concepts and technologies which will aid in the location, identification, and targeting of reduced signature, as well as conventional, airborne and surface targets.

(U) FY 1989 Accomplishments:
- (U) Developed automatic target cueing techniques for infrared sensors to identify and attack concealed ground targets.
- (U) Incorporated neural network and parallel processing techniques into multi-sensor fusion algorithms to meet increased throughput requirements and reduce pilot workload.

(U) FY 1990 Planned Program:
- (U) Demonstrate automatic target cueing for forward looking infrared systems and laser radars.
- (U) Demonstrate covert targeting algorithms.
- (U) Develop covert recce/strike targeting concepts for both manned and unmanned platforms to identify and attack surface targets.
- (U) Define conceptual covert air combat systems which exploit improved sensors, multi-sensor integration, and aircraft internetting for enhanced situational awareness and survival.

(U) FY 1991 Planned Program:
- (U) Investigate multi-sensor fusion algorithms for improved air-to-air and air-to-ground tactical and strategic targeting.
- (U) Study fire control requirements for unmanned vehicles.
- (U) Investigate the avionics technical requirements for strike of ground targets from a high mach vehicle.
- (U) Develop the capability for rapid evaluation of automatic target recognition algorithms.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: Advanced Decision Systems, Mt View, CA; The Analytical Sciences Corporation, Boston, MA; Honeywell, Minneapolis, MN; Hughes Aircraft Corporation, Conoga Park CA; McDonnell Douglas, St Louis, MO.

(U) Related Activities:
- (U) Coordination is accomplished through Joint Services Guidance and Control Committee.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

11. (U) Project 7633, Passive Electronic Countermeasures: The objective of this project is to increase system survivability by improved threat warning, by experimental evaluation of foreign defensive systems (exploitation) to expose vulnerabilities of these systems to countermeasures, by reduction of aircraft detectability, and by improved expendables including chaff and optical reflecting devices.

(U) FY 1989 Accomplishments:
- (U) Demonstrated an acousto-optic tunable filter for laser warning in the far infrared.
- (U) Developed expendables to decoy doppler radars.

(U) FY 1990 Planned Program:
- (U) Demonstrate a spectrally agile focal plane IR array to reduce false alarm rates for missile warning.
- (U) Develop an instantaneous frequency measuring (IFM) radar receiver which can correctly measure simultaneous pulses. This is essential for dense signal environments.
- (U) The Rapid Scanning Superhet Receiver (RSSR) will be enhanced to automatically identify several spread spectrum radars.

(U) FY 1991 Planned Program:
- (U) Demonstrate a laser tail warning receiver to provide capability against a specific very serious new threat.
- (U) Demonstrate an image processing approach to threat identification will to reduce ambiguities and false alarms.
- (U) Laser warning receiver hardening techniques will be developed to prevent false alarms from electromagnetic interference.
- (U) Develop high speed processing techniques for laser warning receivers.
- (U) Develop an acousto-optic dispersive light filter programmable grating for vidicon television camera laser detectors.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: Litton Applied Technology Division, Sunnyvale CA; System Research Laboratory, Dayton OH; Loral, Yonkers NY.

(U) Related Activities:
- (U) Joint Director of Laboratories, Technology Program for Electronic Warfare, Tri-Service Coordinating Body.
- (U) PE 0603270F, Electronic Combat Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Work is coordinated with subgroup Q of the TTCP for U.K., Canada and Australia.

Program Element: #0602204F Budget Activity: #1 - Technology Base
PE Title: Aerospace Avionics

12. (U) Project 7662, Avionics Data Transmission and Reception: This project addresses the growing need for a capability to transmit information to, from, and between aircraft with high integrity, low probability of interception (LPI), and resistance to jamming and false transmission. This work is vital to provide battlefield commanders with the needed intelligence in near real time and provide aircraft the ability to communicate in the presence of sophisticated enemy jamming.

(U) FY 1989 Accomplishments:
- (U) Fabricated hand held laser radio for Special Operational Forces covert application.
- (U) Assembled and tested an ultraviolet communication system to verify LPI characteristics.

(U) FY 1990 Planned Program:
- (U) Test adaptive signal masking waveforms with brassboard to evaluate improvements in communication performance.
- (U) Evaluate holographic devices for wide field of view non-gimbaled laser beam steering for communications.
- (U) Complete study of integrated communication, navigation and identification technologies for the 2005 timeframe.

(U) FY 1991 Planned Program:
- (U) Simulate adaptive communication system for evaluation of adaptive techniques.
- (U) Test transmit techniques for holographic beam steering for laser communications.
- (U) Test LPI performance of adaptive communication transceiver brassboards.
- (U) Investigate design concepts for omni-directional optical communications receiver.
- (U) Complete intra-flight data link conceptual design.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: Georgia Technical Research Institute, Atlanta GA; Electronic Decision, Inc., Urbana IL; Westinghouse Electric, Baltimore MD; System and Applied Sciences Corporation, Dayton OH.

(U) Related Activities:
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0603109F, ICNIA/INEWS.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: The subpanel on LPI Communications of the TTCP coordinates LPI technology programs.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06HT Laboratory Support	10,194	11,785	13,180	Cont	TBD
1121 Training Development and Assessment Technology*	2,983	2,334	2,621	Cont	TBD
1123 Aircrew Training Technology*	9,871	7,614	7,924	Cont	TBD
1710 Logistics and Maintenance Technology	4,047	2,822	2,950	Cont	TBD
3017 Command and Control Training	1,601	1,043	1,072	Cont	TBD
7719 Force Acquisition & Distribution Systems	3,770	2,556	2,741	Cont	TBD
Total	32,466	28,154	30,488	Cont	TBD

*As part of the streamlining effort, Project 7734 was combined into Project 1121, and Projects 1192 and 6114 were combined into Project 1123.

B. (U) BRIEF DESCRIPTION OF ELEMENT: Increases operational readiness by developing technologies to enable more effective classification, assignment, training, and retention of personnel; to minimize the manpower and equipment necessary to conduct maintenance; and to increase weapons systems supportability to improve wartime logistics' planning.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06HT, Laboratory Support: Funds the operation of the Air Force Human Resources Laboratory, including pay and related costs of civilian scientists, engineers, and support personnel, travel, rent, communications, maintenance, supplies and equipment. Supports and complements all projects in this PE.

2. (U) Project 1121, Training Development and Assessment Technology: Improves the quality and effectiveness of training for AF enlisted maintenance and support personnel by developing technology to accelerate learning, increase skill/knowledge retention, and improve job performance. Develops cost effective methods for designing, delivering, and evaluating training. Determines the most effective uses of computer technology for training.

(U) FY 1989 Accomplishments:
- (U) Determined parameters for deciding when computer-based job aids are more cost effective than additional training.

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PE Title: Personnel, Training, and Simulation

- (U) Determined optimal instructional sequencing and delivery strategies for computer-based training.
- (U) Demonstrated and evaluated alternative methods for automating the instructional systems development process.

(U) FY 1990 Planned Program:
- (U) Determine the feasibility of using neural networks to enhance the performance of intelligent tutoring systems.
- (U) Begin investigations regarding machine learning and knowledge-based instructional planning.
- (U) Develop methods to simulate current and alternative AF enlisted specialty structures, estimating training resource capacity and training costs.
- (U) Develop methods to use job performance for training content validity assessment.

(U) FY 1991 Planned Program:
- (U) Determine the effectiveness of using neural networks to train and control intelligent tutors.
- (U) Continue experiments on the effectiveness of different instructional approaches in intelligent training systems.
- (U) Continue development of machine learning and knowledge based instructional planning technologies.
- (U) Continue development of methods for identifying areas of over- and under-training based on job performance.

(U) Work Performed By: Program management by the Human Resources Laboratory, Training Systems Division, Brooks AFB TX. The five prime contractors are: FMC Corp, Santa Clara CA; MEI Associates, Lexington MA; Harris Corp, Melbourne FL; Universal Energy Systems, Dayton OH; and McDonnell Douglas Corp., St. Loius MO.

(U) Related Activities:
- (U) PE 0603227F, Personnel, Training, and Simulation Tech.
- (U) PE 0604243F, Manpower, Personnel, and Training Dev.
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area.
- (U) PE 0602785A, Manpower, Personnel, and Training Tech.
- (U) AF has formal agreements with Army and Navy to share development of computer-based training technologies.
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 1123, Aircrew Training Technology: Develops new methods and techniques for aircrew training. Investigates the entire spectrum of aircrew training to determine the best ways of designing, delivering and assessing ground based and aircraft

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

training. Develops flight simulator component technologies to reduce the cost of future aircrew training systems, and to provide new capabilities for realistic combat training.

(U) FY 1989 Accomplishments:
- (U) Determined flight simulator critical visual cues for low-level flight and performance effects of trade-offs in scene brightness, resolution, and contrast.
- (U) Researched scene fidelity to specify simulation requirements for ground radar resolution and infrared displays.
- (U) Began Tri-Service effort to develop local and long distance communications networking standards for linking aircraft, tank, and helicopter simulators.
- (U) Demonstrated the feasibility to rehost high fidelity simulation and support software to microprocessor systems.

(U) FY 1990 Planned Program:
- (U) Demonstrate a stand alone aircrew performance measurement system.
- (U) Complete development of an artificial intelligence model of pilot knowledge structures, to evaluate air combat decision-making strategies and develop improved training.
- (U) Determine the training value and optimal use of computer generated special effects, such as smoke, contrails, explosions, and sun angle shading in flight simulators.
- (U) Define simulator display requirements for combat training with respect to color, scene content, and field-of-view.
- (U) Develop guidelines for the display of tactical air combat performance information for training purposes.

(U) FY 1991 Planned Program:
- (U) Develop a model incorporating visual training effectiveness data to optimize simulator fidelity variables for aircrew training and mission rehearsal.
- (U) Demonstrate long-distance simulator networking between the Operations Training Division at Williams AFB, AZ, Naval Training Systems Center, FL, and Fort Rucker, AL.
- (U) Begin development of rapid database development technologies for simulator mission rehearsal.
- (U) Develop metrics for measuring aircrew performance.
- (U) Explore methods for training cockpit attention and task management.

(U) Work Performed By: Program management by the AF Human Resources Laboratory, Operations Training Division (AFHLR/OT), Williams AFB AZ. The five prime contractors are: University of Dayton, Dayton OH; Link Flight Simulation Corp., Binghamton NY; Logicon, San Diego CA; General Electric Corp., Daytona Beach FL; and Verac Corp., San Diego CA.

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

(U) Related Activities:
- (U) PE 0603227F, Personnel, Training, and Simulation Tech
- (U) PE 0604227F, Flight Simulator Development
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area
- (U) PE 0602727A, Non-System Training Devices Technology
- (U) The AF has formal agreements with the Army for visual display and advanced computer image generation technology.
- (U) The Navy has a liaison office at AFHRL/OT.
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 1710, Logistics and Maintenance Technology: Develops new technologies to improve AF combat and peacetime operations logistics support. Develops improved logistics planning and assessment models for realistic computation of wartime logistics requirements and capabilities. Develops methods to identify tradeoffs to minimize the manpower and equipment necessary to conduct aircraft maintenance in a dispersed location. Develops software tools enabling the design-in of improved reliability, maintainability, supportability, and man-machine interfaces.

(U) FY 1989 Accomplishments:
- (U) Began development of improved, computer-based reliability and maintainability design evaluation measures and criteria for use by program directors and engineers during weapon system development.
- (U) Began development of methods to identify critical maintenance tasks to be performed in emergency situations with associated training requirements.

(U) FY 1990 Planned Program:
- (U) Continue development of combat-portable maintenance aids, with special emphasis on providing capability for in-field training and aircraft battle damage repair estimating.
- (U) Continue development of advanced computer-aided design graphics to allow estimation of maintainablity and system operation in early design stages.
- (U) Continue development of improved simulation models to enable enhanced analysis of AF-wide combat logistics resource requirements.

(U) FY 1991 Planned Program:
- (U) Develop computer-aided design tools to incorporate data on human capabilities in space into design of new systems.
- (U) Develop advanced models to predict the impact of operational scenarios on combat logistics requirements.
- (U) Develop prototype training methods to enable maintenance

personnel to cope with combat stress and maintain acceptable levels of performance.

(U) Work Performed By: Program managament by the AF Human Resources Laboratory, Logistics and Human Factors Division, Wright Patterson AFB OH. The four prime contractors are: Applied Sciences Assoc., Valencia PA; Institute for Defense Analyses, McClean VA; Systems Exploration Inc., San Diego CA; and Systems Research Laboratory, Dayton OH.

(U) Related Activities:
- (U) PE 0603106F, Logistics Systems Technology
- (U) PE 0602716A, Human Factors Engineering Technology Dev
- (U) PE 0602234N, Mission Support Technology: Human Factors Technology Area
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 3017, Command and Control Training. Develops methods for analyzing peacetime/wartime command and control (C2) job performance and training requirements, and develops new training and evaluation methods for complex C2 decision making and team performance. Emphasis is on training to enable optimal use of complex command and control information systems.

(U) FY 1989 Accomplishments:
- (U) Developed and evaluated preliminary models to allow systems designers to predict the impacts of automation on previously manual C2 systems.
- (U) Developed a proof-of-concept rapid training system for Headquarters Pacific Air Force battle staff augmentees.

(U) FY 1990 Planned Program:
- (U) Continue development of models to define and replicate tactical battle staff decision making skills.
- (U) Continue development of models to predict impact on training requirements and team performance of command and control system automation.

(U) FY 1991 Planned Program:
- (U) Develop an artificial intelligence based embedded training program for Tactical Air Control Center battle managers.
- (U) Continue development of improved training methods for individual and team battle management decision making.

(U) Work Performed By: Program management by the AF Human Resources Laboratory (AFHRL), Logistics and Human Factors Division, Wright Patterson AFB OH. The five major contractors

are: BBN Laboratories, Cambridge MA; Logicon Inc., San Diego CA; University of Dayton, Dayton OH; Systems Research Laboratory, Dayton OH; and Systems Exploration, INC., San Diego CA.

(U) Related Activities:
- (U) PE 0602702F, Command, Control, and Communication
- (U) PE 0603789F, C3I Technology Development
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area.
- (U) PE 0602785A, Manpower, Personnel, and Training Technology
- (U) AFHRL has formal agreements with the Rome Air Development Center to share C2 systems research products.
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 7719, Force Acquisition and Distribution Systems: Provides methods to ensure that the best qualified individuals are selected, classified, and assigned through the development of personnel qualification and aptitude measurement methods, job specification standards, and manpower and personnel models.

(U) FY 1989 Accomplishments:
- (U) Determined the ability of the various job performance measures to reliably capture the performance of technicians.
- (U) Developed measures to predict suitability for fighter, bomber, tanker, or transport aircraft training.
- (U) Determined the feasibility of using the enlisted value-of-experience model for evaluating rated career fields.

(U) FY 1990 Planned Program:
- (U) Continue development of methods to determine the common higher order intellectual tasks from a group of related AF jobs to improve training effectiveness and efficiency.
- (U) Develop methods to predict personality, motivational, and leadership qualities for officer selection/classification.
- (U) Begin development of a skills transfer matrix based on the ease of retraining across Air Force jobs.
- (U) Evaluate candidate classification models for Specialized Undergraduate Pilot Training.

(U) FY 1991 Planned Program:
- (U) Expand previous models quantifying the value of experience to develop an objective force structure analysis model.
- (U) Develop model to link AF enlisted and officer accessions and retention, and civilian availability to estimate future weapon system supportability and maintainability.
- (U) Begin development of a total force impact model to specify

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PE Title: Personnel, Training, and Simulation

supportable manpower, personnel, and training constraints for use in early weapon system planning documents and provide design criteria to weapon system developers.

(U) Work Performed By: Program management by the AF Human Resources Laboratory, Manpower and Personnel Division, Brooks AFB TX. The two contractors are: Metrica Inc., Bryan TX; and Operational Technologies Corp., San Antonio TX.

(U) Related Activities:
- (U) PE 0603227F, Personnel, Training, and Simulation Tech
- (U) PE 0604243F, Manpower, Personnel, and Training Development
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area
- (U) PE 0602785A, Manpower, Personnel, and Training Technology
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602206F Budget Activity: 1-Technology Base
PE Title: Civil Engineering & Environmental Quality

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1900 Environmental Quality Technology	3,600	2,579	2,453	Cont	TBD
2673 Civil Engineering Technology	2,977	3,281	3,162	Cont	TBD
Total	6,577	5,860	5,615	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program develops technology for civil engineering and Air Force-unique environmental requirements in deploying, operating, and maintaining Air Force weapon systems. This goal is achieved by exploratory development in the following areas: protective construction of air base facilities, utilities, and operating surfaces against conventional and chemical/ biological attacks; air mobile structures; rapid air base battle damage assessment and repair; cost-effective maintenance and repair of air base facilities, utilities and operating surfaces; peacetime and post-attack air base and aircraft fire suppression/crash rescue; control, detection, and disposal of pollutants from Air Force operations; reduce hazardous waste generation; and remedial actions for Air Force site cleanup.

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

1. (U) Project 1900, Environmental Quality Technology: Characterizes the chemistry of Air Force-generated pollutants and toxic materials, assesses their interaction with the environment, and develops control and clean-up technologies. Research is conducted to reduce the cost and increase the effectiveness of technologies that protect the environment. New Air Force fuels and chemicals, such as jet engine and rocket fuels, are monitored to anticipate and prevent environmental problems from occurring and to prevent delays in testing and fielding weapon systems.

(U) FY 1989 Accomplishments:
- (U) Determined the optimum use of fuel additives to reduce particulate emission generated by jet engine maintenance tests--exceeded EPA air quality standards.
- (U) Designed specifications for combustor that destroys contaminated rocket fuels and complied with Environmental Protection Agency.

Program Element: #0602206F Budget Activity: 1-Technology Base
PE Title: Civil Engineering & Environmental Quality

(U) FY 1990 Planned Program:
- (U) Investigate toxic waste reduction resulting from aircraft de-painting.
- (U) Develop analytical procedures to identify the source of fuel spills to determine responsibility for cleanup.
- (U) Investigate environmentally safe, economical methods for disposing of hazardous waste resulting from the manufacture of rocket propellants.

(U) FY 1991 Planned Program:
- (U) Analyze the environmental hazards of new rocket propellants.
- (U) Investigate Nitrogen Oxide formation and control in aircraft engines and environmental compliance to avoid shutdown.
- (U) Develop ultrasonic aircraft paint-stripping technology using water or biodegradable material, minimize hazardous waste disposal and electroplate paint-stripping operations--payoff; potential savings of $200,000 waste disposal cost per Air Logistics Command per year.

(U) Work Performed By: Project managed by the Air Force Engineering and Services Lab, Tyndall AFB FL. Top contractors: U. of Calif., Irvine CA; EG&G, Idaho Falls ID; 3M Corporation, St. Paul MN; Martin Marietta, Oak Ridge TN; U. of Florida, Gainesville FL.

(U) Related Activities:
- (U) Program Element (PE) #0601102F, Defense Research Sciences.
- (U) PE#0602102F, Materials.
- (U) PE#0602202F, Human Systems Technology.
- (U) PE#0602203F, Aerospace Propulsion.
- (U) PE#0603211F, Aerospace Structures.
- (U) PE#0603723F, Civil and Environmental Engineering Technology.
- (U) No unnecessary duplication of effort within USAF or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2673, Civil Engineering Technology: Provides the technology base for current and future Air Force systems in the following areas: survivable air base structures, utilities, and operating surfaces against more accurate and powerful conventional and chemical/biological weapons; air base battle damage assessment and repair; air mobile structures; cost-effective maintenance and repair of air base facilities, utilities, and operating surfaces; and DoD lead service for air base and aircraft crash rescue and fire suppression.

(U) FY 1989 Accomplishments:
- (U) Developed a way to assess survivability based on the merit of proposed air base design improvements.
- (U) Developed a new dispensing concept for stand-off fire suppression for live ordnance and hazardous materials.

Program Element: #0602206F Budget Activity: 1-Technology Base
PE Title: Civil Engineering & Environmental Quality

(U) FY 1990 Planned Program:
- (U) Study bonding process for concrete construction materials to increase air base facility strength and durability.
- (U) Research dynamic material properties to economically construct buried air base protective structures.
- (U) Determine feasibility of using vibration to reduce upheaval formed around airfield bomb craters--reduce post-attack runway repair time by up to one-half.

(U) FY 1991 Planned Program:
- (U) Develop reliable, high temperature resistant pavement design for short takeoff and landing aircraft.
- (U) Evaluate the use of inorganic and expedient repair materials to support post-attack runway repair.
- (U) Develop concepts for use of new composite materials in base protective structures.
- (U) Develop operational halon firefighting replacement agent--effective, environmentally safe, and reduces ozone depletion.

(U) Work Performed By: Project managed by the Air Force Engineering and Services Lab, Tyndall AFB FL. Top contractors: New Mexico Engineering Research Institute, Albuquerque NM; Applied Research Associates, Albuquerque NM; U. of Florida, Panama City FL; Texas A&M, College Station TX; and Resource International, Westerville OH.

(U) Related Activities:
- (U) PE#0601102F, Defense Research Sciences.
- (U) PE#0602102F, Materials.
- (U) PE#0602202F, Human Systems Technology.
- (U) PE#0602203F, Aerospace Propulsion.
- (U) PE#0603211F, Aerospace Structures.
- (U) PE#0603231F, Crew Systems and Personnel Protection.
- (U) PE#0603307F, Air Base Operability Advanced Development.
- (U) PE#0603723F, Civil and Environmental Engineering Technology.
- (U) No unnecessary duplication of effort within USAF or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion Technology

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06RL Laboratory Operations	13,258	13,406	13,594	Cont	TBD
2864 Space Vehicles Technology	3,399	3,520	3,682	Cont	TBD
3058 Space Propulsion Technology	6,952	7,205	7,544	Cont	TBD
3059 Ballistic Missile Propulsion Technology	1,526	1,582	1,656	Cont	TBD
3148 Air-Launched Missile Propulsion Technology	2,005	2,072	2,179	Cont	TBD
5730 Fundamental Technologies	8,494	8,805	9,218	Cont	TBD
Total	35,634	36,590	37,873	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This science and technology program exploits new concepts and techniques for rocket propulsion and space vehicles technology. It develops rocket propulsion technology to increase the performance, reliability, and cost effectiveness of tactical and strategic missiles and space systems. This program also provides technology options to enhance the performance, survivability, and operation of advanced space vehicle subsystems. This program accomplishes bench-scale tests to prove the feasibility of new technologies before starting larger scale demonstrations which more closely resemble configurations useful in a system. Following the feasibility demonstrations, the most promising rocket propulsion and space vehicles technology options are selected for further demonstration in Space and Missile Rocket Propulsion (PE 0603302F) and Advanced Spacecraft Technology (PE 0603401F). The selection is based on potential payoff and relevance to Air Force capability needs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06RL - Laboratory Operations: This project supports and complements the other projects in this program element and provides for management, support, and operation of the Astronautics Laboratory, Edwards AFB CA. It provides for the pay and related costs of civilian scientists, engineers, technicians, and support personnel; procurement of equipment and supplies; maintenance and modification of facilities; communications, utilities, and production services; and other operating expenses.

2. (U) Project 2864 - Space Vehicles Technology: This project develops and integrates technology for spacecraft structural design and control, space power, thermal management, and in-space operations. This technology enhances the performance, survivability, and

Program Element: #0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion Technology

operations of Air Force space systems.

(U) FY 1989 Accomplishments:
- (U) Measured contamination of space sensors from fuel venting.
- (U) Established feasibility of using multi-layer insulation on full-scale cryogenic propellant tanks for in-space storage.
- (U) Investigated advanced heat transfer technology to reduce weight of spacecraft radiators by 90 percent.

(U) FY 1990 Planned Program:
- (U) Evaluate composite components with embedded sensors and actuators as control technique for large space structures.
- (U) Determine structural and vibrational control required for proposed space based wide area surveillance concepts.
- (U) Verify computer analysis codes which define structural control requirements for large spacecraft deployment.

(U) FY 1991 Planned Program:
- (U) Complete experiments on smart composite structures with embedded sensors and actuators to verify ability to accurately monitor and control large spacecraft.
- (U) Demonstrate multi-layer insulation as passive thermal control technique to meet in-space cryogenic storage requirements and increase spacecraft life.
- (U) Develop preliminary design of solar electric orbit transfer vehicle for critical experiment to demonstrate payoffs of electric propulsion and survivable space power.

(U) Work Performed By: This project is managed by the Astronautics Laboratory, Edwards AFB CA. The contractors are Ball Aerospace Systems, Boulder CO; Boeing Aerospace, Seattle, WA; Martin Marietta, Denver, CO; McDonnell Douglas Astronautics, Huntington Beach CA; and TRW, Redondo Beach CA.

(U) Related Activities:
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602203F, Aerospace Propulsion.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) PE 0603402F, Space Test Program.
- (U) Related to space vehicle technology developments at NASA. Coordination accomplished through the Air Force/NASA Space Technology Interdependency Group and an Astronautics Laboratory/NASA Langley Research Center Memorandum of Understanding on space systems research and technology development.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion Technology

3. (U) Project 3058 - Space Propulsion Technology: This project advances rocket propulsion technology for future Air Force space systems, including spacecraft, orbit transfer and maneuvering vehicles, and launch vehicles. This technology increases system performance and reliability, enhances flexibility, and reduces payload launch and orbit transfer costs. This project continues to model, characterize, and reduce the signatures of rocket propulsion systems.

(U) FY 1989 Accomplishments:
- (U) Demonstrated large, lightweight titanium tanks for low cost orbit transfer vehicle propulsion.
- (U) Developed arcjet (electric propulsion) thruster components and transitioned to space propulsion demonstration effort.
- (U) Designed and fabricated sub-scale magnetoplasmadynamic (electric propulsion) thruster for in-house testing.
- (U) Demonstrated nozzleless booster concept in large-scale test firings to reduce launch vehicle recurring costs.

(U) FY 1990 Planned Program:
- (U) Evaluate altitude-compensating nozzle to optimize launch vehicle performance over entire ascent trajectory.
- (U) Fabricate porous disk (solar propulsion) thruster with over twice the performance of chemical thrusters.
- (U) Design vaneless turbopump which enables advanced, high-performance engines for future launch vehicles.
- (U) Complete assessment of high energy propulsion system components with potential to triple payload delivery.

(U) FY 1991 Planned Program:
- (U) Evaluate feasibility of using diamond film coatings to increase durability and life of liquid engine turbopump components by 300 percent.
- (U) Demonstrate dual mixture ratio injector that will optimize large liquid engine performance and significantly lower launch vehicle life cycle costs.
- (U) Measure and characterize low signature rocket motors to reduce observables and enhance system survivability.
- (U) Demonstrate porous disk thruster and inflatable solar concentrator to enable solar orbit transfer vehicle propulsion with 240 percent increase in payload capability.

(U) Work Performed By: This project is managed by the Astronautics Laboratory, Edwards AFB CA. The contractors are Aerojet Tech-Systems, Sacramento CA; Atlantic Research, Gainesville VA; L'Garde, Chicago IL; Pratt & Whitney, West Palm Beach FL; and Rockwell International/Rocketdyne, Canoga Park CA.

(U) Related Activities:
- (U) PE 0603302F, Space and Missile Rocket Propulsion.
- (U) PE 0603401F, Advanced Spacecraft Technology.

Program Element: #0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion Technology

- (U) PE 0603402F, Space Test Program.
- (U) PE 0305171F, Space Shuttle Operations (Upper Stages).
- (U) Related to space systems propulsion activities at NASA. Coordination accomplished through the Air Force/NASA Space Technology Interdependency Group and the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

(U) Other Apropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 3059 - Ballistic Missile Propulsion Technology: This project develops affordable propulsion technology for intercontinental missile boosters, post boost systems, and reentry vehicles. The technology increases range and throw-weight, improves service life, and enhances survivability. This project identifies variables which affect operational life and explores options to increase the reliability and service life of existing and future strategic missile systems.

(U) FY 1989 Accomplishments:
- (U) Verified computed tomagraphy non-destructive evaluation (NDE) technique which identifies defects in rocket motors and transitioned capability to Minuteman missile program.
- (U) Demonstrated fast burning propellant to support high acceleration, survivable intercontinental missile concepts.

(U) FY 1990 Planned Program:
- (U) Investigate processing and aging variables which cause failures in solid rocket motors and develop techniques to predict and extend missile service life.
- (U) Evaluate fast burn booster components that are able to withstand stressing launch environment and still perform intercontinental missile mission.

(U) FY 1991 Planned Program:
- (U) Establish U.S. capability to fabricate advanced carbon-carbon nozzles and exit cones without reliance on other countries to provide these components.
- (U) Advance quantitative NDE inspection techniques which locate flaws early in manufacturing process, using defect image analysis, to increase producibility and reduce costs.
- (U) Develop methodologies which predict in-flight insulation erosion and investigate erosion resistant insulations to prevent catastrophic in-flight failures.

(U) Work Performed By: This project is managed by the Astronautics Laboratory, Edwards AFB CA. The contractors are Aerojet Solid Propulsion, Sacramento CA; Boeing Aerospace, Seattle WA;

Program Element: #0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion Technology

Hercules, Magna UT; Thiokol, Brigham City UT; and United Technologies/CSD, San Jose CA.

(U) Related Activities:
- (U) PE 0603302F, Space and Missile Rocket Propulsion.
- (U) PE 0603311F, Advanced Strategic Missile Systems.
- (U) PE 0604312F, ICBM Modernization.
- (U) Coordination accomplished through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 3148 - Air Launched Missile Propulsion Technology: This project develops rocket propulsion technology for tactical air-to-air and air-to-surface missile systems. It emphasizes technology to reduce motor plume signature and motor hazards, increase propulsion flexibility, and improve the reliability of motor components. In addition, this project explores innovative propulsion concepts to improve multi-mission flexibility and probability of kill.

(U) FY 1989 Accomplishments:
- (U) Explored innovative propulsion concepts and potential payoffs for future air-to-air and air-to-surface missiles.
- (U) Demonstrated feasibility of new energy management concept for solid rocket motors using laser and fiber optics.

(U) FY 1990 Planned Program:
- (U) Develop low observable igniter for tactical missiles to reduce ignition flash and missile launch detectability.
- (U) Evaluate the effectiveness of reducing rocket motor exhaust signature to enhance missile probability of kill and launch aircraft survivability.

(U) FY 1991 Planned Program:
- (U) Demonstrate high-energy, minimum smoke propellant that is not susceptible to accidental detonation and meets joint service insensitive munitions requirements.
- (U) Develop a low cost tactical rocket motor that significantly reduces unit cost of air-to-surface standoff weapons.
- (U) Investigate damage response of composite motor cases and assess ability of cases to perform in harsh air-launched missile environment.

(U) Work Performed By: This project is managed by the Astronautics Laboratory, Edwards AFB CA. The four contractors are Aerojet Solid Propulsion, Sacramento CA; Atlantic Research,

Program Element: #0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion Technology

Gainesville VA; Hercules, Magna UT; and Thiokol, Brigham City UT.

(U) Related Activities:
- (U) PE 0602602F, Conventional Munitions.
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare.
- (U) PE 0602303A, Missile Technology.
- (U) PE 0603302F, Space and Missile Rocket Propulsion.
- (U) Coordination accomplished through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee and the Joint Tactical Air-to-Air Missile Office.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 5730 - Fundamental Technologies: This project develops enabling core technologies which are applicable to propulsion and space vehicle advancement. This project includes revolutionary research in the critical high energy density materials (HEDM) technology to create compounds which provide dramatic increases in propulsion performance. The fundamental technologies increase the design reliability of propulsion and space vehicle systems by alleviating failures and low performance. The technologies include better understanding of the effects of combustion on performance, new propellant ingredients, determination of factors limiting service life, and investigation of the feasibility of advanced propulsion and space vehicle concepts.

(U) FY 1989 Accomplishments:
- (U) Investigated stabilizer for new polymer to permit its use in missiles and improve range by 10 percent.
- (U) Demonstrated low-cost propellant processing technique that reduces the cost of propellant by 50 percent.
- (U) Continued HEDM effort, researching the creation of new compounds and experimentally verifying promising compounds.
- (U) Provided solution to in-flight insulation erosion problem in ballistic motors to prevent catastrophic failures.

(U) FY 1990 Planned Program:
- (U) Determine electrical properties of solid propellants and composite cases that affect vulnerability of rocket motors to accidental ignition due to electrostatic discharge.
- (U) Initiate detailed studies of engineering applications for promising compounds created for propulsion in HEDM effort.
- (U) Develop experimental processes and equipment to verify predictions of complex gas flow in nozzle exit cones and apply techniques to increase total engine performance.

Program Element: #0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion Technology

(U) FY 1991 Planned Program:
- (U) Conduct characterization and experimental scale-up of HEDM propellant candidates to demonstrate 25 percent increase in performance over existing propulsion systems.
- (U) Complete testing on liquid engine combustion stability mechanisms to increase ability to avoid costly combustion instability problems during engine design and development.
- (U) Investigate effects of long-term, in-space storage on space vehicle structures and rocket motor components and use information to predict structural limits.
- (U) Evaluate coatings which enable mixing of incompatible solid propellant ingredients and conduct motor firings to demonstrate performance increases of new formulations.

(U) Work Performed By: This roject is managed by the Astronautics Laboratory, Edwards AFB CA. The contractors are Aerojet Solid Propulsion and TechSystems, Sacramento CA; Atlantic Research, Gainesville VA; Hercules, Magna UT; Thiokol, Brigham City UT; United Technologies/CSD, San Jose CA.

(U) Related Activities:
- (U) PE 0305171F, Space Shuttle Operations (Upper Stages).
- (U) PE 0602602F, Conventional Munitions.
- (U) PE 0602111N, Anti-Air/Anti-Surface Weapons.
- (U) PE 0602303A, Missile Technology.
- (U) PE 0603302F, Space and Missile Rocket Propulsion.
- (U) Coordination accomplished through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

A. (U) Resources ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06WL Lab Operations	20,022	19,258	19,458	Cont	TBD
2007 Nuclear Safety	762	400	400	Cont	TBD
2218 DEW Technology Assessment	1,800	1,855	1,855	Cont	TBD
3326 Laser Applications	5,600	4,387	7,001	Cont	TBD
5797 Advanced Weapons Concepts	5,800	4,770	6,512	Cont	TBD
8809 Nuclear Survivability & Hardness Technology	1,623	967	967	Cont	TBD
Total	35,607	31,637	36,193	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology effort advances the state of the art in nuclear survivability and in directed energy weapons (DEWs) such as high energy lasers (HELs), high power microwaves (HPM), and plasmas. DEWs are of great interest because they will allow long range, near-instantaneous-kill of many potential targets. This effort also supports studies to ensure that our nuclear weapons can be handled and operated safely. Management and support of the Weapons Laboratory at Kirtland Air Force Base, NM, is included.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06WL, Lab Operations: This project supports and complements all other projects in this program element and provides for management, support, and operation of the Weapons Laboratory, Kirtland AFB, NM. It provides for the pay and related costs of civilian scientists, engineers, and support personnel; transportation of equipment, rents, communications and utilities costs; reproduction services, procurement of supplies and equipment; and contractor support services for maintenance and modification of facilities.

2. (U) Project 2007, Nuclear Safety: This project addresses safety and security issues for nuclear weapon delivery systems.

(U) FY 1989 Accomplishments:
- (U) Completed biennial operational nuclear safety reviews of B-52 with ACM, F-16, F-11, PA-200 Tornado aircraft, Peacekeeper, and Minuteman.
- (U) Completed initial nuclear safety analysis of Short Range Attack Missile (SRAM) II.

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

(U) FY 1990 Planned Program:
- (U) Perform F-15E aircraft pre-operational study.
- (U) Perform FB-111A Operational Review.
- (U) Perform initial safety study on Peacekeeper/Rail Garrison.

(U) FY 1991 Planned Program:
- (U) Conduct special safety studies on: B-1B/ACM, NATO F-16C/D.
- (U) Perform operational safety review of PA-200 Tornado.
- (U) Conduct pre-operational safety study for Peacekeeper/Rail Garrison.
- (U) Conduct modern nuclear safety design criteria special study analysis on older nuclear weapons.

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM manages this program. Its one contractor is Orion International Technology, Inc, Albuquerque, NM.

(U) Related Activities:
- (U) PE 0603311F, Advanced Strategic Missile Systems
- (U) PE 0604312F, ICBM Modernization
- (U) PE 0604222F, Nuclear Weapons Support
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None

3. (U) Project 2218, DEW Technology Assessment: This project assesses DEW lethality against foreign targets, vulnerability of US strategic and tactical systems to DEWs, and operational utility of DEWs for specific Air Force missions. It also evaluates technology for innovative nuclear power concepts.

(U) FY 1989 Accomplishments:
- (U) Extended tactical and strategic HPM propagation models and investigated applications for an HPM weapon.
- (U) Performed an HEL foreign satellite failure mode analysis.
- (U) Performed a laser susceptibility analysis on the Peacekeeper.
- (U) Optimized ground based laser (GBL) anti-satellite (ASAT) system concepts.
- (U) Conducted compact reactor studies for space applications.
- (U) Performed mixed force (directed energy and kinetic energy) analyses to determine the optimum mix for ASAT deployment.

(U) FY 1990 Planned Program:
- (U) Perform laser susceptibility tests on satellite subsystems (antennas, pressure vessels, electronics).
- (U) Test satellite materials for susceptibility to repetitively pulsed lasers.

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

- (U) Perform HPM susceptibility analyses on F-16 flight control systems.
- (U) Prepare space experiment laboratory for thermal, vacuum, and vibration qualification testing.
- (U) Conduct National Aerospace Plane material response tests at the Laser Effects Testing Facility.

(U) FY 1991 Planned Program:
- (U) Complete trade-off studies on GBL system optimization and technology feasibility.
- (U) Improve laser and HPM atmospheric propagation codes.
- (U) Evaluate military utility of multiple telescope laser systems.
- (U) Assess the potential of plasmas as a DEW.
- (U) Conduct HPM susceptibility analyses on pod electronics.

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM manages this program. The top five contractors are: Kaman Sciences Corporation, Albuquerque, NM; Science and Engineering Associates, Albuquerque, NM; Ball Systems Engineering Division, Albuquerque, NM; Rockwell Power Services, Albuquerque, NM; and R&D Associates, Marina Del Rey, CA.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics
- (U) PE 0603605F, Advanced Weapons Technology
- (U) PE 0603224C, Survivability, Lethality, and Key Technologies
- (U) PE 0603314A, Directed Energy
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None

4. (U) Project 3326, Laser Applications: This project examines the technical feasibility of lasers as weapons for AF mission requirements. It includes related technologies such as pulsed short wavelength laser devices for use as illuminators for an active 24 hour imaging system sources and several promising imaging techniques (active and passive) for aimpoint maintenance/selection and damage assessment.

(U) FY 1989 Accomplishments:
- (U) Demonstrated higher power, improved efficiency, repetitively pulsed chemical oxygen iodine laser (COIL) device.
- (U) Demonstrated pulsed, visible wavelength chemical laser.
- (U) Demonstrated advanced oxygen and iodine generators for COIL.
- (U) Began nonlinear optics phase conjugation to automatically remove atmospheric distortions in space object imaging.

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

(U) FY 1990 Planned Program:
- (U) Begin scale-up of visible wavelength chemical laser.
- (U) Begin experiments for multiple telescope passive imaging.
- (U) Validate algorithm for a high resolution active imaging concept.

(U) FY 1991 Planned Program:
- (U) Begin field experiments for a passive imaging concept.
- (U) Complete design concepts of a high resolution, sparse array passive imaging system.
- (U) Evaluate COIL mirror optical coatings under high intensity levels.
- (U) Begin active imaging field experiment on the 3.5 meter telescope.

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM manages this program. The top five contractors are: Rockwell Power Services, Albuquerque, NM; University of Arizona, Tucson, AZ; S Systems Corp, Inglewood, CA; and WJ Shafer and Associates, Inc, Wakefield, MA.

(U) Related Activities:
- (U) PE 0602307A, Laser Weapons Technology
- (U) PE 0603221C, Directed Energy Weapons
- (U) PE 0603224C, Survivability, Lethality, and Key Technologies
- (U) PE 0603314A, Directed Energy
- (U) PE 0603605F, Advanced Weapons Technology
- (U) PE 0603250F, Lincoln Laboratory
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None

5. (U) Project 5797, Advanced Weapons Concepts: This project explores nonconventional, non-nuclear weapons concepts using innovative technologies. Primary areas of research are high power microwaves (HPM), high energy plasmas such as compact toroids (donut shaped plasma masses with magnetic fields wrapped around the ring structure), and high energy pulse power.

(U) FY 1989 Accomplishments:
- (U) Initiated solid state HPM experiments on the susceptibility of a PAVE PAWS radar module and special assets.
- (U) Designed and constructed a compact pulse power device to support long pulse HPM experiments.
- (U) Designed and implemented an advanced data acquisition system for HPM effects experiments.
- (U) Successfully completed initial experiments for plasma toroid formation.

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

(U) FY 1990 Planned Program:
- (U) Complete solid state HPM tests on PAVE PAWS radar module.
- (U) Perform HPM lethality experiments on a foreign system.
- (U) Conduct HPM tests against an F-16 Flight Control System.
- (U) Generate and accelerate multi-megajoule compact toroids.

(U) FY 1991 Planned Program:
- (U) Complete investigation on the effects of single versus multiple and short versus long HPM pulses.
- (U) Develop high energy, phased-array technology for an HPM device driven by relativistic electron beam sources.
- (U) Evaluate potential of ultra-wideband HPM radiation to upset/disrupt systems.
- (U) Focus and propagate compact plasma toroids.
- (U) Develop advanced HPM sources and high current cathodes.

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM manages this program. Contractor support is provided by Rockwell Power Services, Albuquerque, NM; Maxwell Laboratories, Inc, San Diego, CA; R&D Associates, Marina Del Rey, CA; Mission Research Corporation, Albuquerque, NM; Ball Systems Engineering Division, Albuquerque, NM.

(U) Related Activities:
- (U) PE 0602120A, Electronic Survivability & Fuzing Technology
- (U) PE 0602111N, Anti-Air Warfare/Anti-Surface Warfare Technology
- (U) PE 0602202F, Human Systems Technology
- (U) PE 0602204F, Aerospace Avionics
- (U) PE 0603270F, Electronic Combat
- (U) PE 0603605F, Advanced Weapons Technology
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None

6. (U) Project 8809, Nuclear Survivability & Hardness Technology: This project develops nuclear survivability technology for AF systems. This includes design criteria, specifications, standards and design handbooks, and methods to alleviate the effects of nuclear weapons on Air Force systems. Conceptual and feasibility studies for nuclear weapons development are also included here.

(U) FY 1989 Accomplishments:
- (U) Nuclear criteria studies included: update of KC-135 Tanker Single Integrated Operation Plan, National Aerospace Plane, and Advanced Time Sensitive Communications Systems.
- (U) Completed short range attack missile-tactical (SRAM-T) nuclear weapon feasibility study.

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

- (U) Completed preliminary assessment of warhead concepts for hypervelocity-class vehicles.

(U) FY 1990 Planned Program:
- (U) Fabricate space shuttle experiments to evaluate exposure of integrated optics to space radiation environments.
- (U) Initiate nuclear criteria studies for Space Based Wide Area Surveillance System and Defense Satellite Program Follow-on.
- (U) Complete feasibility study for final earth penetrating weapon (EPW) nuclear weapons designs.
- (U) Evaluate retrieved space radiation fiber optic experiment which was launched into orbit in 1984.
- (U) Start developing computer models of damaged missile silos to evaluate multiple nuclear blast and shock effects.

(U) FY 1991 Planned Program:
- (U) Launch the Integrated Optics Space Radiation Effects Experiment into orbit.
- (U) Complete nuclear criteria studies for Defense Satellite Program follow-on.
- (U) Evaluate high temperature superconductors for space.

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM manages this program. The top five contractors are: University of New Mexico, Albuquerque, NM; Science Applications, Inc, La Jolla, CA; Mission Research Corp, Santa Barbara, CA; Ashmon Services, Huntsville, AL; and R&D Associates, Marina Del Rey, CA.

(U) Related Activities:
- (U) PE 0602715H, Defense Nuclear Agency
- (U) PE 0603311F, Advanced Strategic Missile Systems
- (U) PE 0603605F, Advanced Radiation Technology
- (U) PE 0604222F, Nuclear Weapons
- (U) PE 0604711F, Systems Survivability (Nuclear Effects)
- (U) PE 0604747F, Electromagnetic Radiation Test Facilities
- (U) PE 0604312F, ICBM Modernization
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06AL AF Armament Laboratory Operations	14,332	14,151	14,305	Cont	TBD
2068 Advanced Guidance Technology	10,980	11,600	11,726	Cont	TBD
2502 Ordnance Technology	8,946	8,769	8,865	Cont	TBD
2543 Weapons Effectiveness Methodology	1,846	1,770	1,789	Cont	TBD
2567 Aeromechanics Technology	8,094	6,753	6,827	Cont	TBD
TOTAL	44,198	43,043	43,512	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This effort advances the technology base for air-delivered conventional weapons to support non-nuclear Air Force missions. The program includes: (1) design and demonstration of advanced air-delivered ordnance; (2) guidance and flight control to assure weapon delivery; (3) advanced low-drag high performance airframes, conformal/internal carriage and separation and improved submunition dispensing concepts; (4) safety and performance; (5) high performance aircraft guns and ammunition; and (6) modeling, technical assessments and evaluation criteria for all efforts. This program element also funds the management and support of the Air Force Armament Laboratory at Eglin AFB FL.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06AL: AIR FORCE ARMAMENT LABORATORY OPERATIONS. This project supports and complements all other projects in the program element and provides for management, support, and operation of the Air Force Armament Laboratory, Eglin AFB FL. It provides civilian salaries, transportation, rents, maintenance, communications, supplies and equipment and modification of facilities.

2. (U) Project 2068: ADVANCED GUIDANCE TECHNOLOGY. This project develops advanced midcourse and terminal guidance technologies for air-to-surface and air-to-air conventional weapons. It also develops advanced instrumentation systems to more effectively test new conventional weapons. The payoffs from this project include: all-weather delivery, increased accuracy, a "launch and leave" capability, increased number of kills per sortie, increased aircraft survivability and improved reliability and affordability.

Program Element: #0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

(U) FY 1989 Accomplishments:
- (U) Built algorithms and breadboard hardware for Joint AF/Navy Noncooperative Vector Scoring System to provide accurate missile/target encounter information without missile hardware modification.
- (U) Transition of a digital frequency unit to PE 0604314F, Advanced Medium Range Air-to-Air Missile (AMRAAM).
- (U) Initiated captive flight testing of gallium arsenide submunition sensors against armored land combat vehicles.

(U) FY 1990 Planned Program:
- (U) Complete flight testing of gallium arsenide submunition sensors to gather target/background infrared (IR) data.
- (U) Complete Noncooperative Vector Scoring System flight test.
- (U) Complete fabrication of the Have Torch breadboard seeker.
- (U) Initiate the Infrared/Radio Frequency (IR/RF) Dome program to develop dome materials that transmit IR and RF energy and withstand the high Mach environment.
- (U) Initiate development of laser diode arrays for submunition sensors for better target discrimination selection.
- (U) Initiate development of high speed airborne video system to support Seek Eagle program.
- (U) Begin development of Subminiature Telemetry system for inexpensive instrumentation of munitions and aircraft.
- (U) Begin Have Rebound (bistatic radar) fabrication and test.
- (U) Develop and upgrade in-house image processing and radio signal processing laboratories to provide increased support capability for guidance system projects.

(U) FY 1991 Planned Program:
- (U) Initiate development of beam sharpening techniques for real beam millimeter wave (MMW) radar seekers to provide better resolution for detecting armored targets.
- (U) Complete the Have Torch active air-to-air seeker program with ground testing of its potential against air targets.
- (U) Select candidate materials on the IR/RF Dome program and test in the wind tunnel to determine the most promising materials. Conduct comprehensive tests to evaluate their optical properties.
- (U) Begin development of low cost Altitude Measurement System for Seek Eagle application.
- (U) Complete development of quasi-optical, solid state mixer subsystem for MMW radar.
- (U) Complete the Have Rebound program and test it against flyover targets.

(U) Work Performed By: Project managed by the Air Force Armament Laboratory, Eglin AFB FL. Major contractors are: Hughes Corp, Long Beach CA; Raytheon Co, Bedford MA; Loral, Akron OH; McDonnell-Douglas Corp, St Louis MO; and Texas Instruments, Dallas TX.

Program Element: #0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

(U) Related Activities:
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0603363F, Armament Technology Integration
- (U) PE 0602303A, Missile Technology
- (U) PE 0604314F, Advanced Medium Range Air-to-Air Missile
- (U) PE 0604258N, Vector Scoring
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 2502: ORDNANCE TECHNOLOGY. This project develops advanced non-nuclear ordnance technologies for air-to-surface and air-to-air conventional weapons. The payoff from this project includes improved munitions storage capability and transportation safety, increased warhead effectiveness against buried and hardened targets, and improved submunition dispensing.

(U) FY 1989 Accomplishments:
- (U) Determined the feasibility of using reactive fragments to defeat ground based air defense systems such as radars and radar vans.
- (U) Incorporated slapper detonators into development of fuzing technology necessary for safing, arming, and firing of insensitive munitions.
- (U) Completed design of a brassboard aimable warhead fuze.

(U) FY 1990 Planned Program:
- (U) Initiate development of active/passive, dual-mode target detection devices for fuzing against future threats.
- (U) Initiate fuze development project for airfield attack munitions.
- (U) Demonstrate aimable warhead fuze performance during final target interaction tests.
- (U) Complete in-house development of melt-cast insensitive high explosive (IHE) to meet 1.6 hazard classification and begin full scale evaluation.
- (U) Initiate and complete an in-house reactive fragment warhead loading facility.

(U) FY 1991 Planned Program:
- (U) Demonstrate anti-armor fuze and insensitive munition fuze performance during final target interaction testing and warhead function testing.
- (U) Develop reactive fragment technology for runway defeat and defense supression aerial targets.
- (U) Complete the selection and demonstration of reactive materials for runway cratering bomb application.

Program Element: #0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

- (U) Complete interim qualification of high energy IHE and demonstrate in an advanced missile warhead.
- (U) Demonstrate explosive launch of reactive fragments.

(U) Work Performed By: Project managed by the Air Force Armament Laboratory, Eglin AFB FL. Major contractors are: Martin Marietta, Orlando FL; Honeywell, Hopkins MN; Aerojet Solid Propulsion Co, Sacramento CA; Atlantic Research Corp, Gainesville VA; and General Electric Co, Burlington VT.

(U) Related Activities:
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0603363F, Armament Technology Integration
- (U) PE 0604314F, Advanced Medium Range Air-to-Air Missile
- (U) PE 0604602F, Armament Ordnance Development
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 2543: WEAPON EFFECTIVENESS METHODOLOGY. This project assesses the lethality and effectiveness of current and planned air-to-surface and air-to-air conventional weapons technology programs and assesses the vulnerability of targets those programs are intended to defeat. Payoffs include: improved weapon design, and improved technology planning and increased technology focus.

(U) FY 1989 Accomplishments:
- (U) Built and tested full-scale and third scale models of fixed hardened targets to assess the lethality of deep penetrating, blast weapons.
- (U) Included countermeasures effects into lethality codes. Key in evaluating effectiveness of weapon designs.

(U) FY 1990 Planned Program:
- (U) Conduct testing to evaluate fixed target response (breaching and structural damage to concrete walls) to cased charge blast and fragments.
- (U) Develop effectiveness code to evaluate different weapon concepts in support of weapon design.
- (U) Develop physical and functional threat aircraft descriptions, develop computer models and conduct component lethality assessment.

(U) FY 1991 Planned Program:
- (U) Evaluate effectiveness of hypersonic delivery dispensers against fixed, hardened targets and enemy airfields.
- (U) Develop new air-to-air effectiveness code to evaluate new munition concepts.

Program Element: #0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

- (U) Evaluate the effect of smart fuzing and improved guidance on lethality of new munition concepts.

(U) Work Performed By: Project managed by the Air Force Armament Laboratory, Eglin AFB FL. The three major contractors are: LTV Aerospace, Dallas TX; Denver Research Institute, Denver CO; and Applied Research Associates, Albuquerque, NM.

(U) Related Activities:
- (U) PE 0603307F, Air Base Survivability
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0604602F, Armament Ordnance Development
- (U) PE 0604604F, Submunitions Development
- (U) PE 0602624A, Weapons and Munitions Technology
- (U) PE 0602332N, Surface/Aerospace Weapons Technology
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 2567: AEROMECHANICS TECHNOLOGY. This project funds technology efforts to improve aerodynamic efficiency for conventional weapons. These technologies improve aircraft performance by reducing weapon drag, and will enable supersonic low-altitude weapon release, to increase aircraft survivability.

(U) FY 1989 Accomplishments:
- (U) Completed and evaluated the Expert Missile Maintenance Aide depot-level prototypes. This diagnostic software provides rapid trouble-shooting of malfunctioning air-to-air (Sparrow) and air-to-ground (GBU-15) weapons.
- (U) Developed Computational Fluid Dynamics (CFD) techniques to analyze missile releases from aircraft in transonic and supersonic flight.
- (U) Initiated fabrication of components for low cost, light-weight organic composite dispenser airframes.
- (U) Designed, fabricated, and installed a dual-spool fiber optic data link into a TV guided bomb (GBU-15) and began flight tests to determine system performance.

(U) FY 1990 Planned Program:
- (U) Develop CFD techniques for the aerodynamic analysis of hypersonic weapons.
- (U) Continue low cost light weight composite weapon airframe fabrication.
- (U) Complete design of advanced lightweight composite air-to-air missile airframe (HAVE DASH) compatible with both low drag external aircraft carriage and high density internal carriage applications.

Program Element: #0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

- (U) Integrate hardware, field computer and software into a instrumentation van and begin testing tactical grade inertial systems.
- (U) Begin development of tri-service miniature, low cost, tactical missile grade inertial measurement unit (IMU).
- (U) Complete flight tests of dual-spool fiber optic data link with GBU-15 test vehicle at ranges exceeding 20 kilometers.

(U) FY 1991 Planned Program:
- (U) Complete fabrication and initiate flight qualification ground testing of lightweight composite missile airframe.
- (U) Develop CFD analysis of submunition deployment from a hypersonic carrier vehicle.
- (U) Continue development of Tri-service tactical grade miniature ring laser gyro IMU's to provide positioning data to the weapon autopilot. The miniature IMU's will be smaller less expensive and more reliable than existing tactical IMU's.
- (U) Initiate in-house study for aerodynamic, structural and integration technologies for hypersonic weapons.
- (U) Validate via flight testing the fiber payout techniques previously developed using sled track testing.
- (U) Investigate fiber optic data link design for powered tactical weapons. Ground testing conducted on sled track configuration.
- (U) Develop CFD computer model to predict weapon separation from a carrier vehicle in velocity ranges beyond Mach 5.

(U) Work Performed By: Project managed by the Air Force Armament Laboratory, Eglin AFB FL. The three major contractors are: McDonnell-Douglas, St Louis MO; Rockwell Missile Systems Division, Duluth GA; and Ford Aerospace, Newport Beach CA.

(U) Related Activities:
- (U) PE 0603230F, Advanced Tactical Fighter
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0603363F, Armament Technology Integration
- (U) PE 0604314F, Advanced Medium Range Air-to-Air Missile
- (U) PE 0604602F, Armament Ordnance Development
- (U) PE 0604604F, Submunitions Development
- (U) PE 0602201F, Aerospace Flight Dynamics
- (U) PE 0602618A, Ballistic Technology
- (U) PE 0602332N, Surface/Aerospace Weapons Technology
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06RA Laboratory Operations	37,087	38,855	39,451	Cont	TBD
2338 Assurance Techniques for Electronics	5,500	5,115	4,915	Cont	TBD
4506 Surveillance Technology	9,795	8,985	8,630	Cont	TBD
4519 Communications Technology	4,690	4,215	4,050	Cont	TBD
4594 Intelligence Technology	5,750	5,475	5,205	Cont	TBD
4600 Electromagnetic Radiation, Devices and Components	12,150	10,140	9,748	Cont	TBD
5581 Command & Control Technology	8,036	7,711	7,410	Cont	TBD
Total	83,008	80,496	79,409	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is the primary source of new concepts, feasibility demonstrations and advanced technology for the Air Force Command, Control, Communications and Intelligence (C3I) systems needs. Current developments include: increasing the operational availability of C3I systems through improved reliability and maintainability of electronic components and systems; improving the effectiveness and survivability of C3I systems through reliable and secure communications; improving surveillance range and detection capabilities against both low observable threats and enemy electronic countermeasures; and improving the timeliness and quality of intelligence data for decision making. Technical projects address six technology areas which advance the state-of-the-art in C3I: electronic reliability/maintainability and electromagnetic compatibility; surveillance; communications; intelligence; electromagnetic radiation, devices and components; and information processing.

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

1. (U) Project 06RA, Laboratory Operations: This project supports and complements all other projects in this program element and provides management, support, and operation of Rome Air Development Center (RADC), Griffiss AFB, Rome, NY and the two directorates of RADC located at Hanscom AFB, MA. It provides the pay and related costs of scientists, engineers, and support personnel; transportation of equipment, rents, communications and utilities costs; reproduction services; procurement of supplies and equipment; and contractor services for maintenance and modification of facilities.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

2. (U) Project 2338, Assurance Techniques for Electronics: The Air Force needs technology which increases reliability and maintainability for electronic devices and systems while assessing electromagnetic compatibility. Payoffs are increased system availability and lower life cycle costs. This project focuses on new silicon and gallium arsenide based technology to identify and eliminate design and fabrication characteristics that result in poor reliability. It develops equipment/system reliability and maintainability techniques to be applied to development of military systems, resulting in improved operational readiness and supportability. Areas of emphasis include: techniques to design in reliability; artificial intelligence for system maintenance; and computer aided design techniques to integrate reliability, maintainability, and testability.

(U) FY 1989 Accomplishments:
- (U) Developed test methodology for potential electromagnetic susceptible devices used in radio frequency systems.
- (U) Developed a credible reliability design and failure rate prediction model for printed circuit board connections.
- (U) Developed finite element analysis techniques to predict electronic component time to failure.
- (U) Established the first facility in the Air Force for testing high speed VHSIC integrated circuits and devices.

(U) FY 1990 Planned Program:
- (U) Transition the failure rate prediction model and the automatic printed circuit board tester to Air Force Logistics Command for their depot repair process.
- (U) Develop advanced rating criteria for reliable circuit design.

(U) FY 1991 Planned Program:
- (U) Transition smart built-in-test (BIT) to Joint STARS Program.
- (U) Develop microcircuit time stress measurement device to record a circuit board's lifetime environmental history.
- (U) Develop smart BIT based on Artifical Intelligence technology to determine stability of lightweight airborne and spaceborne phased array systems.
- (U) Develop computer aided design (CAD) procedure for designing improved reliability into future integrated circuits.

(U) Work Performed By: RADC managed project. Major contractors: Syracuse University, Syracuse, NY; Digital Computer Research, Ithaca, NY; Georgia Tech Research Corp, Atlanta, GA; SCEEE, Ft Cloud, VA; Westinghouse Electric Corp, Baltimore, MD.

(U) Related Activities:
- (U) PE 0303126F, Long Haul Communications
- (U) PE 0603617F, C3 Applications
- (U) PE 0603726F, C3I Subsystem Integration
- (U) PE 0603789F, C3I Technology Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 4506, Surveillance Technology: The Air Force needs advanced ground, airborne and space-based system concepts and technologies to improve Air Force surveillance capabilities. Major exploratory development efforts include: technology for new surveillance radars, surveillance technology to counter low observable threats, and counter-countermeasure technology to defeat electronic warfare threats directed at surveillance systems. These efforts are based upon technology such as signal processing, array antenna techniques, and low-cost solid state transmit/receive modules. This project will demonstrate techniques for electro-optical surveillance systems for the detection, tracking and identification of airborne and space-based targets; develop and demonstrate radar surveillance sensor technology and concepts to overcome low cross-section atmospheric targets in a severe jamming environment; and will develop and demonstrate low observable surveillance concepts, signal processing techniques, and signal generation and control technologies.

(U) FY 1989 Accomplishments:
- (U) Demonstrated adaptive nulling capabilities for space radar to counter high speed adaptive jammer threat.
- (U) Completed evaluation of multi-domain signal processing algorithm for radar systems to meet low observable threat.
- (U) Delivered high power L-band transmit/receive modules for ground phased-array radar to improve detection capabilities in a dense jammer/clutter environment.
- (U) Developed the multispectral system testbed to assess fusion algorithm performance to improve detection.

(U) FY 1990 Planned Program:
- (U) Demonstrate mainlobe nulling algorithms for electronic counter-countermeasures.
- (U) Develop multi-band infrared techniques for detection, tracking and identification of airborne targets.
- (U) Develop digital beamforming technology for low-observable surveillance.

(U) FY 1991 Planned Program:
- (U) Test mainlobe nulling for electronic counter-countermeasures.
- (U) Develop multistatic, multifunction real-time fusion to validate surveillance in a tactical threat environment.
- (U) Develop wideband preselector technology to support wideband, multiband, monostatic and bistatic digital beamforming.
- (U) Design a single transmit/receive (T/R) module to do integrated signal generation, reception and signal processing.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

(U) Work Performed By: RADC managed project. Major contractors: PAR Technology Corp, New Hartford, NY; Raytheon Comm Division, Wayland, MA; Atlantic Research Corp, Alexandria, VA; W.J. Schafer Associate, Chelmford, MA; General Electric, Syracuse, NY.

(U) Related Activities:
- (U) PE 0603617F, C3 Application
- (U) PE 0603789F, C3I Technology Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 4519, Communications Technology: The Air Force needs technologies which increase communication data rates, survivability and flexibility. Communication survivability technologies include enduring network technologies, advanced processors, spread spectrum modems and adaptive nulling techniques. This project improves the capacity of communications, enhances system survivability, develops sensor internetting capability, improves communication techniques, and enhances information connectivity, It improves signal processing, develops optical signal processing techniques, and develops optical networks for communication and surveillance applications.

(U) FY 1989 Accomplishments:
- (U) Completed design of an all optical component radio for transition to advanced technology development.
- (U) Completed phased array antenna design that replaces cables with fiber optics for satellite communication applications.
- (U) Demonstrated single mode fiber optics which increases traffic capacity in fiber optic local area networks.

(U) FY 1990 Planned Program:
- (U) Demonstrate survivable, multimedia communications network architectures.
- (U) Demonstrate anti-jam/low probability of intercept capabilities of acoustical charge transport devices.

(U) FY 1991 Planned Program:
- (U) Develop integrated optically-controlled microwave network for phased arrays.
- (U) Develop single planar mode optical interconnect for optical signal processing.
- (U) Develop optimum processors for Neural Network application algorithms for communications systems.
- (U) Demonstrate modular, multi-rate, programmable processors for antijam and low probability of intercept (AJ/LPI).
- (U) Integrate distributed adaptive network technology into satellite ground terminals for survivable communications.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

(U) Work Performed By: RADC managed project. Major contractors: Electronic Decision Inc, Chatsworth, CA; Hughes, Torrance, CA; Hazeltine Corp, Greenlawn, NY; Poly-Scientific Litton Systems, Blacksburg, VA; Harris Corp, Melbourne, FL; TRW, Redondo Beach, CA; Ratheon Comm Division, Wayland, MA.

(U) Related Activities:
- (U) PE 0303126F, Long Haul Communications
- (U) PE 0603617F, C3 Applications
- (U) PE 0603726F, C3I Subsystem Integration
- (U) PE 0603789F, C3I Technology Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None

5. (U) Project 4594, Intelligence Technology: The Air Force needs technologies which improve and automate Air Force capabilities to process, fuse and disseminate useful and timely intelligence information. This project improves recording and handling techniques for timely processing, storage and dissemination of extremely high data rate, large volume intelligence information. It provides rapid recording, storage and retrieval of high data rate, large volume intelligence data; develops signal processing directed at signal intelligence exploitation, information deception, and unintentional emissions; develops technology for correlation and fusion of multisource data; provides advanced processing techniques for the receipt, correlation analysis and display of target reports from advanced sensor systems; supports advanced weapon systems through the exploration of multispectral, multisource imagery; and provides advanced techniques for charting and geodesy data processing.

(U) FY 1989 Accomplishments:
- (U) Developed technique for exploiting airborne spectrometer data for countering denial and deception techniques.
- (U) Developed an Artificial Intelligence based automated imagery exploitation system for identifying ground targets.
- (U) Developed voice synthesis technique for a battle management information display system.

(U) FY 1990 Planned Program:
- (U) Complete investigation of crystalline 3-D memories, optical random access memories, and cache memories.
- (U) Develop wideband analog recording to increase data capacity for intelligence systems.
- (U) Demonstrate applications of Neural Networks to improve image processing and pattern recognition for intelligence sensors.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

(U) FY 1991 Planned Program:
- (U) Complete design of an expert system for electronic intelligence analysis to increase speed and accuracy of electronic intelligence reporting.
- (U) Deliver model of speech processing system to provide clear voice communications for improved air crew performance in heavy cockpit noise.
- (U) Demonstrate effectiveness of electronic warfare manipulative deception techniques to defeat passive collection systems.
- (U) Develop optical memory demonstrations for random access, cache associative and three dimensional memory techniques.

(U) Work Performed By: RADC managed project. Major contractors: GTE Government System Inc, Boston, MA; Gould Defense System Inc, Chicago, IL; Automatic Inc, Falls Church, VA; Harris Corp, Melbourne, FL; PAR Technology Corp, New Hartford, NY.

(U) Related Activities:
- (U) PE 0603260F, Intelligence Advanced Development
- (U) PE 0603726F, C3I Subsystem Integration
- (U) PE 0604750F, Intelligence Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 4600, Electromagnetic Radiation, Devices and Components: The Air Force needs technology for the generation, control, processing and radiation of radio frequency, microwave and millimeter wave energy for C3I systems. The most promising technologies for improving C3I systems are electromagnetic scattering (from targets and clutter), monolithic microwave, millimeter wave integrated components, and antennas/electromagnetic wave propagation. This project develops a technology base for electronic and electro-optic devices, electromagnetic device materials and device radiation hardening for C3I systems; develops optic technology for electronic intelligence processing and data storage, real-time target recognition, control of large phased array antennas, and processing of various space sensors.

(U) FY 1989 Accomplishments:
- (U) Completed design of radomes to reduce radar cross section of antennas.
- (U) Completed development of multi-band infrared camera for aircraft signature measurement using platinum silicide technology.
- (U) Developed digital optical coprocessor to increase speed for electronic intelligence applications.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

(U) FY 1990 Planned Program:
- (U) Test universal galluim arsenide direct digital frequency synthesizer for improved anti-jam systems.
- (U) Complete evaluation of phase-only optical filter for noncooperative target recognition.
- (U) Complete coherence experiment to evaluate large antenna structures for improving over-the-horizon radar.

(U) FY 1991 Planned Program:
- (U) Test high temperature superconductivity material for lower noise in millimeter wave integrated components.
- (U) Develop devices for optic generated microwave signals for phased array antenna systems.
- (U) Implement adaptive polarization to enhance performance of bistatic, low-observable detection radars.
- (U) Demonstrate a large-array performance monitor and a signal corrective system for airborne Smart Skin arrays.

(U) Work Performed By: RADC managed project. Major contractors: Texas Instrument Inc, Dallas, TX; Hazeltine Corp, Greenlawn, NY; Hughes Aircraft Co, Torrance, CA; Eastman Kodak Co, Rochester, NY; EGG&G Raticon, Sunnyvale, CA.

(U) Related Activities:
- (U) PE 0303126F, Long Haul Communications
- (U) PE 0603726F, C3I Subsystem Integration
- (U) PE 0603789F, C3I Technology Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

7. (U) Project 5581, Command and Control Technology: The Air Force needs technologies which advance capabilities in C3I by providing strategic and tactical field commanders with improved techniques for the processing and presentation of information for battle management. Technologies being developed will increase the capability, quality and reliability while reducing the cost of computer resources in weapon systems. This project develops systems that automate and streamline the command and control process. It also improves software engineering tools; software development methodologies and computer based tools; and software quality specification, measurement and assessment. This project develops advanced computer software modeled after human information processing and capable of providing vast improvement in military decision processes. It also develops technology in distributed systems, data bases, and optical computing; develops distributed operating systems, fault tolerance mechanisms and prototype evaluators; and develops technologies associated with knowledge-based, expert, distributed databases.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

(U) FY 1989 Accomplishments:
- (U) Evaluated Knowledge Based Software Assistant models for distributed operating systems.
- (U) Completed designs for digital optical computers.
- (U) Demonstrated Knowledge Based simulation for tactical flight mission planning.

(U) FY 1990 Planned Program:
- (U) Modify the Software Life Cycle Support Environment, an integrated set of support software tools, to provide knowledge-based enhancements.
- (U) Demonstrate multiple host interconnection of computers using distributed configurations.

(U) FY 1991 Planned Program:
- (U) Complete logic modeling and system definition for the software engineering workstation.
- (U) Evaluate potential of commercial database management systems to support distributed tactical data bases.
- (U) Demonstrate an automated C2 system engineering workstation.
- (U) Demonstrate a holographic-based digital optical processor.

(U) Work Performed By: RADC managed project. Major contractors: Syracuse University, Skytop, NY; IITRI, Chicago, IL; Computer Science Corp, Falls Church, VA; Computer Corp, NJ; Honeywell Inc, St Petersburg, FL; International Software Systems, TX; Calspan-UB Research Center, NY.

(U) Related Activities:
- (U) PE 0603617F, C3 Applications
- (U) PE 0603728F, Advanced Computer Technology
- (U) PE 0603789F, C3I Technology Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603106F Budget Activity: #2 - Advanced Technology Development
PE Title: Logistics Systems Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2745 Logistics for Combat Readiness Maintenance	3,175	75	100	Cont	TBD
2940 Computer Technology for Systems Design and Maintenance	4,542	3,429	4,528	Cont	TBD
2950 Integrated Maintenance Information System (IMIS)	5,951	5,610	7,130	Cont	TBD
Total	13,668	9,114	11,758	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program element is one of the primary development programs for the DoD Computer-Aided Logistics Support (CALS) initiative. CALS will replace the current paper-based technical information system with efficient and easily updated electronic data management. This program element will: improve the way maintenance considerations are designed into weapons systems; make engineering and maintenance data electronically available throughout the lifetime of weapons systems; allow faster determination of the best balance of conflicting manufacturing and performance requirements for more reliable and supportable weapons; provide more realistic computer-based logistics planning and combat capability assessment models; and develop portable maintenance electronic job aids to assist maintenance technicians so that they can accomplish more kinds of diverse tasks. This technology supports "Rivet Workforce" goals (e.g., reduce number of maintenance specialties from 24 to 6 for the Advanced Tactical Fighter [ATF]). This is the only R&D supporting Phase III of the Air Force Technical Order Management System (AFTOMS) -- a $400M program to computerize technical data. Variations in funding level are due to OSD directed actions as indicated below.

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

1. (U) Project 2745, Logistics for Combat Readiness Maintenance: This project develops computer models to predict requirements for people, spare parts, maintenance skills and repair activity associated with deployment, battle damage, and intense wartime use of weapon systems.

(U) FY 1989 Accomplishments:
- (U) Transferred as directed by the Office of the Secretary of Defense, $2.6 million to PE #0603001A.
- (U) Transitioned computer model which predicts the impact of reduced numbers of aircraft maintenance specialties.
- (U) Developed training techniques for flight line emergency aircraft repairs in chemical environments.

Program Element: #0603106F Budget Activity: #2 - Advanced Technology Development
Pe title: Logistics Systems Technology

- (U) Produced video tape showing engineers how to design aircraft for repair in chemical protective ensemble.

(U) FY 1990 Planned Program:
- (U) Work on joint service application of the above computer maintenance model with the Army Research Institute.

(U) FY 1991 Planned Program:
- (U) Plan integrated test of above-mentioned model with Project 2950, electronic flight line maintenance aids.

(U) Work Performed By: This project is managed by the Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB OH. The contractor is Systems Exploration Inc., Dayton, OH.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0602205F, Personnel, Training and Simulation.
- (U) PE #0603007A, Human Factors, Personnel, and Training Advanced Technology.
- (U) PE #0603205F, Aerospace Vehicle Technology.
- (U) No duplication occurs within the Air Force or DoD.

(U) Other Appropriation Funds : Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2940, Computer Technology for Systems Design and Maintenance: This project has two major efforts. The first develops and demonstrates Computer Aided Design (CAD) technologies which will allow designers to incorporate reliability, maintainability, and logistics considerations early in the design process. This effort also supports DoD Concurrent Engineering efforts. The other effort, Integrated Design Systems (IDS), develops methods to electronically capture digitized contractor design and technical information databases and use them for subsequent modification and reprocurement.

(U) FY 1989 Accomplishments:
- (U) Developed approved plan for digitized capture and use of technical information data bases at Air Logistics Centers.
- (U) Joint project with Army designed Reliability and Maintainability (R&M) trade-off analysis for mechanical systems.
- (U) Tansitioned to industrial sites a computerized model of maintenance technicians for test and evaluation in CAD systems.

(U) FY 1990 Planned Program:
- (U) IDS schedule revised due to a $2.0 million FY 91 OSD directed budget reduction.

Program Element: #0603106F Budget Activity: #2 - Advanced Technology Development
Pe title: Logistics Systems Technology

- (U) Improve computer-aided maintainability design by modeling the dynamics of a maintenance technician's limbs. Transfer to industry for evaluation in CAD systems.
- (U) Conduct field test of integrated information modeling and management system components at an Air Logistics Center.
- (U) Demonstrate, with Army, software for mechanical design.

(U) FY 1991 Planned Program:
- (U) Improve computer-aided maintainability design by expanding existing anthropometric model of maintenance technicians to include fatigue, and task time.
- (U) Expand demonstration of access to technical data bases and digitized design tools at Air Logistics Center.
- (U) Demonstrate design work-station for on-line trade-offs between R&M and supportability during system design.

(U) Work Performed By: This project is managed by the Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB OH and the Wright Research & Development Center, Wright-Patterson AFB OH. The top 5 contractors are Rockwell International, Los Angeles, CA; Systems Research Laboratories, Beavercreek, OH; General Dynamics Corp, San Diego, CA; Boeing Computer Services, Seattle, WA; and Systems Exploration Inc, Dayton, OH.

(U) Related Activities:
- (U) PE #0602201F, Aerospace Flight Dynamics.
- (U) PE #0603205F, Aerospace Vehicle Technology.
- (U) PE #0602205F, Personnel, Training and Simulation.
- (U) PE #0604740F, Computer Resource Management Technology.
- (U) PE #0780101F, Industrial Preparedness.
- (U) No duplication occurs within the Air Force or DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements : None.

3. (U) Project 2950, Integrated Maintenance Information System (IMIS): This project is developing a portable computer to display instructions and fault diagnosis to flight line maintenance technicians. It will allow replacement of the paper-based Technical Order system with a digital system. It will link all technical order, diagnostic (including built-in weapon system tests), training, scheduling, control, management and supply information required by maintenance technicians. This will significantly increase the productivity of maintenance and support personnel, and resiliency of maintenance organizations in combat.

(U) FY 1989 Accomplishments:
- (U) This year's program included a $2.0M OSD directed enhancement in maintenance diagnostics research and development.

Program Element: #0603106F Budget Activity: #2 - Advanced Technology Development
Pe title: Logistics Systems Technology

- (U) Initialized field tests of portable maintenance aiding and diagnostic technology on flight-line using the F-16.
- (U) Draft specification developed for generation, update, and presentation of pageless digital technical orders to Advanced Tactical Fighter (ATF) and Air Force Technical Order Management System (AFTOMS).
- (U) Initiated program to interconnect stand-alone portable technician maintenance aids to base maintenance and supply.
- (U) Began development of joint services specifications for pageless technical data.

(U) FY 1990 Planned Program:
- (U) Initiate joint IMIS service test with Navy on an F/A-18.
- (U) Continue development of advanced display screens and components for flight line use.
- (U) Transition final specifications for authoring and presenting aircraft technical information to ATF and AFTOMS.
- (U) Continue development of full-base level IMIS prototype incorporating supply interface, maintenance action reporting, and integrated diagnostics.
- (U) Continue development of joint service specifications for pageless technical data.

(U) FY 1991 Planned Program:
- (U) Provide functional specifications for flight line maintenance aiding system.
- (U) Continue development of flight line maintenance aid, incorporating artificial intelligence systems.
- (U) Continue development of IMIS functional demonstration prototype for base level field test.

(U) Work Performed By: This project is managed by the Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB OH. The contractors are Systems Research Laboratories, Beavercreek, OH; General Dynamics Corp, San Diego, CA; McDonnell Aircraft Corp, St Louis, MO; and Systems Exploration Inc, Dayton, OH.

(U) Related Activities:
- (U) PE #0602205F, Personnel, Training and Simulation
- (U) PE #0604740F, Computer Resource Management Technology
- (U) PE #0207219F, Advanced Tactical Fighter
- (U) PE #0604708F, Generic Integrated Maintenance Diagnostics Systems
- (U) PE #0603721N, Integrated Diagnostic Support
- (U) This project is conducted jointly with the Navy and no duplication occurs within the Air Force or DoD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603109F Budget Activity: #2 - Advanced Technology Development
PE Title: INEWS/ICNIA

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete*	Total Program
2273 Integrated Electronic Warfare System (INEWS)	5,794	8,613	5,500	0	79,846
2538 Integrated Communications, Navigation, Identification Avionics (ICNIA)	1,380	15,412	4,518	0	91,379
2734 Very High Speed Integrated Circuits (VHSIC)-based Subsystems.	16,296	12,339	19,554	0	111,563
3003 Common Signal Processor (CSP)	9,951	0	0	0	37,098
3062 Pave Sprinter	3,230	0	0	0	3,100
Total	36,651	36,364	29,572	0	322,986

(* Though PE 63109F currently has no funding beyond FY 1991, the logic, feasibility and sources for extending it beyond then are being identified, investigated and evaluated. Effort portrayed as "initiate" in "FY 1991 Planned Programs" is contingent upon this extension.)

B. (U) BRIEF DESCRIPTION OF ELEMENT: Provides proof-of-concept development and demonstration of VHSIC-based advanced integrated modular avionics for the Advanced Tactical Fighter (ATF) with applicability to the Navy Advanced Tactical Aircraft (ATA, or A-12) and Army Light Helicopter, Experimental (LHX). Builds advanced development model (ADM) subsystems under management guidance from the Wright Research and Development Center, the ATF SPO and the Joint Integrated Avionics Working Group (JIAWG). Continues technical base for long term development of JIAWG common avionics baseline for using aircraft, such as ATA, ATF, LHX. Develops and validates a set of international specifications/standards for a common CNI terminal based on JIAWG architecture in conjunction with the Allied Standard Avionics Architecture Council (ASAAC) and other international, collaborative advanced avionics efforts.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN BOTH FY 1990 AND 1991:

1. (U) Project 2273, INEWS: Threat Warning and Countermeasures capability for Low Observable aircraft which will be fully integrated into Integrated Avionics Suite of the ATF, with applicability to the ATA and LHX.

(U) FY 1989 Accomplishments:
- (U) Completed transition of INEWS Dem/Val and ADM development into Program Element 0604250F for pre-FSD construction of core INEWS module set.

Program Element: #0603109F Budget Activity: #2 - Advanced Technology Development
PE Title: INEWS/ICNIA

- (U) Initiated requirements analysis for real-time avionics artifical intelligence (AI) processor modules for situation awareness (within JIAWG architecture).

(U) FY 1990 Planned Program:
- (U) Initiate advanced IR missile warning system definition in conjunction with the parallel processor advanced development work in project 2734.
- (U) Continue studies and demonstrations in advanced infrared countermeasures.
- (U) Complete AI processor modules requirements analysis.

(U) FY 1991 Planned Program:
- (U) Complete definition and initiate design of a passive IR missile warning massively-parallel processor.
- (U) Deliver INEWS system digital model to the Air Force and Navy.
- (U) Initiate development of AI processor for situation awareness.

(U) Work Performed By:
- (U) In-house work by WRDC/AAW and ATF SPO, Wright-Patterson AFB, OH.
- (U) Major contractors are TRW Corp., San Diego, CA; Westinghouse Electric, Baltimore, MD; Sanders Assoc, Nashua, NH; and General Electric, Utica, NY.

(U) Related Activities:
- (U) Program Element #0604250F, Integrated EW/CNI Development.
- (U) Program Element #0603230F, Advanced Tactical Fighter.
- (U) Program Element #0603270F, Electronic Combat Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

2. (U) Project 2538, ICNIA: Integrated, VHSIC-based, modular Communications, Navigation, Identification (CNI) system--including integrated, multifunction antennas--applicable to the integrated avionics suites of ATF/ATA/LHX. Study and development of specifications and standards for international, collaborative CNI and advanced avionics architectures.

(U) FY 1989 Accomplishments:
- (U) Finalized ICNIA module fabrication and software coding, including Navy unique functions.
- (U) Started terminal assembly and test.
- (U) Recoded operating system and GPS and JTIDS voice software modules into Ada.

Program Element: #0603109F Budget Activity: #2 - Advanced Technology Development
PE Title: INEWS/ICNIA

(U) FY 1990 Planned Program:
- (U) Fabricate, test, and deliver ICNIA ADM Terminals #1, 2, 3, and 4 including Navy unique software functions in ADM #4.
- (U) Flight demonstrate ADM #1 in an Army UH-60 helicopter.
- (U) Start imbedding of ICNIA ADM #3 into Integrated Electromagnetic System Simulator (IESS) facility and testing of ADM #4 in IESS.
- (U) Determine LPI Situational Awareness Data Link (SADL) requirements including JIAWG commonality and fleet interoperability.
- (U) Establish preliminary designs for special integrated antennas.

(U) FY 1991 Planned Program:
- (U) Finalize IESS/ADM #3 interfacing and continue ADM #4 testing.
- (U) Complete LPI SADL detail design efforts and initiate single JIAWG based implementation.
- (U) Breadboard and test critical integrated antennas and electronics.

(U) Work Performed By:
- (U) In-house work by the ATF SPO and WRDC/AAA, Wright-Patterson AFB, OH.
- (U) Major contractors are TRW Corp., San Diego, CA; Rockwell-Collins, Cedar Rapids IA; and Plessy, Wayne, NJ.

(U) Related Activities:
- (U) Program Element #0604250F, Integrated EW/CNI Development.
- (U) Program Element #0603230F, Advanced Tactical Fighter.
- (U) US/France Bilateral MOU for development of advanced processing module set.
- (U) US/FRG Bilateral MOU (draft) for development of advanced video processing module set.
- (U) ASAAC MOU (draft) with France, Germany, and the United Kingdom.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: US/FRG MOU (draft) to develop an advanced video processing module set; ASAAC MOU (draft) to develop a specification and NATO STANAG for an Advanced Avionics Architecture.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603109F Project Number: 2734
PE Title: INEWS/ICNIA Budget Activity: #2 - Advanced Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Title: Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2734 VHSIC-based Subsystems	16,296	12,339	19,554	0	111,563

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Designs, develops, integrates, and tests advanced concepts in avionics. Design and develop modular, multi-application signal and data processor systems to extend the Joint Integrated Avionics Working Group (JIAWG) module set in the area of parallel processing (supercomputers). To support the JIAWG common module validation and verification, this project funds the Demonstration of Avionics Module Exchangeability via Simulation (DAMES) effort. The DAMES is a state of the art simulation tool with the capability to handle large scale circuit designs down to the logic gate level. This simulation offers government validation and verification of module design prior to extensive Very High Speed Integrated Circuit (VHSIC) chip and hardware fabrication, and permits early software integration ahead of hardware availability. Develops and integrates technologies into elements of the integrated avionic suite which enhance the supportability of the avionics system. Develops and validates a set of international specifications/standards for a common CNI terminal based on the JIAWG architecture in conjunction with the Allied Standard Avionics Architecture Council (ASAAC) and other international, collaborative advanced avionics efforts.

C. (U) PROGRAM ACOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Tested VHSIC 1750A advanced development module sets.
   - (U) Installed DAMES simulation and conducted initial DAMES interoperability demonstrations on Common Signal Processor designs.
   - (U) Initiated development of VHSIC (Phase I) 32-bit central processing unit (CPU) module.
   - (U) Completed the multi-contractor definitions of Radiation Hardened 32-Bit Processors (RH-32) for space and airborne applications and prepared for downselect for the development phase.
   - (U) Initiated programs in packaging and cooling to increase reliability and lower cost of JIAWG modules.
   - (U) Initiated program in Modular Avionics Maintenance Technology to lower support costs in the field.
   - (U) Successfully integrated CSP hardware and software, Ultra Reliable Radar (URR) receiver/STALO, and solid state phased array antenna and demonstrated URR system.

Program Element: #0603109F Project Number: 2734
PE Title: INEWS/ICNIA Budget Activity: #2 - Advanced Technology Development

2. (U) FY 1990 Planned Program:
   - (U) Develop system simulation for entire avionics system in coordination with lower level DAMES development.
   - (U) Demonstrate the Active Star Coupler module as a risk reduction for ATF.
   - (U) Continue VHSIC 1750A testing with inclusion of the JIAWG Test and Maintenance (TM) standard bus and ADA real-time operating system.
   - (U) Develop packaging concepts for RF/photonic connection/backplane, rack/system cooling, and low cost, ultra-reliable modules.
   - (U) Initiate requirements analysis for new avionics parallel processing modules to support JIAWG architecture extensions.
   - (U) Investigate technology insertions into the JIAWG processor area, e.g. VHSIC 2, GaAs, advanced packaging, and fiber optics.
   - (U) Conduct demonstration of time stress measurement modules, expert system diagnostic, integrated maintenance system, and Tester Independent Support Software System(TISSS).
   - (U) Initiate advanced avionics architecture studies in support of Allied Standard Advanced Avionics Council (ASAAC).
   - (U) Initiate acquisition of CNI advanced development modules for use in supporting ASAAC effort.

3. (U) FY 1991 Planned Program:
   - (U) Conduct demonstrations in RF packaging, photonic back-plane/connectors, integrated rack/system cooling, and advanced modules.
   - (U) Demonstrate System Simulation for JIAWG architecture.
   - (U) Complete parallel processing module requirements analyses and technology insertion opportunities assessment.
   - (U) Initiate development of highest payoff JAIWG compatible common modules and needed software tools.
   - (U) Conduct demonstration of time stress measurement modules, expert system diagnostic, integrated maintenance system, and TISSS.
   - (U) Continue advanced avionics architecture studies in support of ASAAC.
   - (U) Continue acquisition of CNI advanced development modules for ASAAC.

4. (U) Program to Completion (if PE is extended beyond FY 1991):*
   - (U) Complete 32-bit CPU module development.
   - (U) Develop VHSIC based, JIAWG compatible, parallel processing modules.

* These are potential new projects and logical extensions of ongoing efforts which leverage the work already done and ensure continuing advancements in avionics technology.

Program Element: #0603109F Project Number: 2734
PE Title: INEWS/ICNIA Budget Activity: #2 - Advanced Technology Development

D. (U) WORK PERFORMED BY:
- (U) In-house work by the WRDC/AAA Wright-Patterson AFB, OH. RADC is responsible fot the TISSS effort.
- (U) Major contractors are TRW, Dayton, OH; Harris, Melbourne, FL; Westinghouse, Baltimore, MD; Lockheed, Burbank, CA; IBM, Manassas, VA and Owego, NY; Hughes Aircraft, Los Angeles, CA; and AT&T Bell Labs, Whippany, NJ.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Revised budget estimates.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-83 Advanced Tactical Fighter

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0604250F, Integrated EW/CNI Development.
- (U) Program Element #0603225F, DoD Common Programming Language (Ada)
- (U) Program Element #0603230F, Advanced Tactical Fighter
- (U) Program Element #0603220C, (Rad-Hard 32-bit Processor effort)
- (U) Joint Integrated Avionics Working Group (JIAWG)
- (U) US/France Bilateral MOU for development of advanced processing module set.
- (U) US/FRG Bilateral MOU (draft) for development of advanced video processing module set.
- (U) ASAAC MOU (draft) with France, Germany, and the United Kingdom.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: ASAAC MOU (draft) to develop a specification and NATO STANAG for an Advanced Avionics Architecture.

J. (U) MILESTONE SCHEDULE:

1.	(U)	Completed CSP	February 1989
2.	(U)	Completed integration of CSP, URR, SSPA	May 1989
3.	(U)	Stand alone test of VHSIC 1750	May 1989
4.	(U)	DAMES PI bus interoperability demo	August 1989
5.	(U)	Demonstrate flow through module cooling and ultra reliable electrical connector	April 1990
6.	(U)	DAMES VHSIC 1750 and high speed data bus interoperability demo	May 1990
7.	(U)	VHSIC 32-bit design complete	June 1990
8.	(U)	Active Star Coupler test	August 1990
9.	(U)	Multi chip package for modules and optical connector/backplane design complete	February 1991
10.	(U)	Integrated Maintenance system demo	May 1991
11.	(U)	VHSIC 32-bit breadboard delivered	August 1991

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603112F
PE Title: Advanced Materials for Weapons Systems

Budget Activity: #2 - Adv Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2100 Laser Hardened Materials	*0	7,100	11,792	Cont	TBD
3153 Nondestructive Inspection Development	*0	1,539	3,050	Cont	TBD
3946 Materials Transition	0	0	200	Cont	TBD
	*0	8,639	15,042	Cont	TBD

*Project 2100 was funded in Program Element 0603211F, Aerospace Structures and Materials, at $8.487M in FY 1989. Project 3153 was also funded in Program Element 0603211F at $2.017M in FY 1989, for a total of $11,066M.

B. (U) BRIEF DESCRIPTION OF ELEMENT: Program Element 0603112F, Advanced Materials for Weapon Systems, was created from the materials portion of Science and Technology Program Element 0603211F, Aerospace Structures and Materials, to accelerate the transition of materials to current and future weapon systems. Future Air Force systems will rely on materials technology for increased performance, longer life, improved reliability and maintainability, and low producibility costs. Currently no program exists to transition new materials into Air Force systems other than projects 2100 and 3153. New developments in Program Element 0602102F, Materials, have had to wait for an advanced development component demonstration or manufacturing technology demonstration in order to complete the material developments. Beginning in FY 1991 Project 3946 will develop the necessary processing and scale-up data on new classes of advanced materials to shorten transition time into their respective applications. Currently this Advanced Development program demonstrates subsystem applications of hardening techniques against low, medium, and high power laser threats in mission scenarios and advanced nondestructive inspection techniques for Air Force systems. These new technologies are required to provide current and new aerospace systems the capabilities to protect against laser threats and to reliably inspect aerospace structures.

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

1. (U) Project 3153, Nondestructive Inspection Development: Develops and accelerates the integration, demonstration, and application of new ultrasonic, electromagnetic, radiographic, thermal, and chemical nondestructive inspection/evaluation technology to satisfy critical depot level and initial manufacturing quality, integrity, and safety assurance requirements. Demonstrates, validates, and transfers new

Program Element: #0603112F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Materials for Weapons Systems

or greatly improved defect detection/evaluation capabilities. Tailors new methodology to satisfy specific critical nondestructive inspection/evaluation (NDI/E) requirements, such as inspection for hidden corrosion. Improves methods and equipment to significantly increase consistency, reliability, and cost-effectiveness of NDI/E procedures.

(U) FY 1989 Accomplishments:
- (U) Continued developing breadboard backscatter imaging X-Ray Computed Tomography (XCT) system with higher than conventional capability X-ray source.
- (U) Completed XCT techniques for inspecting electronic piece parts and closed systems, such as sealed thermal batteries.

(U) FY 1990 Planned Program:
- (U) Continue the major testing and validation efforts on new XCT equipment and procedures.

(U) FY 1991 Planned Program:
- (U) Complete validation testing and document cost effective procedures and equipment specifications for critical applications of XCT systems.
- (U) Begin developing several prototype NDI systems that will rapidly locate damage sites on large area composite structures and have accept/reject capability for greatly enhanced supportability. To be demonstrated in FY 95.
- (U) Initiate program to develop portable real-time filmless X-ray NDI system for use by field and maintenance depot personnel. To be demonstrated in FY 95.
- (U) Initiate program to develop an impact damage detection technique that will rapidly identify damage sites which exceed a specific impact energy threshold level to save inspection time and improve sortie generation rate. To be demonstrated in FY 95.

(U) Work Performed By: This project is managed by the Materials Laboratory, Wright-Patterson AFB OH. The two contractors are Northrop Aircraft Co., Hawthorne CA; and Boeing Aerospace Co., Seattle WA.

(U) Related Activities:
- (U) Program Element #0602102F, Materials
- (U) Program Element #0708011F, Industrial Base Program.
- (U) Integrated with the Air Force NDI Program Office, San Antonio TX.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None

Program Element: #0603112F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Materials for Weapons Systems

2. (U) Project 3946, Materials Transition: Develops necessary processing and scale-up data on new classes of advanced materials to shorten transition times into their respective applications. Work efforts focus on applying a material's capabilities to a system's needs. Develops the understanding needed to prove manufacturing feasibility and reliable properties/performance behavior for the intended use of the material. Provides detailed characterization data (engineering data and failure/fatigue behavior) for immediate application by the intended subsystem/component designers.

(U) FY 1989 Planned Program:
- (U) Not applicable.

(U) FY 1990 Planned Program:
- (U) Not applicable.

(U) FY 1991 Planned Program:
- (U) Initiate program to develop necessary materials transition data for nickel aluminide alloys to be used as low density alloy materials for turbine engine components and as single crystal materials for turbine engine blades in support of the Integrated High Performance Turbine Engine Technology (IHPTET) program. Will yield a 25 to 35% weight savings and a 50% reduction in cost over current superalloys and refractory metals used in turbine engines.

(U) Work Performed By: To be determined by competitive source selection in FY 1991.

(U) Related Activities:
- (U) Program Element #0602102F, Materials
- (U) Program Element #0603211F, Aerospace Structures
- (U) Program Element #0603202F, Aerospace Propulsion Subsystem Integration.
- (U) Program Element #0603216F, Aerospace Propulsion and Power Technology.
- (U) Program Element #0708011F, Industrial Base Program.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603112F
PE Title: Advanced Materials for Weapons Systems
Project Number: 2100
Budget Activity: #2 - Adv Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Laser Hardened Materials	*0	7,100	11,792	Cont	TBD

*Project 2100 was funded in Program Element 0603211F, Aerospace Structures and Materials, at $8.487M in FY 1989.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES: This project develops and demonstrates new materials and design concepts for protecting Air Force space and airborne systems and personnel against laser radiation. A significant threat exists for all Air Force systems and aircrews. It is projected to grow considerably in the near term. The goal is to ensure system mission accomplishment both during and after the laser threat encounter. Specific goals include protection against interference of automated subsystems (spoofing), denial of information to subsystems (jamming), and functional damage. Approaches are demonstrated on representative hardware to ensure that validated hardening options are available for transition to Air Force systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Began developing near term broadband laser eye protection.
   - (U) Initiated program to evaluate laser vulnerability of aircraft structures.
   - (U) Initiated programs to generate five separate innovative optical sensor designs which provide for both laser survivability and performance.
   - (U) Conducted laser survivability and performance testing on a laser hardened visible-near infrared sensor.
   - (U) Conducted laser survivability and performance testing of a high temperature laser hardened transparency material.

2. (U) FY 1990 Planned Program:
   - (U) Begin testing advanced broadband laser eye protection for tactical aircrews.
   - (U) Critically review the five innovative optical sensor designs and transition them to system designers.
   - (U) Critically review the broadband laser eye protection concepts

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PE Title: Advanced Materials for Weapons Systems
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for MAC and SAC aircrews.
- (U) Complete testing the hardened reconnaissance optics system in preparation for transitioning the design to system designers.

4. (U) FY 1991 Planned Program:
   - (U) Test high temperature laser hardened transparency materials.
   - (U) Continue testing advanced broadband laser eye protection.
   - (U) Initiate program to protect tactical aircrews from variable frequency (agile) lasers.
   - (U) Initiate program to develop necessary data for transitioning hardening materials to aeronautical systems.
   - (U) Select, fabricate, and test components to evaluate laser vulnerability of aircraft structural materials. Model damage and assess system and mission implications.
   - (U) Continue other efforts.

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

D. (U) WORK PERFORMED BY: This program is managed by the Materials Laboratory, Wright-Patterson AFB OH. The top five contractors are McDonnell-Douglas Corp, St Louis MO; Texas Instruments, Dallas TX; Honeywell, Bloomington MN; Loral, Phoenix AZ; and Illinois Institute of Technology Research Institute, Chicago IL.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: The differences in milestones are due solely to FY 1990 budget reductions of $4.477M ($1.477M by DOD, $3.000M by Congress) for the Program Element, which led to a $3.538M reduction in funding for this project.
   - (U) Delays the Variable Frequency Laser Eye Protection Critical Design Review (CDR) from Mar 90 to Mar 93, which delays the transition of this broad band eye protection for tactical aircrews from Mar 91 to Mar 94.
   - (U) Delays the final test on Out-of-Band Protection for Canopies and Structures from Dec 91 to Dec 92, which delays the availability of this protective concept for all aircraft from Dec 92 to Dec 93.
   - (U) Delays the CDR on "Smart" Laser Eye Protection for aircrews and sensors (a considerable improvement over variable frequency protection) from Jun 91 to Jun 94, which delays transition of these protective concepts from Oct 92 to Oct 96.
   - (U) Delays the start of the Optical Switches contract from Sep 91 until Sep 92, which delays the transition of this true broad band protective concept from Sep 94 to Sep 95.
3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) Program Management Directive (PMD) 2140(16)/0603211F

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- (U) AF SON 505-87, Aircrew Ocular Laser Protection, 11 Oct 88
- (U) SAC SON 17-87 (Draft), Integrated Protection Aircraft Transparency, 1 May 87

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0602102F, Materials.
- (U) Program Element #0602202F, Human Systems Technology.
- (U) Program Element #0603231F, Crew Systems Technology.
- (U) Program Element #0604706F, Aircrew Laser Technology.
- (U) Program Element #0708011F, Industrial Base Program.
- (U) Coordinated with other Department of Defense and government activities through the Triservice Laser Hardening Materials and Structures Working Group
- (U) No unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

1.	(U) Balanced (Performance/Hardening) Sensor Program Critical Design Review (CDR)	Jan 1990
2.	(U) Optical Switches Contract Start	Sep 1992
3.	(U) Out-of-Band Protection for Canopies and Structures Test	Dec 1992
4.	(U) Variable Frequency Laser Eye Protection CDR	Mar 1993
5.	(U) "Smart" Laser Eye Protection for Aircrews CDR	Jun 1994
6.	(U) Survivable High Performance [All-Purpose] Sensor CDR	Dec 1994

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603202F
Title: Aircraft Propulsion Subsystem Integration
Project Number: 668A
Budget Activity: #2 Adv Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Title Aircraft Propulsion Subsystem Integration (APSI)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
APSI	20,666	20,527	28,404	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This Science and Technology program provides for the design, development, test and assessment of advanced air-breathing propulsion system technologies applicable to a broad range of subsonic, transonic/supersonic, and high Mach aircraft. Its objective is to functionally demonstrate and assess advanced turbine propulsion system component and integration technologies. The payoff of this program is improved engine structural durability, lifecycle cost, and performance along with enhanced airframe/propulsion system integration. The APSI program has three distinct tasks. Task I deals with system component technology such as advanced low pressure fans and turbines, engine controls, and nozzles. Task II includes demonstrator engines such as the Joint Technology Demonstrator Engine (JTDE) for manned systems and the Expendable Turbine Engine Concept (ETEC) for missile applications. These demonstrator engines apply the core technology developed under the Advanced Turbine Engine Gas Generator (ATEGG) program. Task III deals with system integration problems such as inlet and nozzle engine/airframe integration and low observable technologies. This program will provide aircraft systems with a potential for longer range, higher cruise speed with lower specific fuel consumption, surge power for successful engagements, high sortie rates with reduced maintenance, reduced life cycle cost and improved survivability resulting in increased mission effectiveness. The APSI program is 100% committed to the Integrated High Performance Turbine Engine Technology (IHPTET) initiative. IHPTET is a three phase, totally integrated DOD, DARPA, NASA, and Industry effort focused on doubling turbine engine propulsion capability by the year 2003 (Advanced Tactical Fighter engine is the baseline).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Performed combined environmental and reliability testing on a man-rated fault tolerant electronic fuel control.
   - (U) Rig tested Expendable Turbine Engine Concept (ETEC) technologies such as hybrid (ceramic/metallic) thrust bearings, ceramic turbine blades, and graphite/epoxy composite fan.
   - (U) Wind tunnel tested engine/aircraft integration concepts for supersonic cruise fighters with both Conventional Take Off and Landing and Short Take Off and Vertical Landing (STOVL).
   - (U) Completed signature tests of an advanced cruise missile prop fan.

Program Element: #0603202F
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- (U) Rig tested a high efficiency compressor fan with swept aerodynamic blading. This fan produced a 3% gain in efficiency with a 20% decrease in fan rotor weight.

2. (U) FY 1990 Planned Program:
   - (U) Initiate testing of the Pratt and Whitney Joint Technology Demonstrator Engine (JTDE) for IHPTET Phase I. This will demonstrate fighter engine technologies with a 10% improvement in thrust-to-weight and 20% fuel savings.
   - (U) Conduct sea level engine testing of ETEC missile demonstrators at selected subsonic and supersonic conditions.
   - (U) Conduct altitude testing of the Garrett ETEC demonstrator engine at Arnold Engineering Development Center.
   - (U) Initiate next generation ETEC program jointly with Navy (JETEC), to include prop fan technology for improved fuel efficiency.
   - (U) Initiate design of multifunctional (thrust vectoring/reversing) exhaust nozzle. This nozzle will provide future aircraft with pitch and yaw vectoring capability.
   - (U) Wind tunnel test advanced engine/airframe integration concepts for supersonic cruise fighters.

3. (U) FY 1991 Planned Program:
   - (U) Begin testing General Electric JTDE for IHPTET Phase I.
   - (U) Continue testing the Pratt & Whitney JTDE for IHPTET Phase I.
   - (U) Begin design and fabrication of key components for the Joint Air Force/Navy ETEC demonstrators.
   - (U) Begin hardware fabrication of multifunctional nozzle. This nozzle will be tested on the Pratt & Whitney JTDE in FY 1993.
   - (U) Engine test a DARPA uncooled carbon/carbon turbine in a ETEC demonstrator.
   - (U) Conduct wind tunnel testing of Mach 4-6 advanced inlets and nozzles.

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

D. (U) WORK PERFORMED BY: This program is managed by the Aero Propulsion and Power Laboratory of the Wright Research and Development Center, Wright-Patterson AFB OH. The current contractors involved in this program are: Allison Gas Turbine Division, Indianapolis IN; Garrett Engine Division, Phoenix AZ; General Electric, Evendale OH; Lockheed, Rye Canyon CA; Pratt & Whitney Aircraft, West Palm Beach FL; Teledyne/CAE, Toledo OH; and Williams International, Walled Lake MI.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: None

Program Element: #0603202F
Title: Aircraft Propulsion Subsystem Integration

Project Number: 668A
Budget Activity: #2 Adv Technology Development

F. (U) PROGRAM DOCUMENTATION: N/A

G. (U) RELATED ACTIVITIES:

- (U) Exploratory development base provided by Aerospace Propulsion PE 0602203F, and PE 0602122N, Materials PE 0602102F, and Aerospace Flight Dynamics PE 062201F.
- (U) Closely related to Advanced Turbine Engine Gas Generator (ATEGG) Project 681B, PE 0603216F which is managed from same office and provides core gas generator development efforts.
- (U) Integrated with the Navy PE 0603210N Advanced Aircraft Propulsion Systems, basis for cooperative Air Force/Navy demonstration of advanced engine technology. The Air Force and the Navy currently have formal Memorandums of Understanding covering efforts under the Joint Technology Demonstrator Engine (JTDE) program and the Joint Expendable Turbine Engine (JETEC) concept program.
- (U) Part of DOD Integrated High Performance Turbine Engine Technology (IHPTET) initiative which combines efforts of Air Force, Navy, Army, DARPA, and NASA in advanced aerodynamics, materials, and innovative design capability. The goal of IHPTET is to demonstrate minimum weight, high core power engine technology that offers at least 100% improvement over state-of-the-art technology by the year 2003.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1.	(U) High Efficiency Swept Fan Test	Aug 1989
2.	(U) Expendable Turbine Engine Concepts (ETEC) Tests	Dec 1989
3.	(U) Test Mach 2-3 aircraft/engine inlets	Apr 1990
4.	(U) ETEC Altitude testing at AEDC	Aug 1990
5.	(U) JTDE Tests for IHPTET Phase I	Dec 1990
6.	(U) Test Mach 4-6 aircraft/engine inlets and nozzles	Jun 1991
7.	(U) Joint Air Force/Navy ETEC tests	Oct 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
69CK Advanced Electronics	4,028	4,210	5,400	Cont	TBD
69DF Attack Management	2,996	4,000	5,188	Cont	TBD
665A Electro-Optical Targeting Sensors	5,775	5,342	7,001	Cont	TBD
1177 Non-Cooperative Identification Techniques	4,842	3,314	5,240	Cont	TBD
2334 Airborne Radar Electronic Counter-Countermeasures	4,033	5,015	6,177	Cont	TBD
2345 Covert Airborne Communications	2,048	2,550	3,302	Cont	TBD
2746 Low Probability of Intercept Communications	777	0	0	0	NA
Total	24,499	24,431	32,308	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Principal Air Force source for development of advanced avionics technology to find, identify, and attack targets. Technology supports improvements in fire control for both air and ground targets; target identification; electro-optical sensors for target identification and acquisition; electronic counter-countermeasures for tactical airborne radars; and covert airborne communications. The program element also supports development of advanced electronic devices for military needs. Projects 2746 and 2345 combined in FY 90 due to FY 88/89 congressional reductions. The funding increase in the outyears recovers the program after congressional reductions to the FY 88/89 programs. Focus of this growth is on improving positive target identification; monolithic device packaging to reduce power/weight and improve reliability; and attack management, electro-optical sensor, and radar counter-countermeasures to improve performance of weapon systems in hostile environments.

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

1. (U) Project 69CK, Advanced Electronics: The requirements for electronic component technologies developed in this project stem from military needs that cannot be satisfied by commercially available products. Currently, efforts support the major thrusts of reducing cost of ownership and enhancing system/subsystem performance through development of improved components. Efforts in this project support application for multifunctional microwave fire control radar, electronic warfare systems and electronic devices and device architectures to enable congressionally mandated integrated/modular avionics goals to be meet. This project also develops laser sources, detectors, and integrated optics for aerospace electro-optical

sensors and countermeasures applications.

(U) FY 1989 accomplishments:
- (U) Achieved power supply module development goals of high reliability (200,000 hours), high efficiency (95%), and high density (200 watts/pound) for application with high speed integrated circuits.
- (U) Combination of active/passive (hybrid) radar array approaches defined to reduce high cost of solid state array (aperture) implementations.

(U) FY 1990 Planned Program:
- (U) Complete design of hybrid array architectures as low cost alternatives to conventional solid state phased array.
- (U) Complete fabrication architecture studies on digital packaging and interconnect technology for improving signal processor performance via dense packaging/short interconnects.

(U) FY 1991 Planned Program:
- (U) Complete development of improved performance (power conversion efficiency) airborne X-band radar transmit and receive solid state array monolithic modules.
- (U) Deliver advanced microwave radar array module packages as part of the thrust to reduce active array radar costs.
- (U) Array level interconnect architectures defined which substantially reduces cost and volume and improves reliability of aerospace antennas and signal/data processors.

(U) Work Performed By: The Electronics Technology Laboratory, Wright-Patterson AFB OH, manages this project. Major contractors are: Hughes Aircraft, El Segundo CA; Texas Instruments, Dallas TX; General Electric, Syracuse NY; AT&T, Parsipenny NJ; and Rockwell, Thousand Oaks CA.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603706E, Microwave and Millimeter Wave Monolithic Integrated Circuits.
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 69DF, Attack Management: Current avionic suites contain independent subsystems which are not effectively integrated to help the pilot under combat conditions. This project alleviates attack deficiencies against both air and surface targets by providing intraflight mission management, attack management decision aids,

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

integrated attack information presentation, fire control solutions and weapon launch modes.

(U) FY 1989 Accomplishments:
- (U) Completed integration of the Air-to-Air Attack Management design into real-time man-in-the-loop simulation.
- (U) Demonstrated single pass maneuvering, engagement and attack of multiple ground targets using near real-time simulations.

(U) FY 1990 Planned Program:
- (U) Verify Air-to-Air Attack Management pilot-vehicle interface design through pilot-in-the-loop simulation and transition as upgrades to air interceptor aircraft.
- (U) Define concepts to exploit real-time targeting information onboard advanced strike aircraft.
- (U) Complete and verify multiple target attack weapon delivery using real-time man-in-the-loop simulation.

(U) FY 1991 Planned Program:
- (U) Define targeting/fire control requirements for multi-role fighters for improved crew performance in battlefield air interdiction and defensive counterair missions.
- (U) Integrate state-of-the-art infrared target sensors with real-time automated target cueing to reduce pilot workload and increase strike effectiveness.
- (U) Define advanced weapon/fire control interface improvements to increase lethality of airborne weapon systems.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH, manages this project. Major contractors are: McDonnell Douglas, St Louis MO; Northrop Corporation, Hawthorne CA; Hughes Aircraft, El Segundo CA; and Martin Marietta, Orlando FL.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 665A, Electro-Optical Targeting Sensors: This project provides the electro-optical sensor technology necessary to achieve a precise, real-time, automatic tactical/strategic reconnaissance and targeting capability in adverse weather both day and night. It identifies and develops critical sensor technologies required to increase infrared sensor detection range by a factor of two over fielded system capabilities.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

(U) FY 1989 Accomplishments:
- (U) Determined critical component requirements for a dual band thermal imaging sensor. The goal is a two-fold range/accuracy improvement over LANTIRN and PAVE TACK.
- (U) Completed definition of an advanced multi-function air-to-air sensor to improve covert detection, warning and identification of airborne threats.

(U) FY 1990 Planned Program:
- (U) Complete design of a dual band thermal imaging sensor. The goal is a two-fold range/accuracy improvement over LANTIRN and PAVE TACK.
- (U) Complete design of an advanced multi-function air-to-air sensor that improves covert detection, warning, and identification of airborne threats.
- (U) Determine strategic targeting laser radar component requirements to give a five-fold improvement in range.

(U) FY 1991 Planned Program:
- (U) Demonstrate advanced dual band focal plane arrays and transition technology to LANTIRN and B-1B programs.
- (U) Start fabrication of critical components of the strategic targeting laser radar which has application for detecting concealed targets. Goal is to improve range performance five-fold.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH, manages this project. Major contractors are: Hughes Aircraft, El Segundo CA; Honeywell Inc, Lexington MA; and Rockwell, Anaheim CA.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603367F, Relocatable Target Capability.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 1177, Non-Cooperative Identification Techniques: Current technology permits recognition of threat aircraft from only a limited aspect (view) and at ranges that restrict the utility of current generation long range air-to-air missiles. This project develops and demonstrates the technologies required to achieve positive, high confidence, non-cooperative identification (NCID) of airborne and surface targets at ranges compatible with our tactical missiles, day or night, and in adverse weather.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

(U) FY 1989 Accomplishments:
- (U) Completed, in Phase II of the Automatic Radar Target Identification, ground-to-air validation of NCID algorithms using real and synthetic data sets for higher confidence identification.
- (U) Developed intra-radar techniques and algorithms for airborne radar air target identification exploiting available aircraft signatures from operational fire control radars.

(U) FY 1990 Planned Program:
- (U) Demonstrate multi-sensor non-cooperative identification (NCID) based on attribute level fusion of sensor inputs and target signature models.
- (U) Transition initial interface control documents to industry for integration of positive NCID capability into airborne attack radars.

(U) FY 1991 Planned Program:
- (U) Complete intra-radar target identification algorithms and transition as upgrades to existing Service air interceptor aircraft.
- (U) Complete initial set of validated all aspect identification algorithms and synthetic data base generation techniques and transition to aircraft development/upgrade programs.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH, manages this project. Major contractors are: General Dynamics, Pomona CA; Georgia Tech Research, Atlanta GA; Hughes Aircraft, El Segundo CA; and Honeywell Inc, Minneapolis MN.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603742F, Combat Identification System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 2334, Airborne Radar Electronic Counter-Countermeasures (ECCM): Current and future airborne weapon system radars must be able to operate in an intense electronic combat environment. This project develops technologies and concepts for reduction of susceptibilities of fire control radars to enemy electronic countermeasures and is an integral part of the DOD Electronic Combat Plan.

(U) FY 1989 Accomplishments:
- (U) Completed design and identified critical components for a very wideband adaptive multimode radar system concept which will demonstrate improved ECCM capability.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Avionics

- (U) Verified advanced ECCM techniques and transitioned an ECCM solution to appropriate airborne systems.

(U) FY 1990 Planned Program:
- (U) Demonstrate the offensive ECCM concept of simultaneous transmit and receive to counter electronic countermeasure effects upon airborne radars.
- (U) Demonstrate critical component/technology for a very wideband adaptive multimode radar system concept that will improve electronic counter-countermeasures (ECCM) capability.

(U) FY 1991 Planned Program:
- (U) Continue hardware upgrade and demonstrate key elements of the simultaneous transmit and receive capability.
- (U) Develop and fabricate key components that will improve the ECCM capability for a very wideband adaptive multimode radar system concept.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH, manages this project. Major contractors are: Hughes Aircraft Company, El Segundo CA; Raytheon Company, Bedford MA; and Georgia Tech Research Institute, Atlanta GA.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 2345, Covert Airborne Communications: Current radio system detectability must be reduced to keep communication emissions from being the mechanism by which low observable airborne platforms are detected and located. Fielded spread spectrum radios are designed to maximize jam resistance with little regard applied to covertness. Current reconnaissance/intelligence data links do not have jam resistant wideband imagery channels. Current air-to-air data link acquisition and reacquisition technology requires waypoint planning which is time consuming and non-reactive to changes in threat locations. This project provides the technology to improve these areas.

(U) FY 1989 accomplishments:
- (U) Designed a wide bandwidth spread spectrum modem for air-to-air covert reconnaissance/intelligence data links.
- (U) Completed design of key subsystem (voice encoder) for application in a low data rate L-band covert radio terminal.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

(U) FY 1990 Planned Program:
- (U) Complete fabrication and laboratory checkout of an air-to-air data link spread spectrum modem.
- (U) Complete design of a low data rate covert L-band radio terminal.
- (U) Complete design of antennas and receiver/transmitter subsystems for use in air-to-air data link systems.

(U) FY 1991 Planned Program:
- (U) Complete fabrication and laboratory checkout of an air-to-air data link for reconnaissance/intelligence applications.
- (U) Fabricate low data rate L-band covert radio terminal that will improve communications performance in a hostile environment.
- (U) Perform detailed design of low probability of intercept intra-flight data link system that will improve mission management.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH, manages this project. Major contractors are Unisys, Salt Lake City UT and Qualcomm, San Diego CA.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0207217F, Tactical Air Reconnaissance System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603205F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Vehicle Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2506 Control of Flight	8,627	849	3,112	Cont	TBD
2508 Aeromechanics/Vehicle Subsystems	2,165	299	2,250	Cont	TBD
2978 Reliability and Maintainability	4,791	4,086	5,875	Cont	TBD
3422 Integrated Control/Avionics Technology	5,446	12,915	10,101	Cont	TBD
TOTAL	21,029	18,149	21,338	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Develops and validates component technologies for improved aerodynamics, flight control systems and vehicle subsystems for current and future aircraft. Emphasis is on improved reliability and maintainability (R&M), performance, and survivability at lower cost. PE 0603245F, Advanced Flight Technology Integration, flight tests technologies developed in this PE.

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

1. (U) Project 2506, Control of Flight: Develops flight control technologies which include integration of flight/propulsion control and vehicle management system (VMS) technologies for improved total aircraft efficiency, performance and maneuverability. Specifically this project (1) develops and validates new hydraulic and electric control surface actuation systems to reduce weight, volume and power for future aircraft applications. (2) Develops the technology to demonstrate a short takeoff and landing (STOL) capability and improve maneuverability for future fighters by designing, fabricating, and using pitch axis thrust vectoring/reversing (TV/TR) exhaust nozzles. (3) Develops and validates a fault tolerant, integrated flight and propulsion control system to optimize vehicle performance over all flight phases (fault tolerant software and architecture insures flight safety and reliability). And (4) develops improved control and maneuverability technology (multi-axis thrust vectoring nozzles) at reduced weight, radar cross section and drag to improve aircraft lethality and survivability. Increased FY91 funding reflects electric actuator testing starting and integrated flight/propulsion work gearing up.

(U) FY 1989 Accomplishments:
- (U) Fabricated and installed TV/TR exhaust nozzles on F-15 Short Takeoff and Landing/Maneuver Technology Demonstrator (STOL/MTD) aircraft.

Program Element: #0603205F Budget Activity: #2 - Adv Tech Devel
Title: Aerospace Vehicle Technology

- (U) Transferred STOL/MTD flight/nozzle control data to the Advanced Tactical Fighter.

(U) FY 1990 Planned Program:
- (U) Complete STOL/MTD maneuver enhancement nozzle cooling and thrust reversing actuator design and installation.
- (U) Conduct system level verification of an advanced infrared sensor for use in the STOL/MTD landing guidance system.

(U) FY 1991 Planned Program:
- (U) Complete component flight test of electric actuator mounted on standard F-18 aileron.
- (U) Develop predesign for fault tolerant integrated flight/ propulsion control system.
- (U) Complete assessment and payoff of multi-axis thrust vectoring nozzle and tactics.

(U) Work Performed By: Project managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. The two contractors are MCAIR, St Louis, MO STOL/MTD, and General Dynamics, Forth Worth TX.

(U) Related Activities:
- (U) PE 0603245F, Advanced Flight Technology Integration
- (U) PE 0603230F, Advanced Tactical Fighter
- (U) PE 0602201F, Aerospace Flight Dynamics
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2508, Aeromechanics/Vehicle Subsystems: Develops aerodynamic technologies for improved aircraft flight maneuverability, and develops subsystem technologies for improved air vehicle performance, and reliability at lower cost. Includes (1) the Hybrid Laminar Flow Control (HLFC) program which designs, fabricates and ground tests a wing leading edge suction concept producing less drag on transport aircraft wings; estimated to yield fuel savings of 15% for derivative and future transport aircraft; (2) development of the aerodynamic technologies needed to support smooth skin, variable camber wings; (3) low drag, low observable, external weapon carriage concepts for incorporating air-to-surface weapons on present, derivative and new fighter aircraft; and (4) Integrated Closed-Loop Environmental Control System (ICECS) development and test for reduced weight or increased range. Increased FY 91 funding reflects ICECS hardware testing taking place.

(U) FY 1989 Accomplishments:
- (U) Completed design engineering and started hardware fabrication for the HLFC system.

Program Element: #0603205F Budget Activity: #2 - Adv Tech Devel
Title: Aerospace Vehicle Technology

- (U) Demonstrated a 35% per flight hour reduction in wing maintenance using a fully enclosed variable camber wing.

(U) FY 1990 Planned Program:
- (U) Complete hardware fabrication, installation, and start ground testing the HLFC system on a Boeing 747 aircraft.
- (U) Conduct low drag, low observable weapon carriage wind tunnel experiments.

(U) FY 1991 Planned Program:
- (U) Complete ground testing of the HLFC system.
- (U) Complete electromagnetic and wind tunnel testing of low observable external weapons carriage.
- (U) Complete ICECS "g" load testing on centrifuge to provide cost efficient representative flight environment testing.

(U) Work Performed By: Project managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. The two contractors are Boeing, Seattle WA and Allied Signal, Torrance CA.

(U) Related Activities:
- (U) PE 0603245F, Advanced Flight Technology Integration.
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 2978, Reliability and Maintainability: Designs and develops air vehicle technologies for improved reliability, maintainability and supportability while increasing survivability and repairability of failed and damaged systems. Includes the following programs: (1) the Self-Repairing Flight Control System (SRFCS) program develops reconfiguration for aerodynamic surfaces, and expert maintenance diagnostics for flight control systems to increase aircraft battle damage survivability, reduce the complexity and number of actuators required to control an aircraft and aid flight-line maintenance; (2) the Integrated Environmentally Engineered Electronics (IEEE) program develops and demonstrates a fracture mechanics design approach for electronic components, desensitizing them to temperature and vibrations, thus making them more reliable; (3) the Aircraft Battle Damage Repair (ABDR) program develops and demonstrates field repairs for battle damaged aircraft, geared towards increasing aircraft availability and sortie rates; (4) the multi-axis SRFCS program will extend the application of the primary technologies developed under SRFCS by including propulsion system and thrust vectoring for control of the vehicle after reconfiguration. In the flight control maintenance diagnostic area, the program will be compatible with other systems. For instance, the ground system will be compatible with the

Program Element: #0603205F Budget Activity: #2 - Adv Tech Devel
Title: Aerospace Vehicle Technology

Integrated Maintenance Information System (IMIS) being developed for Logistics Command, and the on-board system will be compatible with VMS achitectures and allow for extension and/or coexistance with other vehicle diagnostic systems. Increased FY 91 funding indicates added emphasis on R&M to significantly reduce the cost of ownership for current and future systems.

(U) FY 1989 Accomplishments:
- (U) Simulated reconfiguration of future fighter aircraft during combat engagement/disengagement.
- (U) Fabricated and inspected IEEE specimens basesd on APG-63 component failure data and used fracture mechanics models for initial specimen validation.
- (U) Demonstrated and evaluated fiber optic inspection device concept for inspecting inaccessible spaces on damaged aircraft.

(U) FY 1990 Planned Program:
- (U) Field demonstrate SRFCS maintenance diagnostics for an analog and digital F-16 flight control system.
- (U) Conduct IEEE hardware testing in a combined environmental (temperature and vibration) test facility and correlate results with analytical models.
- (U) Continue ABDR hardware orientated quick aircraft repair systems development for highly composite aircraft.

(U) FY 1991 Planned Program
- (U) Make the SRFCS maintenance diagnostic system compatible with Logistic Command's IMIS system.
- (U) Start multi-axis SRFCS predesign work.
- (U) Using F-15 radar components, demonstrate IEEE application to operational hardware.
- (U) Complete ABDR aircraft integral fuel tank repair system development.

(U) Work Performed By: Project managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. The five contractors are MCAIR, St Louis MO; GE, Binghamton NY; Hughes Aircraft, El Segundo CA; Booz-Allen, Dayton OH; and Honeywell Inc., Minneapolis MN.

(U) Related Activities:
- (U) PE 0603245F, Advanced Flight Technology Integration.
- (U) PE 0603106F, Logistics Systems Technology.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603205F Project Number: 3422
Title: Aerospace Vehicle Technology Budget Activity: #2 Adv Tech Devel

A. (U) RESOURCES ($ in Thousands)

Project Title Integrated Control/Avionics Technology

Popular Name	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Integrated Control and Avionics for Air Superiority, ICAAS	5,446	12,915	10,101	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Integrated Control and Avionics for Air Superiority (ICAAS) program develops advanced flight guidance/control and pilot/vehicle interface component technologies needed to enable fighter aircraft to kill and survive when outnumbered in air combat; the targeted kill ratio is 10:1. Focus is on beyond-visual-range, all the way to close-in air-to-air combat, optimum missile engagement and threat avoidance. A mission environment simulation and crew station synthesis capability will be developed to augment ICAAS performance and effectiveness assessment; this will be an in-house capability. PE 0603205F will focus on engineering design and multi-aircraft engagement ground simulation work. PE 0603245F will reduce integration risk and validate ICAAS engagement/threat avoidance software through flight testing.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Evaluated preliminary ICAAS designs and down selected to a single contractor.
   - (U) Matured preliminary ICAAS designs into a final integrated design.

2. (U) FY 1990 Planned Program:
   - (U) Develop ICAAS aircraft engagement software and hardware specifications for (2 vs 8) simulation and (2 vs 4) flight test.
   - (U) Start engineering design for 4 friendly internetted (data linked) fighters vs 16 enemy aircraft.
   - (U) Develop ICAAS mission environment simulation and crew station capability.

3. (U) FY 1991 Planned Program:
   - (U) Conduct ICAAS 2 vs 8 internetted simulations.
   - (U) Update ICAAS software based on computer simulations and flight test.
   - (U) Complete engineering design for 4 vs 16 aircraft simulation.

D. (U) WORK PERFORMED BY: Project managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. The Flight Dynamics Lab will conduct in-house mission simulations and crew station development in support of ICAAS performance and effectiveness evaluation. The only contractor is MCAIR, St Louis MO.

Program Element: #0603205F Project Number: 3422
Title: Aerospace Vehicle Technology Budget Activity: #2 Adv Tech Devel

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC SON 002-86 Improved Interceptor (Draft).
- (U) TAF SON 310-85 Air Defense Aircraft, 7 Jan 86.
- (U) TAF SON 304-83 Advanced Tactical Fighter, 9 Nov 84.
- (U) TAF SON 321-82 Dual Role Fighter, 5 Jan 84.

G. (U) RELATED ACTIVITIES:
- (U) PE 0603245F, Advanced Flight Technology Integration. Flight tests technologies developed in this PE.
- (U) PE 0603231F, Crew Systems and Personnel. Provides human factors principles to cockpit design methods.
- (U) PE 0603230F, Advanced Tactical Fighter (ATF)
- (U) No duplication of effort within the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- (U) Contractor down selection conducted	1 Qtr 89
- (U) Critical Design Review (CDR) conducted	4 Qtr 90
- (U) Mission Environment simulation and crew station capability completed for ICAAS performance and effectiveness assessment	4 Qtr 90
- (U) Two friendly vs eight enemy fighter (2 vs 8) simulation testing started	1 Qtr 91
- (U) ICAAS system validation and assessment completed	4 Qtr 92

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603211F Budget Activity: #2 - Adv Tech Devel
PE Title: Aerospace Structures

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
69CW Advanced Composites	7,410	8,571	9,795	Cont	TBD
486U Advanced Metallic Structures	8,610	8,572	9,340	Cont	TBD
2100 Laser Hardened Materials	8,487	*0	*0	Cont	TBD
3153 Nondestructive Inspection Development	2,017	*0	*0	Cont	TBD
	26,524	17,143	19,135	Cont	TBD

*In FY 1990, Projects 2100 and 3153 transferred to Program Element 0603112F, Advanced Materials for Weapon Systems, in order to accelerate transition of advanced materials.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Advanced Development program demonstrates advanced structural design concepts using new or improved metallic (486U) nonmetallic (69CW) and materials. More damage tolerant, reliable, maintainable and durable structures of lighter weight and lower cost are developed for aerospace application.

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

1. (U) Project 69CW, Advanced Composites: This project develops advanced nonmetallic structures technology using carbon-carbon, thermoplastic, and ceramic materials. These technologies will enhance low observability and survivability, reduce weight, and decrease life cycle costs for Air Force aircraft, missiles, and space systems.

(U) FY 1989 Accomplishments:
- (U) Flight tested of high temperature thermoplastic F-15 engine access doors and F-16 main landing gear doors which are low weight, damage tolerant non-load bearing structures.
- (U) Tested carbon-carbon nozzle flap surfaces on an F-110 engine to demonstrate operational durability.

(U) FY 1990 Planned Program:
- (U) Flight test A-10 thermoplastic composite trailing edge flap.
- (U) Develop combined infrared and radar absorbing low observable structures for aircraft and missile applications.
- (U) Design ceramic composite turbine engine nozzle component to demonstrate radar signature attenuation and weight savings.

Program Element: #0603211F Budget Activity: #2 - Adv Tech Devel
PE Title: Aerospace Structures

(U) FY 1990 Planned Program:
- (U) Fabricate elevated temperature aluminum structures designed as a lower cost replacement for titanium.
- (U) Initiate development of a metal matrix composite compressor with operating temperature to 1400°F, an increase over the current 1100°F, for use in advanced jet engines.
- (U) Test metal matrix composite fighter vertical stabilizers to demonstrate weight and strength advantages over current metals.

(U) FY 1991 Planned Program:
- (U) Complete ground testing and evaluation of hybrid structure components and transition to advanced aircraft programs.
- (U) Initiate programs demonstrating Rapid Solidification Technology alloys and ultralightweight airframes to significantly reduce the acquisition cost and weight (thus increasing performance) of aircraft.
- (U) Complete preliminary design of metal matrix composite large space structure with advanced damping initiated in FY 1989.

(U) Work Performed By: This program is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB OH. The major contractors include: Lockheed Aeronautical Systems Corp, Marietta GA and Burbank CA; Northrop Corp, Hawthorne CA; McDonnell Douglas Corp, St Louis MO; General Dynamics Corp, Fort Worth TX; and General Electric Corp, Evendale OH.

(U) Related Activities:
- (U) Tri-Service Metal-Matrix Composite Steering Group.
- (U) PE 0708011F, Air Force Manufacturing Technology Program.
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0602102F, Materials.
- (U) PE 0603112F, Advanced Materials for Weapon System.
- (U) PE 0603224C, Survivability, Lethality, and Key Technologies.
- (U) Supports the DoD Integrated High Performance Turbine Engine Technologies (IHPTET) initiative.
- (U) This is a well coordinated project. No duplication occurs within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0603211F Budget Activity: #2 - Adv Tech Devel
PE Title: Aerospace Structures

(U) FY 1991 Planned Program:
- (U) Test the ceramic engine nozzle component designed in FY 1990 for structural soundness, leading to engine test in FY 1992.
- (U) Test low infrared observable structures for aircraft and missiles.
- (U) Fabricate and test a transparency system for future tactical aircraft to improve supportability, fuselage integration, man-machine interfaces (heads-up displays, crew ingress/ egress), combat survivability, and natural hazard survivability.

(U) Work Performed By: This program is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB OH. The major contractors include: Lockheed Aircraft Corp, Burbank CA; Northrop Corp, Hawthorne CA; McDonnell-Douglas Corp, St Louis MO; General Dynamics Corp, San Diego CA and Ft Worth TX; and Pratt & Whitney, West Palm Beach FL.

(U) Related Activities:
- (U) PE 0602102F, Materials.
- (U) PE 0602201F, Aerospace Flight Dynamics.
- (U) PE 0603112F, Advanced Materials for Weapon Systems.
- (U) PE 0708011F, Air Force Manufacturing Technology Program.
- (U) Supports the DoD Integrated High Performance Turbine Engine Technology (IHPTET) initiative.
- (U) This is a well coordinated project. No duplication occurs within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 486U, Advanced Metallic Structures: This project develops and demonstrates new metallic structures technology using metal matrix composites, rapidly solidified metal powders, advanced aluminum alloys, and advanced damping materials which offer the potential for significantly reducing the weight and life cycle cost of present and future aircraft, aeropropulsion, missile, and space systems. These structures will also have greater reliability and enhanced resistance to natural and man-made hostile environments.

(U) FY 1989 Accomplishments:
- (U) Combined metal matrix composite with advanced damping techniques for more rigid large space structures.
- (U) Used advanced metallic structures to design replacements for replace maintenance-prone aircraft parts on A-7, A-10, and F-111 aircraft. This will reduce life cycle costs.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603216F Budget Activity: #2 - Adv Technology Development
Title: Aerospace Propulsion and Power Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2480 Aviation Turbine Fuel Technology	748	0	1,000*	Cont	TBD
2697 Atmospheric Propulsion Concepts	3,605	4,362	7,518	Cont	TBD
3035 Aircraft Power Systems	2,903	2,416	4,236	Cont	TBD
3036 Battery Technology	614	0	0	Cont	TBD
681B Advanced Turbine Engine Gas Generator (ATEGG)	24,897	25,000	27,400	Cont	TBD
TOTAL	32,767	31,778	40,154	Cont	TBD

* FY 91 funding is exclusively for the demonstration of advanced, high thermal stability fuel technology, transitioning from PE 0602203F.

B. (U) BRIEF DESCRIPTION OF ELEMENT: These projects ensure a continuous development and demonstration of the most advanced turbine engine high pressure core components, advanced airbreathing engine concepts, and advanced power technology for all Air Force aerospace vehicles. Anticipated technology advances from this program include 35-60% reduction in aircraft takeoff gross weight and more than 100% range increase compared to state-of-the-art technology; on the order of 50% increased average missile velocity and terminal velocity for enhanced lethality; new high temperature fuels for propulsion and thermal management of advanced subsonic, supersonic and hypersonic vehicles; advanced aircraft power systems that use nonflammable hydraulic fluids; cold weather engine starting at -65°F from the present capability of +12°F; and a more-electric aircraft power concept with up to 400% reliability improvement over current hydraulic systems.

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

1. (U) Project 2480, Aviation Turbine Fuel Technology: Investigates new fuel sources to minimize cost and ensure continuous aviation fuel deliveries to the Air Force for conventional aircraft. Develops new fuel technology with high heat absorbing capability (endothermic) and high thermal stability hydrocarbon fuels (JP fuels) for future aircraft.

(U) FY 1989 Accomplishments:
- (U) Completed first generation endothermic fuel program by demonstrating the feasibility of an endothermic reaction with fuel, catalyst and heat exchanger.

Program Element: #0603216F Budget Activity: #2 - Adv Technology Development
Title: Aerospace Propulsion and Power Technology

(U) FY 1990 Planned Program:
- (U) Project is not funded and no effort is planned.

(U) FY 1991 Planned Program:
- (U) Initiate second generation endothermic fuel program to demonstrate new higher cooling capability liquids, more efficient catalyst, and a more compact heat exchanger reactor design. This is a follow-on effort to further develop technology that is transitioning from PE 0602203F.
- (U) Initiate a high temperature hydrocarbon fuel program to demonstrate a 100°F improvement in temperature capability for JP-8. This is a follow-on effort to further develop technology that is transitioning from PE 0602203F.

(U) Work Performed By: Project managed by the Aero Propulsion and Power Laboratory, Wright-Patterson Air Force Base OH. Contractors for the second generation endothermic and the high temperature hydrocarbon fuel programs will be chosen via competitive procurement.

(U) Related Activities:
- (U) Exploratory development base provided by Aerospace Propulsion, PE 0602203F.
- (U) Coordination with Army, Navy, DARPA, NASA, Department of Energy, industry, and academia is accomplished by joint projects and the DOD Mobility Fuels Committee.
- (U) No duplication of effort in the Air Force or the Department of Defense.

(U) Other Appropriated Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2697 Atmospheric Propulsion Concepts: Provides for the assessment and demonstration of unconventional airbreathing propulsion subsystems to assure future propulsion options for missiles and high Mach vehicles. The Variable Flow Ducted Ramjet (VFDR) concept sponsored by the project is an improved propulsion option for the AMRAAM Pre-Planned Product Improvement (P^3I) program.

(U) FY 1989 Accomplishments:
- (U) Verified VFDR gas generator/grain casting procedures by successfully producing void free grains.
- (U) Successfully tested VFDR gas generators with integrated valve throttling control system.

(U) FY 1990 Planned Program:
- (U) Expand technical scope of VFDR program to support technology transition into the AMRAAM Pre-Planned Product Improvement (P^3I) program in FY 93.

Program Element: #0603216F Budget Activity: #2 - Adv Technology Development
Title: Aerospace Propulsion and Power Technology

- (U) Select booster propellant for VFDR and initiate environmental and performance testing.
- (U) Initiate VFDR gas generator testing with flight weight engine hardware.

(U) FY 1991 Planned Program:
- (U) Validate VFDR components over a wide range of environmental/ flight conditions prior to full scale engine tests.
- (U) Continue the engine performance tests begun in FY 1990 to determine engine efficiency, durability and ramjet transition.
- (U) Conduct testing of port and inlet covers to preclude accidental ingestion of foreign objects into the VFDR engine.
- (U) Initiate VFDR Preliminary Flight Rating Test (PFRT) effort.

(U) Work Performed By: Project managed by Aero Propulsion and Power Laboratory, Wright-Patterson Air Force Base OH. The two contractors are Atlantic Research Corporation, Gainesville VA, and Hercules Inc, McGregor TX.

(U) Related Activities:
- (U) Exploratory development base provided by Aerospace Propulsion PE 0602203F, Materials PE 0602102F, and Aerospace Flight Dynamics PE 0602201F.
- (U) The Joint Army-Navy-NASA-Air Force (JANNAF) Propulsion Committee coordinates efforts to provide non-duplicative options for future missiles systems.
- (U) No duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 3035 Aircraft Power Systems: Develops and demonstrates aircraft power systems such as hydraulics, engine starters, auxiliary power units (APU) and secondary electrical power. The principle focus of this project is the more electric aircraft concept aimed at improving reliability and weight savings of aircraft power systems.

(U) FY 1989 Accomplishments:
- (U) Completed 8000 psi nonflammable hydraulic component tests.
- (U) Initiated an advanced aircraft engine starter program that will be capable of multiple starts in cold weather (-65°F).

(U) FY 1990 Planned Program:
- (U) Complete 8000 psi nonflammable hydraulic fluid demonstration.
- (U) Evaluate new longer life engine starter vane.
- (U) Initiate aircraft electrical secondary power distribution program to improve aircraft reliability up to 400% by replacing hydraulics, gear boxes, and mechanical controls.

Program Element: #0603216F Budget Activity: #2 - Adv Technology Development
Title: Aerospace Propulsion and Power Technology

(U) FY 1991 Planned Program:
- (U) Performance test an engine starter from -65°F to 130°F to demonstrate 500 simulated starts without refurbishment.
- (U) Demonstrate an advanced APU with an 80% increase in power to volume and 100% increase in altitude capability.
- (U) Fabricate secondary power distribution system and initiate experimental bread board tests for more electric aircraft concept.

(U) Work Performed By: Project managed by the Aero Propulsion and Power Laboratory, Wright-Patterson Air Force Base OH. The two contractors are McDonnell Aircraft Co, St Louis MO and General Dynamics Co, Fort Worth TX.

(U) Related Activities:
- (U) Exploratory development base provided by Aerospace Propulsion PE 0602203F, Materials PE 0602102F, and Aerospace Flight Dynamics PE 0602201F.
- (U) No duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 3036 Battery Technology: Develops aircraft and missile batteries to provide higher energy density and improved reliability. Although not currently funded, this project is expected to resume in the future.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603216F
Title: Aerospace Propulsion and Power Technology
Project Number: 681B
Budget Activity: #2 - Adv Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Title: Advanced Turbine Engine Gas Generator (ATEGG)

Popular Name	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ATEGG	24,897	25,000	27,400	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This Advanced Development program will ensure that turbine engine gas generator technology is available to meet the requirements of future aircraft propulsion systems. The objective of this program is to provide the continued evolution of advanced technologies into an advanced gas generator in which the performance, cost, and durability aspects can be assessed in a real engine environment. The gas generator, or core, is the basic building block of the engine and it consists of a compressor, a combustor, and a high pressure turbine which powers the compressor. This critical hardware demonstration will enhance the early, low risk transition of these technologies into engineering development where they can be applied to growth systems and/or new systems. The technologies are scalable, flexible, and applicable to a large range of potential systems applications. This project is 100% committed to the Integrated High Performance Turbine Engine Technology (IHPTET) initiative. IHPTET is a three phase, totally integrated DOD, DARPA, NASA, and Industry effort focused on doubling turbine engine propulsion capabilities by the year 2003 (Advanced Tactical Fighter engine is the baseline).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Evaluated an advanced compressor made of one-piece bladed disks, dual alloy stages and a composite ring disk to achieve higher efficiency while maintaining current life.
   - (U) Fabricated a nonmetallic combustor liner and a zoned combustor to demonstrate a 10% reduction in weight and a 500°F temperature increase.
   - (U) Initiated Joint Turbine Advanced Gas Generator (JTAGG) small core engine gas generator program with the Army and Navy which will provide a combined test bed for small turbine engine technologies.
   - (U) Completed dedicated durability testing of advanced compressor and turbine configurations and provided reliability and maintainability information on new structures and materials.

2. (U) FY 1990 Planned Program:
   - (U) Demonstrate an IHPTET Phase I advanced core with an over-all 20% increase in thrust-to-weight and a 20% reduction in specific fuel consumption.

Program Element: #0603216F Project Number: 681B
Title: Aerospace Propulsion and Power Technology Budget Activity: #2 - Adv Technology Development

- (U) Demonstrate a core driven fan with swept aerodynamics to improve compressor efficiency with a 5% weight savings.
- (U) Evaluate single crystal turbine blades with advanced thermal coatings, and innovative cooling schemes to improve core power by 35% with a 12% weight reduction.
- (U) Design and fabricate core hardware components for Joint Turbine Engine Gas Generator (JTAGG) demonstration.

3. (U) FY 1991 Planned Program:
   - (U) Complete demonstration of an Integrated High Performance Turbine Engine Technology (IHPTET) Phase I core with an overall 30% increase in thrust to weight.
   - (U) Initiate design and fabrication of IHPTET Phase II core gas generator. Established goals are a 35% improvement in thrust-to-weight with a 23% improvement in fuel savings.
   - (U) Evaluate improved compressors using metal matrix rotor structure and single support rotors to achieve a 10% increase in rotor speed and 10% reduction rotor weight.
   - (U) Fabricate and test a segmented/multi hole combustor that improves temperature capability by 700°F with a 20% weight savings.
   - (U) Evaluate a high work turbine that has a 50% increase in work extraction and a 20% weight savings. This is accomplished by combining fiber reinforced structural design with advanced blade cooling effectiveness.
   - (U) Initiate testing of IHPTET Phase I JTAGG to provide 20% reduced specific fuel consumption and 40% power to weight improvement for turboprop engine cores.

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

D. (U) WORK PERFORMED BY: The program is managed by the Aero Propulsion and Power Laboratory, Wright-Patterson Air Force Base OH. Contractors involved in this effort are: General Electric, Evendale OH; Pratt and Whitney, West Palm Beach FL; Garrett Engine Division, Phoenix AZ; Allison Gas Turbine Division, Indianapolis IN, and Textron Lycoming of Stratford, Connecticut.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION: Program is documented with technical reports, papers, and presentations.

Program Element: #0603216F Project Number: 681B
Title: Aerospace Propulsion and Power Technology Budget Activity: #2 - Adv Technology Development

G. (U) RELATED ACTIVITIES:

- (U) Exploratory development base provided by Aerospace Propulsion PE's 0602203F, and PE 0602122N, Materials PE 0602102F, and Aerospace Flight Dynamics PE 0602201F.
- (U) Closely related to Aircraft Propulsion Subsystems Integration (APSI), PE 0603202F, which is managed from the same office and adds subsystems such as controls, fans, and fan drive turbines, to the Advanced Turbine Engine Gas Generator (ATEGG) cores for testing as a complete engine.
- (U) Complemented by development efforts under Navy Advanced Propulsion Program, PE 0603210N, Aerospace Structures and Materials, PE 0603211F, and Manufacturing Technology, PE 0708011F and Army Advanced Propulsion Program, PE 0603003A.
- (U) Part of DOD Integrated High Performance Turbine Engine Technology (IHPTET) initiative which combines efforts of Air Force, Navy, Army, DARPA, and NASA in advanced aerodynamics, materials, and innovative design capability. The goal of IHPTET is to demonstrate minimum weight, high core power engine technology that offers at least 100% improvement over state-of-the-art technology by the year 2003.
- (U) No duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1. (U)	Completed High-Through-Flow Durability Tests	Mar 1989
2. (U)	Begin flowpath testing of GE ATEGG build 2	Feb 1990
3. (U)	Begin flowpath testing of Pratt ATEGG build 2	Apr 1990
4. (U)	Begin flowpath testing of Lycoming JTAGG	Dec 1990
5. (U)	Begin flowpath testing of GE/Garret JTAGG	Feb 1991
6. (U)	Begin flowpath testing of Allison ATEGG	Apr 1991
7. (U)	Begin structural ATEGG demonstration test	Jun 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2364 Training and Performance Data Center	968	0*	0*	0	TBD
2557 Advanced On-the-Job Training System	1,220	0	0	0	10,613
2743 Tactical Multi-Ship Aircrew Training Research*	4,206	3,991	4,430	Cont	TBD
2922 Manpower and Force Management*	641	1,054	1,382	Cont	TBD
2949 Advanced Training Technology	1,241	2,375	2,386	Cont	TBD
Total	8,276*	7,420	8,198	Cont	TBD

*Project 2364 transferred by OSD to Defense Logistics Agency (DLA) PE 64722S. As part of the streamlining efforts, Project 2363 was combined with Project 2743 and Project 3057 was combined with Project 2949. FY 1989 total includes funding for Project 3057, formerly documented in PE 0603751F.

B. (U) BRIEF DESCRIPTION OF ELEMENT: Develops and demonstrates: computer-based training authoring and delivery systems; decision aiding systems to optimize personnel use; job performance measurement technologies; analytical tools to improve consideration of manpower, personnel and training in the system design process and technologies to enable realistic, small- or large-scale aircrew combat training.

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

1. (U) Project 2364, Training and Performance Data Center: By OSD direction, in FY 1990, this project is transferred to DLA, PE 0604227S.

2. (U) Project 2557, Advanced On-the-Job Training System: This project developed and demonstrated a prototype state-of-the-art training system that integrates and effectively manages, evaluates, and automates job site training for the active AF, Air National Guard, and AF Reserves. In FY 1989, transitioned to PE 0604243F.

3. (U) Project 2743, Tactical Multi-Ship Aircrew Training Research: This project will develop, demonstrate and evaluate simulator-based air combat training as an affordable, effective, and realistic adjunct to flight-based training. It will provide a testbed for examining aircrew skills, cognitive functions, behaviors, and instructional strategies that contribute to success in combat. Different levels of simulator fidelity will provide data to determine the most cost

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

effective levels for training specific aspects of tactical combat. Up to 14 live participants will be able to train simultaneously. Long distance networking will enable joint-Service/combined arms training.

(U) FY 1989 Accomplishments:
- (U) Began refinements to the Fiber Optic Helmet-Mounted Display (FOHMD) to improve image resolution.
- (U) Integrated two FOHMDs with four low fidelity pilot/operator stations to create initial training system.
- (U) Demonstrated long distance networking of air-intercept trainers.

(U) FY 1990 Planned Program:
- (U) Develop improved threat/weapons simulations for training.
- (U) Install the prototype dome display system in lab.
- (U) Evaluate eye tracked system for FOHMD.

(U) FY 1991 Planned Program:
- (U) Complete image resolution enhancements of the FOHMD.
- (U) Demonstrate prototype 2 vs many aircrew combat training system.
- (U) Determine training effectiveness of the dome display.
- (U) Validate full field-of-view dome.

(U) Work Performed By: Program managed by the AF Human Resources Laboratory, Operations Training Division (AFHRL/OT), Williams AFB AZ. The three prime contractors are: University of Dayton, Dayton OH; McDonnell Douglas, St Louis MO; and General Electric Corporation, Daytona Beach FL.

(U) Related Activities:
- (U) PE 0602205F, Personnel, Training, and Simulation.
- (U) PE 0604227F, Flight Simulator Development.
- (U) The AF has formal agreements with the Army for visual display and computer image generation technology.
- (U) The Navy has a liaison office at AFHRL/OT.
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: The US and Canada are developing a FOHMD system for flight simulators.

4. (U) Project 2922, Manpower and Force Management: Provides technology to enable the AF to meet its manpower needs for combat readiness and sustainability. As mandated by Congress, cost effective methodologies for task-level measurement of on-the-job performance will be developed to enable validation of enlistment selection and classification standards, and relate those standards to job requirements. Develops technology and methods to enhance the

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

consid-eration of manpower, personnel, and training (MPT) early in the weapon system design and acquisition process to ensure these MPT requirements are supportable and affordable, and to enable intelligent trade-offs to accommodate MPT limitations and costs.

(U) FY 1989 Accomplishments:
- (U) Determined the value added by job performance information for selection and classification.

(U) FY 1990 Planned Program:
- (U) Begin development of automated procedures for matching comparable system task data for design of new systems.
- (U) Continue development and evaluation of low cost job performance measurement methodologies.
- (U) Begin development of automated procedures for clustering tasks into efficient jobs or training modules.
- (U) Demonstrate effectiveness of biographical data to augment current selection and classification measures.

(U) FY 1991 Planned Program:
- (U) Develop computer occupational survey techniques to support AF technical training: and the determination, evaluation, and revision of AF enlisted classification structure.
- (U) Develop and evaluate predictors of on-the-job performance as related to AF enlistment standards.
- (U) Develop guidelines and specifications for operational development of job performance measurement systems.

(U) Work Performed by: Program managed by the AF Human Resources Laboratory, Manpower and Personnel, and Training Systems Divisions, Brooks AFB TX. The three prime contractors are: Operational Tech Corp., San Antonio TX; Metrica Inc., Bryan TX; and University Energy Systems, Dayton OH.

(U) Related Activities:
- (U) PE 0602205F, Personnel, Training, and Simulation
- (U) PE 0604243F, Manpower, Personnel, and Training Dev
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 2949, Advanced Training Technologies: Modern high technology systems have relieved the human from performing many of the routine diagnostic and repair tasks, making it difficult to obtain the necessary job experiences for growth from novice to expert. This project develops computer-based training systems to replace that lost experience. It also develops guidelines and specifications for the most cost effective and efficient application to Air Force training environments. Develops and

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

demonstrates software to enable AF training developers to rapidly and inexpensively build Intelligent Computer-Assisted Training (ICAT) systems. ICAT systems act like a human tutor, continually evaluating and interacting with the student to deliver more individualized and effective training.

(U) FY 1989 Accomplishments:
- (U) Developed Avionics Job Family Trainer to train expert skills common to three AF F-15 avionics specialties.
- (U) Began software design and development of a rapid prototyping testbed for ICAT systems.

(U) FY 1990 Planned Program:
- (U) Complete Avionics Job Family Trainer.
- (U) Develop Mechanical Job Family Trainer for F-15 mechanics, hydraulics specialists, and crew chiefs.
- (U) Demonstrate an ICAT rapid prototyping capability for evaluating ICAT designs and applications.
- (U) Evaluate the utility of incorporating high fidelity equipment or system simulations within ICAT systems.

(U) FY 1991 Planned Program:
- (U) Field evaluation of the Avionics Job Family Trainer.
- (U) Complete Mechanical Job Family Trainer.
- (U) Determine the hardware and software requirements for cost effective and "user friendly" ICAT development.
- (U) Determine which instructional strategies provide the best training in ICAT applications.
- (U) Demonstrate microcomputer authority techniques for rapid development of intellignet tutors.
- (U) Demonstrate cost effective intelligent computer assisted training on standard Air Force microcomputers.
- (U) Develop guidelines for engineering and authority effective courseware for computer-based training.

(U) Work Performed By: Program is managed by the AF Human Resources Laboratory, Training Sys Division, Brooks AFB TX. The two prime contractors are: Metrica Inc., Bryan TX and University of Southern California, Los Angeles CA.

(U) Related Activities:
- (U) PE 0602205F, Personnel, Training, and Simulation.
- (U) PE 0604243F, Manpower, Personnel, and Training Dev.
- (U) The AF has formal agreements with the Army and Navy to share ICAT technologies.
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603230F
PE Title: Advanced Tactical Fighter (ATF)

Budget Activity: # 4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2472 Advanced Tactical Fighter	189,296	434,892	229,723	0	1,018,298
2878 Advanced Tactical Fighter Engine	384,035	296,200	450,200	0	1,929,928
2995 Critical Subsystems Development	101,200	314,800	84,000	0	618,600
Total	674,531	1,045,892	763,923	0	3,566,826

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Advanced Tactical Fighter (ATF) program will develop the next generation air superiority fighter for introduction in the late-1990s to counter the emergence of large numbers of advanced Soviet fighters. The ATF is being designed to penetrate enemy airspace and achieve a first-look, first-kill capability against multiple targets. Program emphasis from the outset has been balanced on affordability, performance, survivability, and reliability/maintainability. To develop and mature the advanced concepts and technologies required in this next-generation fighter prior to its entering Full-Scale Development (FSD), intensive hardware demonstrations and risk reduction efforts will be accomplished in a 54-month Demonstration/Validation (Dem/Val) (Prototype) phase. The Dem/Val phase has been structured to incorporate the fabrication and demonstration of a ground-based prototype avionics integration laboratory and construction and flight testing of prototype air vehicle designs. This program element is managed under three separate projects: Project 2472 (ATF) which focuses primarily on the development of the flight vehicle and related subsystems and technologies, Project 2878 (Advanced Tactical Fighter Engine) which develops and tests advanced propulsion systems with the efficiency and reliability required for the ATF mission, and Project 2995 (Critical Subsystems Development) which matures key avionics/armament technologies required to achieve ATF capability objectives with respect to situational awareness, offensive lethality, and threat warning/countermeasures.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project: # 2472
Budget Activity: # 4 - Tactical Programs

Project Title: ATF





POPULAR NAME: ATF

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			DAB II	
Engineering Milestones	Assemble proto A/C Safety rvws			
T&E Milestones	First flight safety reviews	Proto vehicle FF/flight test	Proto vehicle complete flight test reports	
Contract Milestones			FSD RFP/SS & Contract award	
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	178,293	404,600	205,000	934,893 (0)
Support Contract	0	0	0	0 (0)
In-House Support	4,200	4,000	5,000	24,540 (0)
GFE/ Other	6,803	26,292	19,723	58,865 (0)
Total	189,296	434,892	229,723	1,018,298 (0)

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project: # 2472
Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Project 2472, Advanced Tactical Fighter (ATF), focuses primarily on the development of the flight vehicle and related subsystems and technologies. It continues development of the next generation air superiority fighter aircraft design with the performance and survivability features required to counter advanced Soviet fighters that will appear in large numbers in the early 1990s. In this advanced development project, flight vehicle technologies, design concepts, subsystem approaches, advanced materials, etc., that will be important to achieving ATF program and capability objectives will be demonstrated and validated. This will be accomplished through the use of trade-off analyses, detailed design work, wind tunnel and radar cross section tests, materials and component design tests, as well as hardware demonstrations including fabrication and flight testing of air vehicle prototypes.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued subscale wind tunnel tests on aerodynamic model components, engine inlets and ducting, aft body sections, wing planforms, and weapons bay separation functions.
   - (U) Continued fabrication of prototype flight vehicles and initiated integration of propulsion, flight control subsystems, and flight test instrumentation.
   - (U) Conducted technical and safety reviews to clear prototype air vehicles for flight test.
   - (U) Conducted qualification tests on prototype escape systems.
   - (U) Developed FSD/production acquisition strategy.

2. (U) FY 1990 Planned Program:
   - (U) Conduct Full Scale Model RCS Tests.
   - (U) Conduct System Design Reviews with prime contractors.
   - (U) Complete integration of prototype aircraft subsystems and system checkout for first flight.
   - (U) Conduct first flights on each aircraft/engine combination.

3. (U) FY 1991 Planned Program:
   - (U) Complete prototype aircraft flight tests, data collection, and analysis.
   - (U) Complete Full-Scale Development (FSD) source selection and award contract to a single airframe contractor team and single engine contractor (see PE #0604239F).

4. (U) Program to Completion: Not Applicable (Completes in FY 1991).

D. (U) WORK PERFORMED BY: Technology and advanced development efforts for ATF are being managed by the Aeronautical Systems Division, Wright-Patterson AFB OH. Lockheed Aeronautical Systems Co, Burbank CA and Northrop Corp, Hawthorne CA are the prime weapon system contractors for the Demonstration/Validation (Dem/Val) phase. As a result of

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)
Project: # 2472
Budget Activity: # 4 - Tactical Programs

teaming agreements, Boeing and General Dynamics will be principal subcontractors to Lockheed, and McDonnell Aircraft Co will be principal subcontractor to Northrop.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: FSD/Contract Award 4Q FY91 vice 2Q FY91.
3. (U) COST CHANGES: $153,125 increase due to cost of extending Dem/Val for 6 months.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-83, 9 Nov 84.
- (U) TAF 304-83-I/IIA, SORD for ATF (Revision), 1 Feb 89.
- (U) ATF TEMP, 3 Mar 89.

G. (U) RELATED ACTIVITIES:
- (U) At the completion of the Dem/Val phase and a Milestone II decision in FY 1991, ATF will enter FSD and be funded under PE #0604239F (ATF Engineering).
- (U) ATF procurement will be funded under PE #0207219F (ATF).
- (U) Engineering development for ATF training systems is funded in PE #0604227F (Flight Simulator Development).
- (U) In addition to the programs related generally to the ATF (PE #0603230F), there are several generic and continuing technology-base efforts (listed below) that continue to advance the state of the art in air vehicle related technologies and provide the technology base that will contribute to the development of not only the ATF but other air weapon systems, military aircraft, and even commercial aircraft.
- (U) PE #0603205F, Aerospace Flight Vehicle Technology.
- (U) PE #0603211F, Aerospace Structures and Materials.
- (U) PE #0603231F, Crew Systems and Personnel Protection Technology.
- (U) PE #0603245F, Advanced Flight Technology Integration.
- (U) Navy PE #0603231N (Navy Advanced Tactical Fighter) develops and demonstrates the Navy derivative of the ATF. The NATF will enter FSD approximately two years after the ATF.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project: # 2472
Budget Activity: # 4 - Tactical Programs

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Structural/material tests	Ongoing	
Wind tunnel tests	Ongoing	
RCS Model Tests	Ongoing	
Full scale mission simulations	4Q/FY 1988	COMPETITION SENSITIVE
Escape system qualification tests	4Q/FY 1989	COMPETITION SENSITIVE

T&E ACTIVITY (TO COMPLETION)

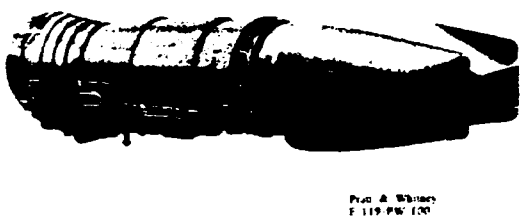
Event	Planned Date	Remarks
Full scale model signature tests	2Q/FY 1990	
Prototype aircraft first flight	2Q/FY 1990	(contract)
Complete prototype aircraft flight test	1Q/FY 1991	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

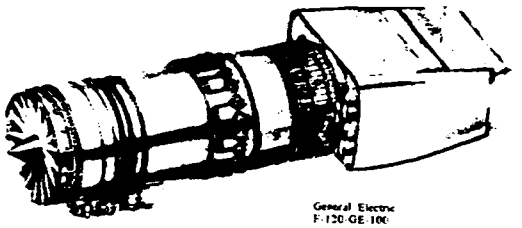
Program Element: # 0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project: # 2878
Budget Activity: # 4 - Tactical Programs

Project Title: ATF Engine



Pratt & Whitney F119-PW-100



General Electric F120-GE-100

POPULAR NAME: ATF Engine

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Preliminary System Spec		DAB II	
Engineering Milestones	Develop eng PDR/Compl. demo engine test	Sys Spec SDR/Proto eng IFR/ Dev eng DDR	DDR for FSD	
T&E Milestones	Continue proto grnd. tests	Proto FF	Complete test First dev engine	
Contract Milestones	Dem/Val II eng con-tract award		FSD RFP/SS & contract award	
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	357,620	272,600	421,700	1,822,837 (0)
Support Contract	0	0	0	0 (0)
In-House Support	0	0	0	0 (0)
GFE/ Other	26,415	23,600	28,500	107,091 (0)
Total	384,035	296,200	450,200	1,929,928 (0)

00359

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project: # 2878
Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Project 2878 (Advanced Tactical Fighter Engine) will develop and test advanced propulsion systems for the Advanced Tactical Fighter (ATF) mission. The project seeks advances in propulsion technology that will be essential to achieving the significant capability improvements needed in the next generation air superiority fighter, including efficient supersonic cruise, increased reliability, and reduced logistics support. This project funds prototype engine demonstration of two advanced engine designs to support the flight demonstration of prototype ATF aircraft prior to Full-Scale Development (FSD) and does the necessary development/fabrication work to protect the weapon system FSD schedule.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed testing of the ground-based demonstrator engines and nozzles.
   - (U) Conducted performance and durability tests in support of flight clearances on the prototype engines.
   - (U) Initiated Initial Flight Release (IFR) for the prototype engines.
   - (U) Accomplished Preliminary Design Review (PDR) of the development engines.
   - (U) Completed PDR of the flight test nozzle designs, tailored for each individual contractor's ATF vehicle design.
   - (U) Awarded Contracts to GE and P&W for development/fabrication efforts to protect the weapon system FSD schedule.

2. (U) FY 1990 Planned Program:
   - (U) Obtain IFR of the prototype engines and support prototype flight tests.
   - (U) Prepare requests for proposal (RFP) for the development and test of FSD engines/nozzles.

3. (U) FY 1991 Planned Program:
   - (U) Complete source selection for a single FSD engine contractor in third quarter FY 1991.
   - (U) Award FSD engine contract in fourth quarter of FY 1991. (see PE #0604239F).

4. (U) Program to Completion: Not Applicable (Program completes in FY 1991).

D. (U) WORK PERFORMED BY: The advanced engine development is being managed by the Aeronautical Systems Division, Wright-Patterson AFB OH. Engine development contractors are United Technologies/Pratt & Whitney Government Engines, West Palm Beach FL and General Electric Co, General Electric Aircraft Engines, Evendale OH. At Milestone II, for the ATF program in FY 1991, a single contractor will be selected for full-scale development of the ATF engines.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Contract award 4Q FY91 vice 2Q FY91.

00360

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)
Project: # 2878
Budget Activity: # 4 - Tactical Programs

3. (U) COST CHANGES: 345,470 increase due to transfer of 330M which had originally been budgeted in the FSD PE and other government costs for engines associated with the 6-month extension.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-83, Nov 84.
- (U) TAF 304-83-I/IIA, SORD for ATF (Revision 1), 1 Feb 89.
- (U) ATF TEMP, 3 Mar 89.

G. (U) RELATED ACTIVITIES:
- (U) PE #0603202F, Aircraft Propulsion Subsystem Integration.
- (U) PE #0603216F, Aerospace Propulsion and Power Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
First demonstration engines to test		
- Pratt & Whitney	Oct 86	(Competition
- General Electric	May 87	Sensitive)
Two-dimensional nozzle thrust vectoring demonstrated		
- Pratt & Whitney	Feb 88	Successful
- General Electric	May 88	Successful
Preliminary design review of development engine	2Q/FY 1989	COMPETITION SENSITIVE
First prototype engine to test	2Q/FY 1989	COMPETITION SENSITIVE

T&E ACTIVITY (TO COMPLETION)

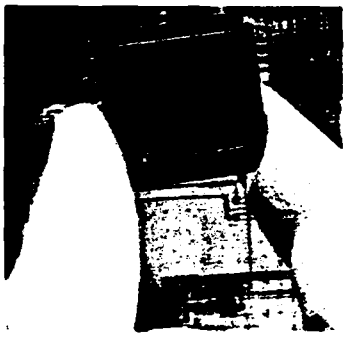
Event	Planned Date	Remarks
First prototype engine delivery	2Q/FY 1990	
Initial flight release of prototype engine	2Q/FY 1990	
Prototype aircraft/engine first flight	2Q/FY 1990	
Complete prototype engine flight test	1Q/FY 1991	

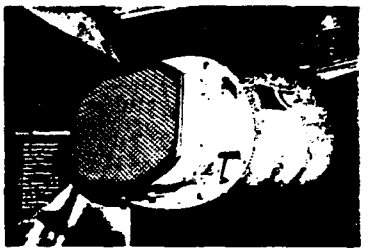
FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project : # 2995
Budget Activity: # 4 - Tactical Programs

Project Title: Critical Subsystems Development





POPULAR NAME: Critical Subsystems

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		AGP & AFL	DAB II	
Engineering Milestones	Complete prototype sensor fabr	System Spec SDR AGP demo		
T&E Milestones	Begin AGP demos and prototype tests	Fault-tol tests/Sensor flight demos	Complete AGP & AFL demos	
Contract Milestones			FSD contract award	
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	100,000	311,000	78,000	603,600 (0)
Support Contract	0	0	0	0 (0)
In-House Support	0	0	0	0 (0)
GFE/ Other	1,200	3,800	6,000	15,000 (0)
Total	101,200	314,800	84,000	618,600 (0)

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project: # 2995
Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
Project 2995 (Critical Subsystems Development) will mature key avionics/armament technologies required to achieve Advanced Tactical Fighter (ATF) capability objectives with respect to situational awareness, offensive lethality, and threat warning/countermeasures. Critical Subsystems Development will demonstrate that certain subsystems employing advanced technologies critical to the development of the ATF can be successfully integrated into an effective system. Several critical technologies in weapons integration, avionics integration, and advanced radar/sensor development must be matured prior to aircraft design freeze. The state-of-the-art microelectronics, sensors, and advanced integrated avionics subsystems developed for ATF in this project will make it possible to process extraordinary amounts of sensor data and vastly improve the pilot's capabilities for threat definition, situational awareness, aircraft fire and flight control, weapon/countermeasure systems management, etc. This project began in FY 1985 and will be completed in time to support a Full-Scale Development (FSD) decision in FY 1991. ATF avionics will exhibit a high degree of commonality with the Joint Integrated Avionics Working Group (JIAWG) developed specifications.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Incorporated additional advanced development modules (ADM) hardware into the avionics ground prototypes, including components derived from the Integrated Electronic Warfare System/Integrated Communications, Navigation, Identification Avionics effort (PE #0603109F and PE #0604250F).
   - (U) Conducted partial demonstrations of the avionics prototypes.
   - (U) Completed fabrication of prototype sensor, electronic combat, and comm/nav/ident components.
   - (U) Initiated sensor ground and rooftop tests.

2. (U) FY 1990 Planned Program:
   - (U) Perform tests to verify fault isolation/fault tolerance and other aspects of the integrated avionics architecture including sensor fusion, pilot vehicle interface, beyond-visual-range target classification, etc.
   - (U) Demonstrate critical flight-related elements of the avionics architecture in avionics flying laboratories (AFL).
   - (U) Continue avionics trade studies and other avionics risk reduction/design refinement activities.
   - (U) Incorporate avionics requirements in FSD request for proposals and in source selection evaluation for a single prime contractor.

3. (U) FY 1991 Planned Program:
   - (U) Complete Dem/Val avionics data collection and analysis through FY 1991.
   - (U) Complete FSD source seclection and award contract (see PE #0604239).

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)
Project: # 2995
Budget Activity: # 4 - Tactical Programs

4. (U) Program to Completion: Not applicable (Completes in FY 1991).

D. (U) WORK PERFORMED BY: Avionics technology and advanced development efforts for ATF are being managed by Aeronautical Systems Division, Wright-Patterson AFB OH. Total ATF weapon system responsibilities, including avionics integration, rest with the prime contractors, Lockheed Aeronautical Systems Company, Burbank CA and Northrop Corporation, Hawthorne CA. Major subcontractors to the ATF primes for avionics subsystems include TRW, San Diego CA, Westinghouse, Baltimore MD, Texas Instruments, Dallas TX, Martin Marietta, Orlando FL, General Electric, Utica NY, AT&T, Whippany NJ, UNISYS, Minneapolis MN, Sanders Corp, Nashua NH, Hughes Corp, Los Angeles CA, and Harris Corp, Melbourne FL.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Contract Award 4Q FY91 vice 2Q FY91.
3. (U) COST CHANGES: $16,900 decrease due to reductions in armament effort during 1989, and reduced funding in 1990.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-83, 9 Nov 84.
- (U) TAF 304-83-I/IIA, SORD for ATF (Revision 1), 1 Feb 89.
- (U) ATF TEMP, 3 Mar 89.

G. (U) RELATED ACTIVITIES:
- (U) In addition to the programs related generally to the ATF PE #0603230F, there are several generic and continuing technology-base efforts (listed below) that are advancing the state-of-the-art in microelectronics integrated circuits, and avionics systems that will contribute to the development of ATF and other future avionics systems.
- (U) PE #0603109F, Integrated Electronic Warfare System/Integrated Communications Navigation Identification Avionics (INEWS/ICNIA).
- (U) PE #0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE #0603253F, Advanced Avionics Integration.
- (U) PE #0603452F, Very High Speed Integrated Circuits (VHSIC).
- (U) PE #0603742F, Combat Identification Technologies.
- (U) PE #0603270F, Electronic Combat Technology.
- (U) PE #0604236F, Infrared Search and Track System (IRSTS).
- (U) PE #0604250F, Integrated Electronic Warfare/Integrated Communications, Navigation, Identification Development.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: #0603230F
PE Title: Advanced Tactical Fighter (ATF)

Project: # 2995
Budget Activity: # 4 - Tactical Programs

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Avionics Ground Prototype (AGP) specifications released	Aug 1987	
Initial avionics prototype core demonstrations	1Q/FY 1989	Successful
Begin flying AFL demonstrations	Ongoing	COMPETITION SENSITIVE

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Final avionics prototype demonstrations	FY 1991	
Complete flying avionics test bed demonstrations	FY 1991	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

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

Project Number Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2722 Biomedical Chemical Warfare Defense	5,098	5,500	4,000	Cont	TBD
2829 Crew-Centered Cockpit Design	4,984	4,926	4,100	Cont	TBD
2830 Advanced Life Support Systems	1,297	2,237	2,000	Cont	TBD
2868 Crew Escape Technologies	3,800	1,070	2,402	Cont	TBD
2992 Space Crew Enhancement	652	685	1,200	Cont	TBD
3257 Helmet-Mounted Systems Technology	4,377	5,112	4,617	Cont	TBD
Total	20,208	19,530	18,319	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program conducts advanced development of concepts, components and systems to protect and extend the performance of Air Force personnel in hazardous wartime environments. The program applies primarily to aircrews, but some applications extend to groundcrews conducting flightline operations. Specific projects include human factors considerations in the design of cockpits that significantly improve combat effectiveness and the protective features of air and groundcrew life support equipment. All demonstrated concepts in this program element will feed into full scale development programs to address over fifteen documented needs from USAF commands which require specific warfighting capabilities. The program is managed through six advanced technology transition demonstrations and 13 smaller technical demonstration efforts. Project names were changed to reflect actual program content; no changes were made in content.

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

1. (U) Project 2722, Biomedical Chemical Warfare Defense: This project ensures the protection and performance of aerospace mission and support personnel, the maintenance of combat sortie generation rates, and the adequate treatment of combat casualties. In coordination with the Army, development will meet Air Force unique requirements for: (1) detection, identification, and warning; (2) decontamination or avoidance of toxic agents; (3) individual protection; (4) collective protection; (5) medical support and air evacuation; (6) prediction of USAF combat attrition rate; and (7) improved air base exercise realism.

(U) FY 1989 Accomplishments:
- (U) Completed first computer model to estimate casualties during realistic air base war exercises.
- (U) Completed study, for Surgeon, to examine the impact of the

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

collective protection on the USAFE attrition rates.
- (U) Completed development testing of an air cooling system.
- (U) Completed toxicological testing of a safe chemical agent to test and train with protective equipment.
- (U) Developed infrared communications device for chemical mask.

(U) FY 1990 Planned Program:
- (U) Begin developing computer model of wartime medical system.
- (U) Demonstrate piezoelectric technology for detecting chemical warfare agents in aircraft interiors.
- (U) Complete functional specifications for laser technology to detect chemical agents on base; transition to development.
- (U) Perform payoff analysis for avionics decontamination.
- (U) Develop a computer model (TRACK) to help make the post-attack environment realistic during air base exercises.

(U) FY 1991 Planned Program:
- (U) Demonstrate infrared communications for flightline maintenance personnel wearing chemical defense masks.
- (U) Complete the threat-related attrition combat exercise kit for more realistic war-time air base exercises.
- (U) Transition detection technology that signals aircrews when a chemical warfare agent is entering their aircraft.

(U) Work Performed By: The two contractors are Systems Research Laboratories, Beavercreek, OH, and BDM International, McLean, VA. In-house development is performed at USAF School of Aerospace Medicine, Brooks AFB TX. Program management is by the Human Systems Program Office, Human Systems Division, Brooks AFB TX. Cooperative efforts are maintained with Army's CREDC, Navy's NRL and U.S. EPA.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0604703F, Aeromedical/Chemical Defense Systems Dev.
- (U) PE #0604601F, Chemical Defense Equipment.
- (U) The Army is DOD lead for chemical warfare defense.
- (U) Multiservice applications identified in the Joint Service R&D and Aquisition Plan for Chemical Warfare Defense.
- (U) Medical chemical defense coordinated by Armed Services Biomedical Research, Engineering and Management Committee.
- (U) No unnecessary duplication within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2829, Crew-Centered Cockpit Design (CCCD): This project develops a traceable crew system design and development process along with computer analysis, design, and test software tools. This process integrates systems and human factors principles early in the acquisition cycle for manned aerospace vehicles, predicts pilot performance and mission success as functions of automation as

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

referenced to a well-understood baseline weapon system to quantify human/system trade-offs, and verifies projected performance and crew workload using contractor's simulators to find the best cockpit design. New test and evaluation methods assure best use of costly mission simulation during all weapon system acquisition phases. When implemented in industry, last minute cockpit redesigns can be reduced or avoided altogether.

(U) FY 1989 Accomplishments:
- (U) Defined a comprehensive crew system design and development process and support architecture.
- (U) Tested and arranged delivery and software training for initial computer-aided design support system for cockpits.
- (U) Transitioned data and software via new Defense Logistics Agency Information Analysis Center.

(U) FY 1990 Planned Program:
- (U) Continue demonstration of new cockpit design process, upgrade design tools, and apply to fighter mission.
- (U) Integrate and test a breadboard cockpit simulator as rapid prototyping test article, for real-time cockpit evaluation.

(U) FY 1991 Planned Program:
- (U) Complete development of a cockpit design process, and deliver a computerized support system for cockpit analysis, design and simulator testing.
- (U) Establish a validation program for a crew-centered design process and perform field demonstrations.
- (U) Develop a product specification for an inflight cockpit performance evaluation system.

(U) Work Performed By: Work performed by two contractors: Veda Inc., Dayton OH; and Boeing Military Airplanes, Seattle WA. Program management by the Human Systems Program Office, Human Systems Division, Brooks AFB TX. In-house development by the Harry G. Armstrong Aerospace Medical Research Laboratory, Wright Patterson AFB OH. Verifying tests on software being performed by the Naval Air Development Center, Defense Logistics Agency, and Aeronautical Systems Division.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0603205F, Aerospace Vehicle Technology - Agreement matrixes manning for developing pilot/vehicle interface.
- (U) Man-machine integration activities were coordinated by a Tri-Service Initiative Panel (chartered by the Joint Directors of Laboratories) chaired by this project (2829).
- (U) Coordination occurs through a Crew Station Working Group within Air Force Systems Command, a Joint Aeronautical Commander's Group Committee, and DOD Human Factors Engineering Technical Advisory Group.
- (U) No unnecessary duplication within the Air Force or DOD.

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 2830, Advanced Life Support Systems (ALSS): This project develops and integrates advanced aircrew life support subsystems. Technology demonstrations integrate and transisition concepts and life support subsystem assemblies to evaluation in the flight test environment. Efforts focus on increasing the aircrew's combat performance while providing sufficient protection from physiological threats, including: high altitudes, high G-forces, electromagnetic threats, thermal burden and ballistic injury.

(U) FY 1989 Accomplishments:
- (U) Improved tactical breathing regulator and G-valve.
- (U) Evaluated foreign life support ensembles for protection.

(U) FY 1990 Planned Program:
- (U) Begin development of Advanced High Altitude Protective System for SAC to improve decompression protection.
- (U) Begin full coverage G-suit technical demonstration.
- (U) Begin development of Low-profile Aircrew Filter Pack for chemical defense/cockpit compatibility.
- (U) Begin development of system for chemical defense / positive pressure breathing for G tolerance.

(U) FY 1991 Planned Program:
- (U) Performance testing of component technologies for high altitude pressure suit systems.
- (U) Perform flight tests of combined chemical defense / positive pressure breathing system for G tolerance.

(U) Work Performed By: The two contractors are Boeing Advanced Systems, Seattle WA and ILC Dover, Dover DE. Program management by the Human Systems Program Office, Human Systems Division, Brooks AFB TX. In-house development and testing by USAF School of Aerospace Medicine, San Antonio TX.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0604706F, Life Support Systems.
- (U) Life support activities are included in the USAF Ten Year Life Support Master Development Plan.
- (U) Coordinated through Tri-Service Life Support Group.
- (U) No unnecessary duplication within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Prototype hardware from the tactical life support system has been provided to Canada for their own development program for improved anti-G protection for aircrew of CF-18 aircraft. Also, this project is coordinated through the Air Standardization Coordinating

Committee, NATO Advisory Groups on Aerospace Research and Development, and specific Data Exchange Agreements.

4. (U) Project 2868, Crew Escape Technologies (CREST): This project integrates advanced subsystems into an ejection seat capable of protecting aircrew throughout the performance envelope of modern aircraft. The goal is to reduce fatalities and major injury rates in emergency ejections at all speeds between 0 and 700 knots. While approximately doubling the current safe ejection envelope, CREST will also provide significant improvements in reliability, maintainability and capability for logistics supportability over current ejection seats. Subsystem development will continue into FY 1991, with technologies becoming available for transition as they are demonstrated. In FY 1991, new work is planned to investigate component technologies for very high speed escape systems of transatmospheric aircraft.

(U) FY 1989 Accomplishments:
- (U) Completed subsystem tests except rocket motor, which failed due to technical reasons.
- (U) Decision made to terminate contract with Boeing due to technical difficulties with rocket motor.

(U) FY 1990 Planned Program:
- (U) Evaluate rocket motor design with the help of the Air Force Astronautics Laboratory.
- (U) Demonstrate 700 knot test and evaluation capability by conducting sled test ejections of new test manikin with new multi-axis sled at Holloman AFB NM.

(U) FY 1991 Planned Program:
- (U) Complete subsystem development, system level integration, and begin system demonstration.
- (U) Begin concept investigations into component technologies for hypersonic escape vehicles.
- (U) Begin concept investigation of lightweight, ballistically protected seats for close air support.

(U) Work Performed By: The only contractor is Boeing Military Aircraft, Seattle WA. Program management by the Human Systems Program Office, Human Systems Division, Brooks AFB TX. In-house development and testing by the Harry G. Armstrong Aerospace Medical Research Laboratory, Wright Patterson AFB OH.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0604706F, Life Support Systems.
- (U) PE #0603269F, National Aerospace Plane.
- (U) Life support activities are included in the USAF Ten Year Life Support Master Development Plan.
- (U) Coordinated through Tri-Service Life Support Group.
- (U) No unnecessary duplication within the Air Force or DOD.

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 2992, Space Crew Enhancement (SPACE): This project develops specialized crew protection and man-machine integration needed to support possible military missions from space. Efforts will improve crew performance and protection in environments unique to military space systems. Near-term efforts support Air Force Space Command's Military-Man-in-Space program. This support involves measuring a human's visual ability in identifying military ground targets from space. Experiments onboard the space shuttle are being conducted to collect the visual performance data.

(U) FY 1989 Accomplishments:
- (U) Completed ground tests of space telescope.

(U) FY 1990 Planned Program:
- (U) Integrate telescope for shuttle flight test via Space Test Program. (Number 1 secondary payload)

(U) FY 1991 Planned Program:
- (U) Identify crew station design criteria and advanced technologies for manned military space systems.
- (U) Initiate development on ensemble subsystems (gloves and joints) for transatmospheric missions.

(U) Work Performed By: The two contractors are Systems Research Laboratories, Beavercreek OH, and Rockwell International, Los Angeles, CA. Program management by the Human Systems Program Office, Human Systems Division, Brooks AFB TX. In-house development by the Harry G. Armstrong Aerospace Medical Research Laboratory, Wright Patterson AFB OH.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0604706F, Life Support Systems.
- (U) PE #0603269F, National Aerospace Plane
- (U) Military space crew activities coordinated through Military/ NASA Space Technology Interdependency Group.
- (U) No unnecessary duplication within the AF, DOD, or NASA.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 3257, Helmet-Mounted Systems Technology: This project develops helmet- mounted systems technology for aircraft cockpits to significantly improve pilot situational awareness. Helmet-mounted displays are sight and sound projections to help the pilot interact with the world in a natural, intuitive manner regardless of visibility beyond the cockpit. One concepts being developed is an all-aspect, fire control system which will allow the pilot, by

turning his head, to utilize the full off-axis/stand-off capability of air-to-air and air-to-surface weapons. Such concepts successfully demonstrated in exploratory development are indicating high payoffs in pilot performance. This project provides for flight testing of night vision goggle/head-up display systems to enable accelerated transition in response to Strategic Air Command, Tactical Air Command and Military Airlift Command's Special Operations Forces requirements.

(U) FY 1989 Accomplishments:
- (U) Started front end analysis of helmet-mounted display/sight (HMD/HMS) operational payoffs and technology assessment.
- (U) Started analysis to determine pilot risk upon ejection while wearing helmet-mounted systems.
- (U) Contracted award for development of advanced, integrated night vision goggle and helmet-mounted display concepts.

(U) FY 1990 Planned Program:
- (U) Complete development of integrated night vision goggle and helmet-mounted display concepts.
- (U) Continue ejection risk analysis for aircrew members while wearing helmet-mounted systems.
- (U) Accomplish safety of flight and begin flight demonstration.

(U) FY 1991 Planned Program:
- (U) Complete flight demonstration of integrated HMD/S system.
- (U) Begin development of air-to-surface, binocular helmet-mounted display and auditory display.

(U) Work Performed By: Program management by the Human Systems Program Office, Human Systems Division, Brooks AFB TX. In-house development by the Armstrong Aerospace Medical Research Laboratory, Wright Patterson AFB OH. Development of advanced, integrated NVG and HMD awarded to McDonnell Aircraft Company, St. Louis MO, as a joint effort with Naval Air Systems Command. Advanced Technology Transition Demonstration accomplished with AFTI/F-16 Air Force Flight Test Center, Edwards AFB CA, SAC, MAC ANG, and AFRES.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0603790D, NATO Cooperative R&D.
- (U) PE #0604706F, Life Support Systems.
- (U) Coordination occurs with Crew Station Working Group within Air Force Systems Command.
- (U) Joint development with the Navy on helmet-mounted displays and integrated night vision goggles.
- (U) No unnecessary duplication within the Air Force or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Discussions are ongoing with Great Britian and France concerning cooperative research.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603245F Budget Activity: #2 - Adv Tech Devel
PE Title: Advanced Flight Technology Integration (AFTI)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2061 Vehicle/Avionics/Weapon Integration	5,850	11,150	14,775	Cont	TBD
2568 Advanced Wing Technology	2,087	1,500	400	Cont	TBD
2682 Airframe Propulsion Integration	5,932	5,327	3,628	Cont	TBD
2979 Reliability and Maintainability	3,227	2,278	5,000	Cont	TBD
3391 X-29 Advanced Tech Demonstrator	7,759	1,330	0	0	26,593
TOTAL	24,855	21,585	23,803	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program flight tests fully integrated, synergistic technologies under simulated mission conditions. Emphasis is on technologies which can provide low cost, low-maintenance, increased reliability, and increased tactical performance and survivability for current and future aircraft. Flight testing of integrated technologies is essential to verify real world benefits/penalties of the integrated system and to reduce technology transition risk. PE 0603205F, Aerospace Vehicle Technology, provides component technologies that are integrated and flight tested in this PE.

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

1. (U) Project 2568, Advanced Wing Technology: Improves aircraft flight maneuverability during combat and emergency operation, and increases aircraft aerodynamic efficiency at cruise speeds. Includes the following: (1) the Mission Adaptive Wing (MAW) demonstration using wing shape control (ended in FY 89), and (2) the joint NASA/Air Force Hybrid Laminar Flow Control (HLFC) program evaluates performance improvements using leading edge suction to effect boundary layer control (on-going). Potential fuel savings of 15% for derivative and future transport aircraft are expected using HLFC.

(U) FY 1989 Accomplishments:
- (U) Completed AFTI F-111 flight testing of the MAW and released design criteria for application to derivative and future air vehicles. Results showed a 25% increase in range using the MAW when flying multi-condition missions.
- (U) Developed a flight test plan for integration and flight testing of the HLFC system on a transport aircraft.

(U) FY 1990 Planned Program:
- (U) Complete HLFC hardware integration and begin flight test.

Program Element: #0603245 Budget Activity: #2 - Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

(U) FY 1991 Planned Program:
- (U) Complete flight testing for the HLFC program with expected results of a 15% fuel savings for long range transports.

(U) Work Performed By: Project is managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. Flight testing is done at Edwards AFB CA. The only contractor is Boeing, Seattle WA.

(U) Related Activities:
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2682, Airframe Propulsion Integration: Integrates aircraft flight control with the aircraft propulsion system (inlet, engine and nozzles) and the vehicle management system (VMS) within a fault tolerant architecture. Fault tolerance is the ability to isolate and prevent failures from propagating during system operation so that mission goals can be achieved. Fault tolerance is critical for integrated systems to prevent one system from contaminating another. Project starts by incrementally integrating and flight testing the above technologies, then melds other integrated technologies from this PE to achieve a total aircraft fault tolerant capability with improved aircraft performance, efficiency and maneuverability for derivative or future fighter aircraft. Programs included are: (1) Short Takeoff and Landing/Maneuver Technology Demonstrator (STOL/MTD) program which integrates and flight tests on a modified F-15B, pitch axis thrust vectoring/reversing (TV/TR) exhaust nozzles, integrated flight/nozzle controls, and aircraft rough field landing gear. The result is an aircraft that will (a) be controlled in the pitch axis by vectored thrust, (b) have improved maneuver and deceleration performance, and (c) take off and land on a 1500 ft by 50 ft wet runway, during 30 knot crosswinds without the aid of a ground-based landing system. The latter reduces dependence on easily targeted runways and allows dispersion to austere bases. (2) An advanced airframe propulsion integration program to integrate and flight demonstrate an integrated flight and propulsion control system with optimized vehicle performance over all flight phases. This integrated system will utilize the aerodynamic surfaces, inlets, engine, and thrust vectoring nozzles to provide a reliable control capability for derivative and future aircraft. It will use low weight, highly reliable, multi-axis (pitch and yaw) thrust vectoring nozzles to enhance air combat lethality and survivability. Aircraft range, acceleration, and engine life should be increased. A VMS will be developed as a part of the overall architecture. VMS reduces the number of individual control boxes in the aircraft and is key in the development of a highly reliable fighter.

Program Element: #0603245 Budget Activity: #2 - Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

(U) FY 1989 Accomplishments:
- (U) Conducted STOL/MTD envelope clearance flights with (pitch axis) TV/TR exhaust nozzle and started comprehensive flight testing of the aircraft and nozzles. Thrust vectoring flights are showing enhanced combat maneuverability.
- (U) Conducted rough field taxi tests over field repaired bomb damaged runways.

(U) FY 1990 Planned Program:
- (U) Complete STOL/MTD military operational utility testing.
- (U) Begin design definition of an integrated flight propulsion control system using multi-axis thrust vectoring nozzles.

(U) FY 1991 Planned Program:
- (U) Start integration of the flight/propulsion control system into the aircraft.
- (U) Start multi-axis nozzle integrated engineering design work.

(U) Work Performed By: Project managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. Flight testing is done at Edwards AFB CA. The two contractors are MCAIR, St Louis MO and GD, Forth Worth TX.

(U) Related Activities:
- (U) PE 0603205F, Aerospace Vehicle Technology
- (U) PE 0603230F, Advanced Tactical Fighter
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 2979, Reliability and Maintainability: Improves the reliability, maintainability, and survivability of present and future aircraft through reconfiguration of the control system to use one aerodynamic control surface in place of another surface, and the application of expert system technology to maintenance diagnostics. Under this project, the Self Repairing Flight Control System (SRFCS) program concentrates on the flight demonstration of software techniques developed under PE 0603205 that permit: simplification of flight control system hardware; accurate, in-flight isolation of cannot duplicate component failures; graceful degradation following battle damage; and an expert maintenance diagnostic system for ground support compatible with present operations and Logistic Command's Integrated Maintenance Information System (IMIS) under development. Reconfiguration capabilities will be extended beyond aerodynamic control surfaces to include propulsion, thrust vectoring, and center of gravity shifts to control the aircraft. FY 91 funding reflects SRFCS work being extended to cover the full aircraft flilght control system and the incorporation of propulsion and thrust vectoring into SRFCS.

Program Element: #0603245 Budget Activity: #2 - Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

(U) FY 1989 Accomplishments:
- (U) Completed SRFCS software integration and hardware in-the-loop piloted simmulation of flight test scenarios.

(U) FY 1990 Planned Program:
- (U) Complete single-surface reconfiguration flight testing.
- (U) Start the integrated engineering design for a complete multi-axis SRFCS capability which is expected to reduce enemy weapon kill probability by a factor of 10.

(U) FY 1991 Planned Program:
- (U) Complete the integrated engineering design for a complete multi-axis SRFCS.
- (U) Start aircraft modification and integration of the multi-axis SRFCS.
- (U) Start incorporating propulsion system and thrust vectoring capability into the SRFCS reconfiguration control laws.

(U) Work Performed By: Project managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. The Flight Dynamics Lab will also perform in-house real time simulations. Flight testing will be done at Edwards AFB CA. The three contractors are MCAIR, St Louis MO; General Electric, Binghamton NY; and Alpha Tech Inc, Burlington MA.

(U) Related Activities:
- (U) PE 0603205F, Aerospace Vehicle Technology
- (U) PE 0603106F, Logistics Systems Technology
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 3391, X-29 Advanced Technology Demonstrator: Develops, integrates, and flight validates advanced aerodynamic, structural, and flight control technologies of a forward swept wing aircraft that will provide design options for future military aircraft. Technologies include an aeroelastically tailored forward swept wing using composite wing skins, discrete variable wing camber, relaxed static stability, and digital fly-by-wire flight controls with canards. This program also evaluates X-29 military utility flight performance and investigates high angle-of-attack (AOA) flight characteristics of the forward swept wing.

(U) FY 1989 Accomplishments:
- (U) Finished X-29 aircraft #1 flight testing and demonstrated transonic performance improvements (over current fighter configurations).
- (U) Upgraded X-29 aircraft #2 flight control software/control laws for high AOA flight testing. Conducted ground and in-flight checkouts of all systems.

Program Element: #0603245 Budget Activity: #2 - Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

(U) FY 1990 Planned Program:
- (U) Redesign X-29 flight control software to fix a single point failure and to improve aircraft #2 agility/maneuver performance.
- (U) Complete X-29 aircraft #2 high AOA flight testing.

(U) FY 1991 Planned Program: Not applicable.

(U) Work Performed By: Project managed by the Flight Dynamics Lab, Wright-Patterson AFB OH. Flight testing is done at Edwards AFB CA. The only contractor is Grumman Aircraft Corp, Bethpage NY.

(U) Related Activities:
- (U) The X-29 program is jointly funded with NASA (PE533-02-51).
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603245F
PE Title: Advanced Flight Technology Integration (AFTI)
Project Number: 2061
Budget Activity: #2 - Adv Tech Devel

A. (U) RESOURCES ($ in Thousands)

Project Title: Vehicle/Avionics/Weapons Integration

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Integrated Control and Avionics for Air Superiority (ICAAS)	5,720	7,150	12,775	Cont	TBD
AFTI F-16 Close Air Support	130	4,000	2,000	Cont	TBD
Total:	5,850	11,150	14,775	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES: This project covers flight technology demonstrations that integrate and flight test primary elements of a fighter weapon system to successfully acquire, engage, and kill multiple air and ground threats and survive. Fighter weapon system technologies integrated and flight tested include: sensors, fire control, flight control, weapons and pilot/vehicle interfaces. This project consists of two programs: (1) The Integrated Control and Avionics for Air Superiority (ICAAS) program which addresses the few (friendly) vs many (enemy) fighter problem during air-to-air engagement at beyond visual range (BVR) with smart transition to within visual ranges (WVR). Here benefits of cooperative action (internetting) among friendly fighters, sensor data fusion, automated attack/defend options for optimum engagement/defense, integrated vehicle flight/fire control, and advanced pilot/vehicle interfaces will be flight tested. Payoffs are a projected 10:1 air-to-air combat exchange ratio, a greatly improved situational awareness during merge and engagement operations, more effective use of air-to-air missiles, and greater pilot survivability. This project will evolve into integration of multi-role avionics and cockpit technologies, and enhanced air vehicle maneuvering capabilities to improve survivability when outnumbered in close-in combat for application to derivative fighters. (2) The AFTI F-16 program which integrates and flight demonstrates technologies which enhance an aircraft's ability to find and destroy enemy ground targets during daytime or at night and under the weather. This will allow current daytime Close Air Support and Battlefield Air Interdiction tactics to be applied at night and under the weather--a capability not presently available today. Projected payoffs are a 50% improvement in first pass target acquisition capability with a 3 to 1 improvement in aircraft survivability. AFTI F-16 is jointly funded by the Balanced Technology Initiative (BTI).

Program Element: #0603245F
PE Title: Advanced Flight Technology Integration (AFTI)
Project Number: 2061
Budget Activity: #2 - Adv Tech Devel

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Integrated target detection, track, and identification algorithms developed under an avionics PE into ICAAS multi-threat engagement software and aircraft flight control systems.
   - (U) Prepared a flight test plan for two friendly fighters vs four enemy aircraft (2 vs 4).
   - (U) Integrated Pave Penny (laser spot tracker) into AFTI F-16.
   - (U) Started AFTI F-16 upgrade (near production) allowing aircraft to accept new subsystems.

2. (U) FY 1990 Planned Program:
   - (U) Integrate 2 vs 4 aircraft engagement software and hardware into the test aircraft and begin system testing.
   - (U) Expand ICAAS 2 vs 4 tactics options and increase the number of sensors being integrated for internetted (automated data link) operations between the two friendly fighters.
   - (U) Flight demonstrate laser spot tracker and two ship coordinated attack against multiple ground targets.
   - (U) Complete AFTI F-16 upgrade (near production) and integrate night under the weather attack technologies into aircraft.

3. (U) FY 1991 Planned Program:
   - (U) Complete ICAAS 2 vs 4 software integration and aircraft modification.
   - (U) Start ICAAS 2 vs 4 flight testing.
   - (U) Expand ICAAS software development to a 4 vs 16 engagement capability. This capability will be limited to ground simulation testing.
   - (U) Evaluate/flight test hardware/software integration and aircraft automation for single seat fighter under the weather night attack.
   - (U) Flight test terrain following and threat avoidance technologies on AFTI F-16.

D. (U) WORK PERFORMED BY: This project is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB OH. Flight testing is conducted at the Air Force Flight Test Center, Edwards AFB CA with support from NASA. The two contractors are MCAIR, St Louis MO and General Dynamics, Ft Worth TX.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:

Program Element: #0603245F Project Number: 2061
PE Title: Advanced Flight Technology Integration (AFTI) Budget Activity: #2 - Adv Tech Devel

- (U) TAF SON 304-83, Advanced Tactical Fighter, 9 Nov 84.
- (U) TAF SON 310-85, Air Defense Aircraft, 7 Jan 86.
- (U) SAC SON 002-86, Improved Interceptor (Draft)
- (U) SAC SON 309-087, Aircrew Night Vision System, 26 Aug 88.
- (U) TAF SON 301-087, Day/Night, All Weather Tactical Reconnaissance Sensor Package, 18 Dec 87.
- (U) TAF SON 312-088, A-10 Follow-On Aircraft, 10 May 89

G. (U) RELATED ACTIVITIES:
- (U) PE 0603205F, Aerospace Vehicle Technology. Provides component technologies that are integrated and flight tested in this PE.
- (U) PE 0603253F, Advanced Avionic Integration. Provides basic avionics algorithms used to develop flight control software.
- (U) PE 0603230F, Advanced Tactical Fighter (ATF).
- (U) PE 0603231F, Crew Systems. Provides helmet mounted display for AFTI F-16 night attack capability.
- (U) No duplication of effort within the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

ICAAS	
- (U) Aircraft mods started	2 Qtr 90
- (U) Internetted (2 vs 4) flight testing started	2 Qtr 91
- (U) 2 vs 4 flight testing completed	4 Qtr 92
- (U) 4 vs 16 internetted simulation testing completed	4 Qtr 92
AFTI F-16	
- (U) Close Air Support Pave Penny and two ship cooperative attack demonstrated	1 Qtr 90
- (U) Upgrade (near production) completed	4 Qtr 90
- (U) Night and under the weather mods completed	1 Qtr 91
- (U) Single seat night/under the weather attack capability demonstrated	4 Qtr 91

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603250F
PE Title: Lincoln Laboratory
Project Number: #649L
Budget Activity: #2-Advanced Technology Development

A. (U) RESOURCES ($ in Thousands)
Project Title: Lincoln Laboratory

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Lincoln Laboratory	25,003	23,073	27,609	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Lincoln Program is a high-technology research and development effort conducted through a cost reimbursable contract with Massachusetts Institute of Technology. Lincoln Laboratory is operated as a Federal Contract Research Center (FCRC) administered by the Department of Defense. Lincoln Laboratory provides advanced research and technology demonstrations in the areas of military satellite communications, space radar technology, space-based visible surveillance, deep-space and tactical battlefield surveillance, advance solid-state devices, materials and processing technology. The Laboratory continues to be a leader in providing critical enabling technologies for advanced space surveillance and communication systems and ensures that the Air Force maintains its technology leadership role in advanced electronics. Explanation for FY91 funds increase found in paragraph "E.3", Cost Changes.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Established rapid turn around integrated circuit modification capability using a laser restructuring technique that compresses design to testing time from months to days.
   - (U) Developed agile extra high frequency (EHF) adaptive antenna subsystems for space communications.
   - (U) Finished brassboard system and space qualification of key Lasercom flight-design subsystems.
   - (U) Completed design and initiate fabrication of space-based radar signal processor test bed.
   - (U) Developed gallium arsenide permeable base transistor (PBT) 44-GHz monolithic microwave integrated circuits (MMICs). These circuits are used in advanced space communication systems.
   - (U) Develop film-growth techniques and device exploration using diamond material which increases the electronic device's speed. Used in intelligence, communications and surveillance systems.
   - (U) Sucessfully launched into orbit the second fleet satellite (FLTSAT) EHF package designed by Lincoln.

2. (U) FY 1990 Planned Program:
   - (U) Design wafer-scale neural network system for image processing.
   - (U) Complete space-based radar signal processor test bed.

Program Element: #0603250F
PE Title: Lincoln Laboratory
Project Number: #649L
Budget Activity: #2-Advanced Technology Development

- (U) Test autonomous acquisition and classification techniques against a variety of tactical targets for aircraft ground attack and smart weapon applications.
- (U) Begin development of Doppler beam sharpening for remotely piloted vehicle (RPV) radar program.
- (U) Continue development of the brassboard agile EHF adaptive antenna for advanced satellite communication systems.
- (U) Continue Lasercom technology program to achieve higher data rates, smaller sizes, less weight for space communication system.
- (U) Begin phased performance evaluation of space-based radar test articles in near-field test range. This is an advanced testing system measuring space test articles.
- (U) Develop GaAs PBT 60-GHz power and 94-GHz small-signal MMIC for advanced space communication systems.
- (U) Continue development of film-growth techniques and fabrication of transistors made from diamond material.
- (U) Develop radiation hardened charged coupled device (CCD) imagers for surveillance and intelligence applications.
- (U) Demonstrate field tests of advanced CCD focal planes in an integrated space surveillance sensor.

3. (U) FY 1991 Planned Program:

- (U) Extend rapid prototyping to sub-micron electronic devices to decrease turn around time in designing and testing new circuits.
- (U) Conduct field test demonstrations of fixed-target detection capability and develop Air Defense RPV radar.
- (U) Develop an airborne test-bed preprocessor embodying neural network and expert system components to demonstrate real-time multidimensional automatic target recognition.
- (U) Complete and test the agile EHF antenna for space applications.
- (U) Integrate/test Lasercom cross-link package flight-design and engineering model and continue technology extension program.
- (U) Begin integration of high-throughput wafer-scale jammer nulling processor with space-based radar processor test bed.
- (U) Integrate all space-based radar test-beds for comprehensive capability demonstration in near-field test range.
- (U) Model and fabricate diamond transistors for high power and high-frequency performance.
- (U) Develop and demonstrate large area array CCD imagers in infrared and ultraviolet bands for space-surveillance sensors.
- (U) Develop materials structures for uniform, high-quantum efficiency long-wavelength IR detectors for space surveillance.
- (U) Develop a fabrication technique that will allow superconductive thin films and semiconductors to be combined at a reasonable fabrication temperature.
- (U) Continue to develop dual-use electro-optical and microelectronic devices and manufacturing techniques that are incorporated into military and commercial products.

Program Element: #0603250F
PE Title: Lincoln Laboratory
Project Number: #649L
Budget Activity: #2-Advanced Technology Development

- (U) In collaboration with industry, develop a space-qualifiable wafer-scale adaptive nulling circuit for space surveillance.
- (U) Incorporate wafer-scale adaptive nulling processor (5 million transistors, 2 billion operations per second) into space-based radar testbed.
- (U) Investigate and build radiation-hardened sub-micron transistors in ultrathin silicon-on-insulator (SOI) material for very high speed integrated circuits.
- (U) Combine reoxidized nitrided oxide (RNO) and ultrathin SOI to demonstrate extremely good hot-carrier reliability in sub-micron transistors.
- (U) Flight tests of multi-dimensional forward and down looking electro-optical sensor suite to collect data on targets in camouflage and foliage concealment.

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

D. (U) WORK PERFORMED BY: There are no prime contractors that support this program. Funds are principally used to pay salaries and to a much lesser degree used to purchase supplies for in-house activities at Lincoln Laboratory.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1.(U) TECHNICAL CHANGES: None
2.(U) SCHEDULE CHANGES: Not Applicable
3.(U) COST CHANGES: Over the past three years, Air Force has reprogrammed $6million into this PE to stabilize and reduce the erosion of Lincoln Laboratory's technology base. This continues to be the reason for the FY91 requested increase.

F. (U) PROGRAM DOCUMENTATION: 1951, MIT Lincoln Laboratory FCRC Charter; 1975, Department of Defense Plan for Administration of Lincoln.

G. (U) RELATED ACTIVITIES:
- (U) PE 0102424F, Space Track
- (U) PE 0102428F, Space Surveillance Technology
- (U) PE 0303401F, Communications Security
- (U) PE 0303603F, MILSTAR
- (U) PE 0601101E, Restructurable Very Large Scale Integration
- (U) PE 0601102F, Defense Research Science
- (U) PE 0602301E, Wafer-Scale Integration
- (U) PE 0602702F, Command, Control and Communications
- (U) PE 0603789F, C3I Technology Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
666A Advanced Reference Systems Development	2,274	2,818	2,633	Cont	TBD
2733 Advanced Reconnaissance/Strike Radars	6,062	5,250	6,873	Cont	TBD
2735 Advanced Systems Avionics Applications	2,299	4,227	3,744	Cont	TBD
3833 Sensor Integration for Covert Penetration	100	1,668	1,829	Cont	TBD
Total	10,735	13,963	15,079	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element develops, integrates and demonstrates advanced avionics technologies. The demonstrations offer strong evidence of increased effectiveness and efficiency and reduced development risk and cost. Thrusts are directed at high speed data buses; efficient, high speed processors; reliable, high performance radars; and accurate/low cost navigation systems. The funding increase in the outyears recovers the program element from congressional reductions to the FY 1988/89 programs. Specific increases in FY 1990/91 reflect growth to support advances in radar technology, system integration, and covert sensor architecture.

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

1. (U) Project 666A, Advanced Reference Systems Development: The survivable penetration and attack by tactical aircraft and accurate weapon delivery require accurate and reliable navigation systems. This project develops navigation sensors, integration techniques, and software to improve the accuracy and availability of navigation and reference information for future weapon systems. Major technology thrusts are jam resistant navigation receivers; multifunction antenna systems for combined communications/navigation/electronic warfare functions; highly reliable/fast response strapdown stellar inertial system; and navigation system integration with emphasis on increased performance, reliability and reduced life cycle costs.

(U) FY 1989 Accomplishments:
- (U) Completed laboratory test of a high accuracy ring laser gyroscope inertial navigation system for tactical applications.
- (U) Completed preliminary design of a fast reacting, highly reliable strapdown stellar inertial system that has application to strategic weapon systems.

(U) FY 1990 Planned Program:
- (U) Fabricate a brassboard of an anti-jam global positioning

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

system receiver that will demonstrate improved performance in a jamming environment.
- (U) Initiate joint Air Force/Navy development of a strapdown stellar inertial system that will improve performance.
- (U) Initiate joint Air Force/Navy integrated antenna system development that will significantly reduce the number of antennas on tactical fighter aircraft.

(U) FY 1991 Planned Program:
- (U) Complete testing and evaluation of an anti-jam Global Positioning System brassboard receiver that will demonstrate improved performance in a jamming environment.
- (U) Fabricate a strapdown stellar inertial brassboard system that will improve reliability, and reduce size, weight and cost over current stellar navigation systems.
- (U) Complete system design of an integrated antenna system that will reduce the number of antennas on tactical fighter aircraft.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH manages this project. Major contractors are: Rockwell International, Anaheim CA; Northrop, Hawthorne CA; and Mayflower Communications, Reading MA.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE 0305164F, NAVSTAR Global Positioning System (User Equipment).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2733, Advanced Reconnaissance/Strike Radars: The ability to detect and acquire targets that are concealed or camouflaged is limited. Continued improvements in low observable and camouflaged, concealment and deception techniques require improvements to be made in airborne reconnaissance/strike radar capabilities to automatically acquire and detect concealed or camouflaged targets. This project develops and demonstrates radar sensor and automatic processing technologies for rapid targeting, and detection of targets camouflaged or concealed in foliage.

(U) FY 1989 Accomplishments:
- (U) Completed rooftop/range testing of an active array radar aperture to provide critical data for risk reduction to the Advanced Tactical Fighter radar.

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

(U) FY 1990 Planned Program:
- (U) Develop concept for all-weather, real-time, automatic classification/recognition of tactical/strategic targets.
- (U) Initiatie joint United States/Canadian program to develop motion compensation techniques to expand Ultra High Resolution Synthetic Aperture Radar imaging capability in high maneuvers. Present capability is confined to limited maneuvers and mild turbulence.

(U) FY 1991 Planned Program:
- (U) Exploit model based vision research and parallel processor technology development to optimize algorithm/hardware for all-weather, real-time, automatic recognition of strategic and tactical targets.
- (U) Complete data collection of Ultra High Resolution Synthetic Aperture Radar (SAR) map and motion compensation data during maneuvering/turbulent flight conditions. Data is to be used to help develop techniques to improve SAR imaging during high maneuvers.
- (U) Develop conceptual design of a wide area air-to-surface search and cuing radar capable of reliably detecting high value strategic/tactical targets deliberately camouflaged or concealed in foliage.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH manages this project. Contractors are: Westinghouse, Baltimore MD and Loral Defense Systems, Litchfield Park AZ.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Defense development sharing project agreement between the United States Air Force and the Canadian Government for motion compensation for accurate synthetic radar imaging.

3. (U) Project 2735, Advanced Systems Avionics Applications: Past avionics systems were developed and designed in piecemeal fashion. This approach resulted in costly, bulky, unigue designs, with complex interfaces with other systems creating a complex maintenance environment. The approach now is toward the design/development of modular avionics which emphasizes resource sharing, fault tolerant operation, and increased performance at lower cost. Work in this project has the objective of validating that the cost burden of future avionics can be lowered while meeting demanding supportability

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

and performance needs. Efforts will focus on using technologies from various government programs for developing and demonstrating integrated avionics architectures, highly reliable avionics, packaging and cooling, and computer architecture designs tools for avionics system designs/product designs/manufacturing. Growth in FY 1990 and 1991 funding reflect this focus.

(U) FY 1989 Accomplishments:
- (U) Completed demonstration and evaluation of the Integrated Terrain Access and Retrieval System, an airborne database management system. This system has capability to store terrain/feature data, waypoint and threat information, digitized images and other forms of digital data.
- (U) Demonstrated a prototype graphics workstation for rapid programming of dynamic, 2- and 3-dimensional displays in Ada software. Goal achieved to reduce the time to develop/modify cockpit display software from months to days.

(U) FY 1990 Planned Program:
- (U) Demonstrate avionics fault tolerance features compatible with the Joint Integrated Avionics Working Group (JIAWG) architecture using laboratory avionics integrated test bed.
- (U) Complete concept study and preliminary designs for common radio frequency modules, reuseable application software modules and software design tools. Goal is to reduce cost and improve performance of future avionics systems.

(U) FY 1991 Planned Program:
- (U) Complete simulation tests on the designs for common radio frequency modules, reuseable application software modules and software design tools.
- (U) Complete requirements analysis for a high speed signal processor based on gallium arsenide technology which will be software programmable for multiple applications.

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH manages this project. Contractors are: TRW, Dayton OH; Research Triangle Institute, Durham NC; Lockheed, Burbank CA; McDonnell Douglas, St Louis MO; and Boeing, Seattle WA.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603109F, INEWS/ICNIA.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 3833, Sensor Integration for Covert Penetration: Most

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

current avionics suites produce radio frequency emissions that reveal the presence of the aircraft as well as provide the pilot with mission performance information. These emissions limit covert penetration. This project provides laboratory and flight demonstration of the system technologies to provide current and future air borne weapon systems with significant new capabilities to penetrate areas without detection. Efforts will concentrate on nap-of-the-earth flight capabilities in day or night with reduced emission, real-time threat avoidance, reduced pilot workload, and improved sensor management for data fusion. Growth in FY 90/91 funds reflect this focus.

(U) FY 1989 Accomplishments:
- (U) Evaluated survivable penetration techniques using inhouse system integration baseline avionics facilities and algorithms for low altitude, survivable penetration.

(U) FY 1990 Planned Program:
- (U) Study alternative techniques for information fusion that optimizes the interface between algorithms and sensor hardware. Goal is to improve speed and efficiency of information fusion.
- (U) Develop efficient fusion algorithms to do threat identification and location using information from onboard sensors.

(U) FY 1991 Planned Program:
- (U) Complete preliminary design of a low cost avionics suite for an advanced transport aircraft.
- (U) Evaluate fusion algorithms with compatible sensor suites to determine efficiency and performance in applications of information fusion.

(U) Work Performed By: Efforts in this project are managed by the Avionics Laboratory, Wright-Patterson AFB OH.

(U) Related Activities:
- (U) PE 0602204F, Aerospace Avionics.
- (U) PE 0603737D, Balanced Technology Initiative.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3479 Advanced Sensor Exploitation	1,292	1,450	682	Cont	TBD
3480 Automated Imagery Exploitation	1,814	1,500	1,000	Cont	TBD
3481 Knowledge Based Technology for Intelligence	1,692	1,480	1,600	Cont	TBD
3482 Scientific & Technical Intelligence Methodologies	94	726	1,100	Cont	TBD
Total	4,892	5,156	4,382	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Program develops and demonstrates advanced technology for intelligence systems capabilities and techniques which support tactical and strategic combat commanders and National Command Authority (NCA) needs for timely, all-source intelligence information. Objectives are to develop improved analytical techniques and training systems to support USAF warfighting missions, to expand and improve intelligence data storage, retrieval and handling capabilities, and to satisfy needs for near-real-time data processing, exploitation and dissemination from present and future advanced sensors. The program is oriented toward solving specific shortfalls and deficiencies as defined by Air Force major commands, unified and specified commands, and scientific and technical intelligence organizations.

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

1. (U) Project 3479, Advanced Sensor Exploitation (ASE): Develops near-real-time all-source correlation fusion using expert systems for receipt, correlation, templating and analysis of sensor data.

(U) FY 1989 Accomplishments:
- (U) Implemented situation assessment module.
- (U) Implemented generic sensor simulator.
- (U) Implemented target analysis module.
- (U) Operationally tested preliminary predictive intelligence capability (Rapid Application of Air Power).
- (U) Implemented enhanced correlation environment.
- (U) Ported ASE software to Portable All Source Analysis System/ Enemy Situation Correlation Element (ASAS/ENSCE) workstation.

(U) FY 1990 Planned Program:
- (U) Initiate analysis of sensor fusion applicability to low OWintensity conflict situations.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

- (U) Develop correlation/fusion evaluation subsystem using expert system approach.

(U) FY 1991 Planned Program:
- (U) Develop low intensity conflict intelligence processor.
- (U) Develop advanced planning system intelligence support module.

(U) Work Performed By: The program is managed by Air Force Systems Command (AFSC), Andrews AFB, MD, with project efforts conducted by the Rome Air Development Center (RADC), Griffiss AFB, NY. The major contractors involved include: PAR Technologies, Inc., New Hartford, NY; Synectics, Fairfax, VA; Hughes Aerospace, Culver City, CA; DBA Associates, Melbourne, FL; and Booz-Allen, Bethesda, MD.

(U) Related Activities:
(U) Program Element #0604750F, Intelligence Equipment.
(U) Program Element #0602702F, Command, Control, and Communications.
(U) Program Element #0603742F, Combat Identification Technology, for emergent technology.
(U) Program Element #0102310F, WWMCCS ADPNORAD.
(U) Program Element #0207411F, EIFEL Improvements.
(U) Program Element #0207412F, Tactical Air Control System Improvements.
(U) Program Element #0207422F, Tactical Air Control System Communications.
(U) Program Element #0207431F, Tactical Air Intelligence Systems.
(U) Program Element #0604321F, Joint Tactical Fusion Program.
(U) Program Element #0207435F, Tactical Imagery Processing, Exploitation, and Dissemination.
(U) Program Element #0303152F, WWMCCS Information System.
(U) Program Element #0603208F, Reconnaissance Sensor Development.
(U) Program Element #0603718F, Command, Control & Communications Advanced Development.
(U) Program Element #0603726F, Optic Development for engineering development of demonstrated solutions to operational requirements.
(U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 3480, Automated Imagery Exploitation (AIE): The objective is to develop and demonstrate technology advancements required for real/near-real-time multi-source/multi-imagery exploitation in a ground station environment. AIE is divided into four areas: Image Interpretation, Target Graphics, Target Location and Exploitation systems.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

(U) FY 1989 Accomplishments:
- (U) Completed the initial Air Order of Battle (AOB) automated change detection task.
- (U) Completed Geopositioning Demonstration System (GDS), a module to demonstrate positioning concepts at Air Force field sites.
- (U) Began to define, develop and integrate software into Rome Air Development Center (RADC) Image Processing Laboratory (IPL) to perform automated change detection of fixed military targets.
- (U) Continued reformatter technology task (Nunn Amendment funding was used).

(U) FY 1990 Planned Program:
- (U) Develop and integrate methods for automated production of terminal homing scenes from multi-source imagery for advanced weapons systems.
- (U) Design, develop and demonstrate an advanced, optimized exploitation capability in the IPL using an improved man-machine interface (MMI).
- (U) Develop algorithms and display methods to aid the photo interpreter in using multisensor/spectral imagery for target identification.

(U) FY 1991 Planned Program:
- (U) Develop and demonstrate imagery exploitation 2000 (IE2000) capability to interface softcopy workstations with new sophisticated windowing capabilities, image processing tools, and cartographic/geographic information.

(U) Work Performed By: See Project 3479.

(U) Related Activities: See Project 3479.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: Currently negotiating with NATO for the Imagery Reformatter.

3. (U) Project 3481, Knowledge Based Technology for Intelligence: The objective is to develop advanced computer software (expert systems) based on artificial intelligence techniques. The goal is to improve the ability of the Air Force intelligence analyst to perform their tasks.

(U) FY 1989 Accomplishments:
- (U) Demonstrated prototype computer subsystem modules to provide warning and assessment of foreign space and missile activity to Space Command.
- (U) Delivered knowledge-based software to the Air Force Intelligence Agency to assist analysts in rapid detection and monitoring of foreign denial and deception activities for air defense.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

- (U) Initiated computer expert system software to accelerate analysis of foreign aircraft tactics/capabilities and provide timely dissemination to the tactical commands.

(U) FY 1990 Planned Program:
- (U) Continue tactics analysis development.
- (U) Expand Denial and Deception effort to cover offensive counter air threats.
- (U) Develop a trans-launch rule base and mission payload assessment capability for Indication and Warning.
- (U) Initiate program for automated language (speech) translation.

(U) FY 1991 Planned Program:
- (U) Develop knowledge-based expert system for space object identification.
- (U) Develop rule based capability for countering denial and deception techniques associated with mobile missiles.
- (U) Continue work in language translation.

(U) Work Performed By: See Project 3479.

(U) Related Activities: See Project 3479.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

4. (U) Project 3482, Scientific and Technical Intelligence Methodologies: The objective is to conduct research on intelligence methodologies and develop operational employment simulation models to satisfy Air Force Foreign Technology Division (FTD) requirements.

(U) FY 1989 Accomplishments:
- (U) Developed the ELINT Analysis Expert System (EATS) to provide direct automated analysis of signal waveforms.

(U) FY 1990 Planned Program:
- (U) Complete the ELINT analysis expert system.
- (U) Develop Scientific and Technical Reporting Information Processing System (STRIPS) to improve on-line merging of S&T intelligence data during imagery exploitation.

(U) FY 1991 Planned Program:
- (U) Develop a man-machine interface to various models and software to couple models existing in different FTD branches
- (U) Develop an expert system for analyzing COBRA-series sensor data.

(U) Work Performed By: See Project 3479.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

(U) Related Activities: See Project 3479.

(U) Other Appropriation Funds: None.

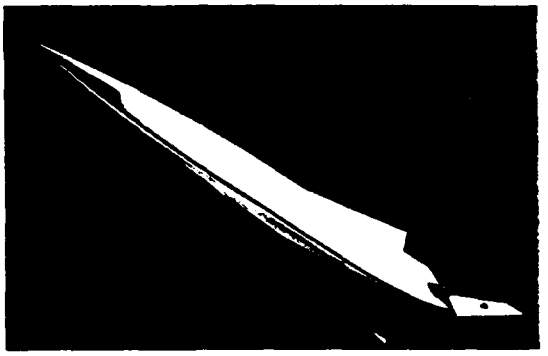
(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603269F
PE Title: National Aero-Space Plane (NASP) Technology Program

Project: # 3384
Budget Activity: # 2 - Advanced Technology Development

Project Title: NASP Technology Program



POPULAR NAME: X-30, NASP

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Start Phase IIC - Mar	Complete Phase IIC	Start Phase IID - Oct	Complete Phases II&III
Engineering Milestones	Engine Design Rev Mar 89	Begin composite config definition Apr 90	Final composite config defined Feb 91	Phase III Decision 2Q FY93
T&E Milestones	NA	NA	NA	TBD
Contract Milestones	Continue Phase II	Continue Phase II	Continue Phase II	Complete Phases II&III
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Propulsion	82,055	61,213	53,316	TBD
Airframe	31,539	26,780	23,697	TBD
Tech Mat & Matl's	75,160	79,581	63,387	TBD
Applications	2,171	3,513	2,600	TBD
X-30 Aero-Spacecraft	0	0	0	TBD
Support Contract	1,053	1,147	750	TBD
In-House Support	4,210	6,491	4,250	TBD
GFE/Other	32,255	13,758	10,000	TBD
Total [1]	228,443	192,483	158,000	TBD

Note 1: Detailed funding breakouts shown above the "total" line represent a pro-rata DoD share of joint DoD/NASA program. Total Program for FY 1990 is $254M and for FY 1991 is $277M.

Program Element: # 0603269F
PE Title: National Aero-Space Plane (NASP) Technology Program
Project: # 3384
Budget Activity: # 2 - Advanced Technology Development

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This program element funds the DoD portion of the joint DoD/NASA technology development and demonstration program for a National Aero-Space Plane (NASP). The NASP program will develop the technological basis for space launch vehicles capable of single-stage-to-orbit and for aircraft capable of hypersonic flight in the atmosphere. The technologies will be demonstrated in a flight research vehicle, the X-30. Following successful demonstration, the technologies will provide the basis for military and civil vehicles capable of: global unrefueled operation, reaching any point of the earth in two hours or less; providing routine, "on-demand" access to near space; reducing payload-to-orbit cost by an order of magnitude; and flexibly based, rapid response, space launch. Future NASP-derived vehicles (NDV's) would provide revolutionary increases in military capability. The NASP is envisioned to be an airbreathing, hydrogen fueled, single-stage-to-orbit experimental vehicle capable of operating (horizontal takeoff/landing) from conventional runways.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Reviewed by National Space Council. Presidential decision to continue as high priority national program
   - (U) Continued fabrication of major structural demonstration components including cryogenic tankage, wing/fuselage attachment structure and large fuselage section
   - (U) Continued to develop and refine three X-30 airframe contractor designs and integrate airframe and engine designs
   - (U) Reviewed scramjet engine designs and awarded Phase IIC contracts
   - (U) Aerodynamic wind tunnel tests on airframe and engine designs
   - (U) Upgraded fluid dynamic codes and validated with wind tunnel data
   - (U) Began scale-up of durable, high-temperature materials
   - (U) Conducted tests on leading edge, nose cap and actively cooled surfaces
   - (U) Upgraded and checked out engine test facilities and tested high speed ramjets/scramjets (component and subscale engines)

2. (U) FY 1990 Planned Program:
   - (U) Form national contractor team for balance of Phase II, continue implementation of Phase II with 2-1/2 year schedule extension
   - (U) Conduct inlet test for engine and airframe configurations
   - (U) Conduct direct-connect engine test
   - (U) Complete first round of aerodynamic wind tunnel tests, define lift/drag, stability and control, and aero-heating characteristics
   - (U) Complete tradeoff studies on options for achieving single-stage-to-orbit, compare manned/unmanned options

Program Element: # 0603269F
PE Title: National Aero-Space Plane (NASP) Technology Program
Project: # 3384
Budget Activity: # 2 - Advanced Technology Development

- (U) Conduct materials characterization tests, continue manufacturing technology efforts on selected materials
- (U) Conduct engine base burning tests and freejet simulation
- (U) Test airframe structural demonstration articles (cryogenic tanks, wing/fuselage attachment structure, and fuselage sections)

3. (U) FY 1991 Planned Program:
   - (U) Select a single airframe/engine configuration for the X-30
   - (U) Test airframe aerodynamic wind tunnel models based on selected X-30 configuration
   - (U) Design/fabricate airframe structural demonstration article based on selected X-30 configuration
   - (U) Review and select materials for ground demonstration engine
   - (U) Complete design of ground demonstration engine
   - (U) Continue design/fabrication of module-to-module engine test rig
   - (U) Continue low speed engine performance tests
   - (U) Complete fabrication of inlet test rig
   - (U) Deliver materials for ground demonstration engine and key structural test rigs
   - (U) Initiate development for long lead items

4. (U) Program to Completion:
   - (U) Complete testing of ground demonstration engine
   - (U) Complete testing of airframe structural demonstration articles
   - (U) Go/no-go decision to proceed into Phase III of the Program
   - (U) Design, fabricate two X-30 flight research vehicles for test
   - (U) First flight of the X-30 and initial flight test program with normal flight envelope expansion
   - (U) Conduct extended X-30 flight research program to demonstrate hypersonic cruise and single-stage-to-orbit
   - (U) Complete assessment of operational utility and applications to provide data on the use of NASP technologies in potential operational follow-on vehicles

D. (U) WORK PERFORMED BY: This is a joint DoD/NASA program. The Air Force has overall responsibility. A Joint Program Office has been established at Wright-Patterson AFB, Ohio. Actual technology development is being conducted by contractors, universities, and in-house Government laboratories. Contractors for engine development are: Pratt & Whitney, West Palm Beach, FL and Rocketdyne, Canoga Park, CA. Contractors for airframe design and component development are General Dynamics, Fort Worth, TX; McDonnell Douglas, Saint Louis, MO; and Rockwell, Downey, CA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None
   2. (U) SCHEDULE CHANGES: The Phase II program has been extended by 2-1/2 years on recommendation from the National Space Council and decision of the President.

Program Element: # 0603269F | Project: # 3384
PE Title: National Aero-Space Plane (NASP) Technology Program | Budget Activity: # 2 - Advanced Technology Development

3. (U) COST CHANGES: Previously agreed yearly funding levels have been reduced for Phase II of the program. FY 1990 and FY 1991 cost changes have been -$107,259 and -$231,524 respectively (DoD portion).

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC SON 07-79, Jun 79
- (U) AFSPACECOM SON 06-84, Mar 86
- (U) Memorandum of Agreement for NASP (AF/Navy/SDIO/DARPA), 25 April 1986
- (U) DoD/NASA Memorandum of Understanding, 27 Sep 1988

G. (U) RELATED ACTIVITIES:
- (U) NASP is a joint DoD/NASA program. Participation among DoD organizations is governed by a Memorandum of Agreement (MOA), signed by all Services/Agencies and by the Under Secretary of Defense for Research and Engineering, dated 25 Apr 1986.
- (U) Relationship between DoD and NASA is governed by a Memorandum of Understanding (MOU), signed by the Secretary of Defense and the NASA Administrator, dated 27 Sep 1988.
- (U) Broad programmatic policy and direction are provided to the NASP program by the NASP Steering Group, chaired by the Under Secretary of Defense (Acquisition) with the NASA Deputy Administrator as Vice-Chairman. All other participating organizations have members. The Director, White House Office of Science and Technology Policy is an ex-officio member. The NASP Steering Group approves all changes in program goals, objectives, funding and schedules.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results

See Section C. for testing accomplished on airframe and engine components.

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Submit Research Plan	2Q/FY1993	Start of Phase III
X-30 First Atmospheric Flight	4Q/FY1997	Start of flight research program to demonstrate NASP technologies
X-30 First Orbital Flight	4Q/FY1999	First demonstration of the ultimate NASP program goal

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603270F Budget Activity: #2 Advanced Technology Development
PE Title: Electronic Combat Technology

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2222 Electro-Optical Countermeasures	2,691	1,158	2,474	Cont	TBD
2432 Warning & Avoidance Receiver Systems Technology	5,757	9,570	12,655	Cont	TBD
2754 C3 Countermeasures Technology	983	1,100	1,830	Cont	TBD
431G Infrared Countermeasures	11,490	10,356	7,465	Cont	TBD
691X Electronic Warfare Technology	13,795	10,016	12,515	Cont	TBD
Total	34,716	32,200	36,939	Cont	

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Electronic Combat Technology program element is an on-going advanced development program intended to expand the electronic warfare (EW) technology base by performing proof of design concepts and demonstrating technologies to solve critical USAF EW requirements. The projects are categorized by the development of components, subsystems, and technology demonstrators that have potential applications to satisfy tactical and strategic EW requirements and to reduce acquisition and life cycle costs of EW systems. The program includes the development and demonstration of radio frequency (RF), infrared (IR), electro-optical (EO) and command, control, and communication (C3) countermeasure technologies. In addition, signature reduction, advanced EW transmitters, receivers, and power management technologies and concepts are demonstrated.

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

1. (U) Project 2222, Electro-Optical Countermeasures (EOCM): Develops technologies for detecting and countering optical and television (TV) directed threats against strategic, airlift and tactical aircraft.

Program Element: #0603270F Budget Activity: #2 Advanced Technology Development
PE Title: Electronic Combat Technology

(U) International Cooperative Agreements: [

2. (U) Project 2754, C3 Countermeasures Technology: Consolidates Command, Control and Communication Countermeasures (C3CM) efforts to develop and demonstrate technologies to counter enemy C3 systems. Develops [

(U) FY 1989 Accomplishments:
- (S) Continued [
- (S) Continued [

(U) FY 1990 Planned Program:
- (U) Complete [
- (U) Complete [
- (U) Initiate brass board development of a [

(U) FY 1991 Planned Program:
- (U) Complete strategic link jammer test.
- (U) Complete [ ] system flight test.
- (U) Initiate [ ] program.
- (U) Continue brass board development of a [system.

(U) Work Performed By: Program Management is provided through the Wright Research and Development Center, Wright-Patterson AFB, OH. Major Contracts are with: Magnovax, Ft Wayne, IN, and Harris, Melborne, FL, Hazeltine Corp, Long Island, NY.

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics.
- (U) Program Element 0604270F, EW Development.
- (U) Program Element 0603270A, Electronic Combat Technology.
- (U) Program Element 0603270N, Electronic Combat Technology.
- (U) Program Element 0603203F, Offensive Avionics, ECCM Technology.

Program Element: #0603270F Budget Activity: #2 Advanced Technology Development
PE Title: Electronic Combat Technology

(U) FY 1989 Accomplishments:
- (U) Started
- (U) Continued

(U) FY 1990 Planned Program:
- (U) Start EO/RF coordinated test to determine the effectiveness of combined EO and RF countermeasures against radar threats capable of optical tracking..
- (U) Complete Coronet Prince prototype flight test.

(U) FY 1991 Planned Program:
- (U) Complete Coronet Prince prototype test program.
- (U) Continue EO/RF coordinated test program.

(U) Work Performed By: The Wright Research and Development Center, Wright-Patterson AFB, OH, manages the program. Testing is performed primarily at Edwards AFB, CA, the Air Force Armament Division, Eglin AFB, FL, and the Tonopah Test Range at Nellis AFB, NV. The major contractors are: Westinghouse, Baltimore, MD, and General Electric Corp., Binghampton, NY.

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics.
- (U) Program Element 0604270F, EW Development.
- (U) Program Element 0603270A, Electronic Combat Technology.
- (U) Program Element 0603270N, Electronic Combat Technology.
- (U) Program Element 0603203F, Offensive Avionics, ECCM Technology.
- (U) The work in this project is closely coordinated with related Army and Navy efforts through Joint reviews conducted by the Joint Director of Laboratories/Technical Panel for Electronic Warfare. It is also coupled with the engineering development community of the three services through the Joint Technical Coordinating Group for Aircraft Survivability and Electronic Warfare. Additionally, the user agencies such as TAC, MAC, SAC, and ASD, conduct an annual review of the programs in this program element.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

Program Element: #0603270F Budget Activity: #2 Advanced Technology Development
PE Title: Electronic Combat Technology

- (U) The work in this project is closely coordinated with related Army and Navy efforts through Joint reviews conducted by the Joint Director of Laboratories/Technical Panel for Electronic Warfare. It is also coupled with the engineering development community of the three services through the Joint Technical Coordinating Group for Aircraft Survivability and Electronic Warfare.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

3. (U) Project 431G, Infrared (IR) Countermeasures: This project demonstrates advanced development systems and techniques to counter enemy air and ground threat systems that operate in the IR spectrum. The programs in this project address the improvements to[

(U) FY 1989 Accomplishments:
- (U) Continued advanced aerodynamic flare development to provide IRCM protection against current deployed IR missile capable of defeating existing decoys..
- (U) Continued the demonstration and ground testing of the Silent Attack Warning System (SAWS), a passive scanning IR missile warning system.
- ( ) Started development of
- (U) Started a laser based IRCM development program (HAVE GLANCE).

(U) FY 1990 Planned Program:
- (U) Continue the HAVE GLANCE Program.
- (U) Continue SAWS demo and ground test program.
- ( ) Continue development started in FY 1988.

(U) FY 1991 Planned Program:
- (U) Complete SAWS flight test.
- (U) Complete development.
- (U) Continue analysis and evaluation of IR CM concepts for advanced seekers and HAVE GLANCE.
- (U) Continue HAVE GLANCE.

Program Element: #0603270F Budget Activity: #2 Advanced Technology Development
PE Title: Electronic Combat Technology

(U) WORK PERFORMED BY: The Wright Research and Development Center, Wright-Patterson AFB, OH manages the program. Testing is performed primarily at the Air Force Armament Division, Eglin AFB, FL, and Tonopah Test Range at Nellis AFB, NV, although other DoD test facilities are sometimes used. The major contractors are: Westinghouse, Baltimore, MD, Loral EOS, Akron OH, Texas Instruments, Dallas, TX, General Electric Corp,

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics.
- (U) Program Element 0604270F, EW Development.
- (U) Program Element 0603270A, Electronic Combat Technology.
- (U) Program Element 0603270N, Electronic Combat Technology.
- (U) Program Element 0603203F, Offensive Avionics, ECCM Technology.
- (U) The work in this project is closely coordinated with related Army and Navy efforts through Joint reviews conducted by the Joint Director of Laboratories/Technical Panel for Electronic Warfare. It is also coupled with the engineering development community of the three services through the Joint Technical Coordinating Group for Aircraft Survivability and Electronic Warfare.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Balanced Technology Initiative provided $400,000 in FY 89.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603270F Project Number: 2432
PE Title: Electronic Combat Technology Budget Activity: #2 Advanced Technology Development

A. (U) RESOURCES ($ In Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2432 Warning and Avoidance Receiver Systems Technology	5,757	9,570	12,655	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project develops advanced electronic combat preprocessor and processor technologies, advanced algorithm and AI/expert software for applications on existing and future EC systems. Improved[ ] are also developed and demonstrated in this project.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Started Very High Speed Integrated Circuits (VHSIC)-based core processor hot-bench for integration with available receivers, processors, and advanced ECM techniques generator.
   - ( ) Started[ ]
   - (U) Started analysis of how to best apply the ADA language to EC.

2. (U) FY 1990 Planned Program:
   - (U) Continue VHSIC-based core processor hot-bench for integration with available receivers and processors along with advanced ECM techniques generator.
   - (U) Complete ADA language for EW applications analysis.
   - (U) Continue multi-spectral shared apertures program.
   - (U) Continue Tactical Situation Assessment and response Strategy that was started in FY 88 to demonstrate the utility of artificial intelligence in integrated systems processing for electronic combat suites.

3. (U) FY 1991 Planned Program:
   - (U) Continue VHSIC-based core processor integration.
   - (U) Start an artificial intelligence situation assessment effort.
   - (U) Start an analysis of angle of arrival power management concepts.

Program Element: #0603270F Project Number: 2432
PE Title: Electronic Combat Technology Budget Activity: #2 Advanced Technology Development

4. (U) Program to Completion: This is an ongoing program.

D. (U) WORK PERFORMED BY: Program Management is provided through the Wright Research and Development Center, Wright-Patterson AFB, OH. Major Contracts are with: Westinghouse, Baltimore, MD; TRW, San Diego, CA; Raytheon, Goleta, CA; and Northrop, Rolling Meadows, IL.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: The technical content of this project was expanded to include off-board countermeasure systems.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: The increased budget reflects the expanded technical objectives of the program.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAC SONS(s): 304-83; 315-73.
- (U) SAC SONS(s): 86-012; 11-87.
- (U) MAC SONS(s): 7-81; 8-81.

G. (U) RELATED ACTIVITIES:
- (U) Program Element 0602204F, Aerospace Avionics.
- (U) Program Element 0604270F, EW Development.
- (U) Program Element 0603270A, Electronic Combat Technology.
- (U) Program Element 0603270N, Electronic Combat Technology.
- (U) Program Element 0603203F, Offensive Avionics, ECCM Technology.
- (U) The work in this project is closely coordinated with related Army and Navy efforts through Joint reviews conducted by the Joint Director of Laboratories/Technical Panel for Electronic Warfare. It is also coupled with the engineering development community of the three services through the Joint Technical Coordinating Group for Aircraft Survivability and Electronic Warfare. Additionally, the user agencies such as TAC, MAC, SAC and ASD, conduct an annual review of the programs in this program element.
- (U) There is no unnecessary duplication of effort within the Air Force for the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

	Dates
- (U) Tactical Situation Assessment and Response Strategy Demonstrations	Aug 90
- (U) ALR-46/69 Random Agile Deinterleaver Insertion OFP demonstration	Jun 92
- (U) IR/RF Decoy test demonstration	Aug 92
- (U) High Power countermeasure brassbroad flight test	Aug 94

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603270F Project Number: 691X
PE Title: Electronic Combat Technology Budget Activity: #2 Advanced Technology Development

A. (U) RESOURCES ($ In Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
691X Electronic Warfare Technology	13,795	10,016	12,515	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project provides advanced development of new techniques and hardware for both existing and new electronic warfare systems to counter threat systems (surface-to-air missile, antiaircraft artillery and air interceptor) operating in the radio frequency spectrum. The project includes the following areas: (1) a supporting simulation effort that guides the allocation of funding through the evaluation of new concepts and techniques; (2) on-board jamming systems, component and techniques needed to jam enemy radar; (3) off-board or expendable systems to confuse enemy radars and dilute enemy defenses; (4) [redacted] (5) the development of standardized and low cost reliable and maintainable components and systems to enable the Department of Defense to better afford the increasing amount and sophistication of electronic countermeasures equipment required on modern aircraft; and (6) development of advanced [redacted] requirements. The enemy air defense network is characterized by both airborne and land based radar and communication systems that locate, monitor, guide and control offensive and defensive elements. The enemy continues to improve these elements against our forces and our operational countermeasures. This requires a strong technology base to provide demonstrated counters to these improvements and avoid technological surprises by new enemy threat systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued [redacted] hardware developments.
   - (U) Continued updated [redacted]
   - (U) Continue Military Airlift Command (MAC) EW studies targeted toward protecting the C-17, C-130, C-5 and C141.
   - (U) Continued active radio frequency (RF) expendable program.
   - (U) Started MAC EW suite development.
   - (U) Continued intrapulse processor development.

Program Element: #0603270F Project Number: 691X
PE Title: Electronic Combat Technology Budget Activity: #2 Advanced Technology Development

2. (U) FY 1990 Planned Program:
   - (U) Continue MAC EW suite development.
   - (U) Continue RF expendable program.
   - ( ) Flight test [redacted]
   - (U) Continue special antenna technology program.

3. (U) FY 1991 Planned Program:
   - (U) Complete advanced threat warning antenna development and test.
   - (U) Start limited field testing of MAC EW suite.
   - (U) Continue ground testing of the solid state jammer.
   - (U) Start [redacted] development program.

4. (U) Program to Completion: This is an ongoing program.

D. (U) WORK PERFORMED BY: The Wright Research and Development Center, Wright-Patterson AFB, OH, manages the program. Contractors include: Westinghouse, Baltimore, MD; Raytheon, Goleta, CA; and Northrop, Rolling Meadows, IL. Testing is performed primarily at the Air Force Armament Division, Eglin AFB, FL, and the Tonopah Test Range at Nellis AFB, NV.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: None.
   3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) TAC SON(s): 315-73; 304-80; 304-83.
   - (U) SAC SON(s): 12-86; 11-87; 6-81.
   - (U) MAC SON(s): 7-81; 8-81.

G. (U) RELATED ACTIVITIES:
   - (U) Program Element 0602204F, Aerospace Avionics.
   - (U) Program Element 0604270F, EW Development.
   - (U) Program Element 0603270A, Electronic Combat Technology.
   - (U) Program Element 0603270N, Electronic Combat Technology.
   - (U) Program Element 0603203F, Offensive Avionics, ECCM Technology.
   - (U) Program Element 0603605F, Advanced Weapons Technology.
   - (U) The work in this project is closely coordinated with related Army and Navy efforts through Joint reviews conducted by the Joint Director of Laboratories/Technical Panel for Electronic Warfare. It is also coupled with the engineering development community of the three services through the Joint Technical Coordinating Group for Aircraft Survivability and Electronic Warfare.
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0603270F Project Number: 691X
PE Title: Electronic Combat Technology Budget Activity: #2 Advanced Technology Development

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

	Dates
1. (U) Flight Test MAC EW suite	FY 1990
2. (U) Complete Advanced Threat Warning Antenna development test	FY 1991
3. (U) Start solid state jammer flight test	FY 1991

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603302F Budget Activity: #2 - Advanced Technology Development
PE Title: Space and Missile Rocket Propulsion

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
6339 Air-Launched Missile Propulsion Technology	2,000	2,300	2,868	Cont	TBD
6340 Space Systems Propulsion Technology	4,282	6,388	7,000	Cont	TBD
6341 Ballistic Missile Propulsion Technology	2,280	2,300	2,700	Cont	TBD
Total	8,562	10,988	12,568	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This science and technology program provides advanced rocket propulsion technology options for tactical and strategic missile and space systems. This critical technology enables new mission capabilities, enhances system survivability and flexibility, and increases reliability and cost effectiveness. This program integrates selected component technologies developed in Rocket Propulsion Technology (PE 0602302F) and conducts risk reducing, "proof of principle" demonstrations in full-scale propulsion systems. The demonstrations are focused on three classes of Air Force systems: air-launched missile, space, and ballistic missile systems.

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

1. (U) Project 6339 - Air-Launched Missile Propulsion Technology: This project flight-qualifies advanced rocket propulsion technology for air-to-air and air-to-surface missile systems. The current effort, High Performance/Low Observable (HPLO) Motor, integrates a promising energy management concept (pulse motor) with low signature propellant and tactical thrust vector control technology. This combination enhances mission capabilities of short and medium range tactical missiles by increasing the lethality envelope by 100 percent and end-game velocity by 200 percent. The HPLO technology enables development of low observable, compressed carriage missiles for advanced fighter and attack aircraft, increasing aircraft weapons loadout 100 percent and enhancing aircraft survivability. This project will complete preliminary flight rating tests and deliver flight-qualified motors in FY 1992. The HPLO motor is included in the Joint Tactical Air-to-Air Missile Master Plan.

(U) FY 1989 Accomplishments:
- (U) Completed detailed design of pulse motor components.
- (U) Initiated fabrication of motor components in preparation for component design verification testing.

(U) FY 1990 Planned Program:
- (U) Complete component development tests to verify component design prior to ground tests of complete motors.

Program Element: #0603302F Budget Activity: #2 - Advanced Technology Development
PE Title: Space and Missile Rocket Propulsion

- (U) Integrate verified motor components and fabricate heavyweight pulse motors for ground testing.

(U) FY 1991 Planned Program:
- (U) Operate heavyweight motors on ground test stands to measure increased pulse motor performance, low signature plume characteristics, and tactical thrust vectoring.
- (U) Update motor design and fabricate full-scale flightweight motors in preparation for preliminary flight rating test series to flight-qualify the pulse motor design.

(U) Work Performed By: This project is managed by the Astronautics Laboratory, Edwards AFB CA. The only contractor for the HPLO Motor is Hercules, Rocket Center WV.

(U) Related Activities:
- (U) PE 0602302F, Rocket Propulsion Technology.
- (U) PE 0603216F, Aerospace Propulsion and Power Technology.
- (U) PE 0603346F, Short Range Attack Missile (SRAM) II.
- (U) PE 0604314F, Advanced Medium Range Air-to-Air Missile.
- (U) Coordination accomplished through the Joint Tactical Air-to-Air Missile Office and Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 6340 - Space Systems Propulsion Technology: This project provides space propulsion technology options for spacecraft and orbit transfer vehicles. There are three ongoing efforts. The first, Flightweight XLR-132 Space Engine, demonstrates a modular, storable propellant, space propulsion system in FY 1991. A single XLR-132 engine can be integrated into a satellite to increase evasive maneuvering for survivability by 40 percent or several engines can be operated together in an upper stage for orbit transfer missions. The XLR-132 engine provides a 45 to 75 percent increase in payload capability over that currently provided by the Inertial Upper Stage (IUS). The second effort will demonstrate a Compact, Cryogenic Propellant Feed System in FY 1991 to provide more volume-efficient orbit transfer stages. This technology increases available payload volume by 30 percent and enables a 30-day hold in low earth orbit compared to less than 10 hours today. The third effort will demonstrate and qualify a 30-Kilowatt Arcjet (electric propulsion) engine in FY 1993 for space flight in 1995. This electric propulsion technology reduces space launch costs by 70 percent by replacing a heavy-lift launch vehicle with a medium-class launch vehicle.

Program Element: #0603302F Budget Activity: #2 - Advanced Technology Development
PE Title: Space and Missile Rocket Propulsion

(U) FY 1989 Accomplishments:
- (U) Sucessfully life tested the thrust chamber, injector, and turbopump in preparation for full-scale XLR-132 engine tests to demonstrate required engine performance.
- (U) Completed component development tests and initiated fabrication of compact, cryogenic propellant feed system.

(U) FY 1990 Planned Program:
- (U) Assemble flightweight XLR-132 engine for full-scale engine demonstration under simulated orbital conditions.
- (U) Complete fabrication of toroidal tank and oxidizer feed system and integrate components into a full-scale assembly.
- (U) Complete preliminary design of arcjet engine components and begin component fabrication and design evaluation testing.

(U) FY 1991 Planned Program:
- (U) Conduct full-scale engine test firings to demonstrate XLR-132 engine performance under conditions which simulate low earth to geosynchronous orbit transfer mission.
- (U) Transition proven XLR-132 engine design to satellite or upper stage program office as outlined in signed technology transition plan.
- (U) Complete extensive structural tests on assembled compact, cryogenic feed system to verify full-scale design which enables more volume-efficient orbit transfer stages.
- (U) Complete the arcjet engine component development and design evaluation tests and prepare detailed propulsion system design for ground tests to qualify arcjet for space flight.

(U) Work Performed By: This project is managed by the Astronautics Laboratory, Edwards AFB CA. The three contractors are Aerojet TechSystems, Sacramento CA; Ball Aerospace Systems, Boulder CO; and Rockwell International/Rocketdyne, Cango Park CA.

(U) Related Activities:
- (U) PE 0303110F, Defense Satellite Communication System (DSCS).
- (U) PE 0305165F, NAVSTAR Global Positioning System.
- (U) PE 0305171F, Space Shuttle Operations (Upper Stages).
- (U) PE 0602302F, Rocket Propulsion Technology.
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) PE 0603402F, Space Test Program.
- (U) Coordination accomplished through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee and the Air Force/NASA Space Technology Interdependency Group.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

- (U) Other Appropriation Funds: Not Applicable.

- (U) International Cooperative Agreements: None.

Program Element: #0603302F Budget Activity: #2 - Advanced Technology Development
PE Title: Space and Missile Rocket Propulsion

3. (U) Project 6341 - Ballistic Missile Propulsion Technology: This project demonstrates advanced rocket propulsion technology for intercontinental missile systems. The current effort, Integrated Stage Concept, is a revolutionary motor configuration which nests the forward dome of the first stage motor into the nozzle of the second stage motor. The integrated stage eliminates the interstage needed for the nozzle exit cone. This technology increases missile range by 20 percent without increasing missile size, or provides a shorter missile with current capability. This simplified missile configuration reduces booster fabrication costs by 30 percent. The integrated stage concept will be demonstrated in FY 1991.

(U) FY 1989 Accomplishments:
- (U) Fabricated composite case and force deflection nozzle components and conducted design evaluation tests.
- (U) Scaled-up clean, low oxidizing propellant and verified its ballistic and mechanical properties in small motor firings.

(U) FY 1990 Planned Program:
- (U) Update integrated stage motor design based on results of successful component development tests.
- (U) Fabricate intermediate-size test motors, using proven components and clean propellant formulation, to prepare for series of ground test firings.

(U) FY 1991 Planned Program:
- (U) Conduct ground test firings under simulated altitude conditions to demonstrate feasibility and additional capability of revolutionary integrated stage concept.
- (U) Initiate effort to demonstrate fast burn booster technology to enhance survivability and capability of intercontinental missiles in post-START environment.

(U) Work Performed By: This project is managed by the Astronautics Laboratory, Edwards AFB CA. The only contractor for the Integrated Stage Concept is Aerojet Solid Propulsion, Sacramento CA.

(U) Related Activities:
- (U) PE 0602302F, Rocket Propulsion Technology.
- (U) PE 0603311F, Advanced Strategic Missile Systems.
- (U) PE 0604312F, ICBM Modernization.
- (U) Coordination accomplished through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee.
- (U) There is no unnecessary duplication of effort within the Air Force, NASA, or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603307F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability Advanced Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3018 Air Base Operability	2,231	2,794	3,430	Cont	TBD
3140 Camouflage, Concealment, and Deception	2,730	0	0	0	TBD
Total	4,961	2,794	3,430	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Air Base Operability (ABO) integrates operational concepts with research, development, and acquisition programs to improve a sustained sortie generation capability should an attack occur on or close to an air base. The Air Force must provide enough people, aircraft, facilities and key supporting systems so that theater air bases can continue to operate following enemy attacks allowing air power to be continuously and effectively employed throughout the conflict.

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

1. (U) Project 3018, Air Base Operability: Provides Advanced Development efforts for active and passive defense, base recovery, and command control and communication survivability.

(U) FY 1989 Accomplishments:
- (U) Provided advanced development efforts for active and passive defense, base recovery, and command, control, and communication survivability.
- (U) Continued analyses for the Base Operability Annual Analysis /Base Capability Acquisition Plan (BOAA/BCAP) process, the utility survivability model, and theatre level effectiveness modeling of multiple air bases.
- (U) Continued efforts to improve ABO communications and base communications survivability.
- (U) Focused efforts on improving utility survivability and recovery techniques.
- (U) Accomplished chemical/biological cell study.
- (U) Initiated a study on using mobile laser to neutralize ordinance in a Base Recovery After Attack (BRAAT) environment.
- (U) Completed the defensive fighting position program.
- (U) Completed study showing nuclear survivability benefits of the ABO program.

Program Element: #0603307F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability Advanced Development

(U) FY 1990 Planned Program:
- (U) Continue to develop and refine modeling approaches to identify and satisfy the most critical ABO needs.
- (U) Continue chemical/biological cell study.
- (U) Continue mobile laser neutralization system study to include actual laser tests on munition items.
- (U) Design a survivable theater electrical generation distribution system.
- (U) Study methods to integrate air base ground defense systems.
- (U) Support Creek Shadow camouflage concealment and deception demonstration.
- (U) Study and propose aircraft shelter modifications to increase survivability.
- (U) Investigate a fixed vertical chaff dispensing system to aid in air base defense.
- (U) Develop and test effectiveness of low cost/lightweight 3-D silhouette.
- (U) Test and report on structural/utility survival in moist soils.
- (U) Study current air base operability data exchange to identify shortfalls and recommend improvements.
- (U) Conduct communication survivability tests.

(U) FY 1991 Planned Program:
- (U) Continue ABO integration efforts.
- (U) Continue structural/utility survival in moist soils tests.

(U) Work Performed By: Softech Incorporated, Alexandria VA; and TRW Defense Systems Group, Redondo Beach CA. In-house development organizations are Munitions System Division, Eglin AFB FL; Aeronautical Systems Division and Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB OH; Air Force Engineering and Services Center, Tyndall AFB FL; Electronic Systems Division, Hanscom AFB MA; and Air Force Weapons Laboratory, Kirtland AFB NM.

(U) Related Activities:
- (U) Program Element #0604617F, Air Base Operability.
- (U) Program Element #0604601F, Chemical/Biological Defense Equipment.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperation Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603311F Budget Activity: #3 - Strategic Programs
PE Title: Advanced Strategic Missile Systems

A. (U) RESOURCES ($ In Thousands)

Project Number & Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
633996	Survive/Endure/Launch	4,500	1,000	4,500	Cont	TBD
633997	Strategic Relocatable Target Attack	14,230	0	0	TBD	TBD
633998	Earth Penetrating Weapons	12,750	0	0	TBD	TBD
633999	Multipurpose Ballistic Reentry Vehicle	6,620	0	0	TBD	TBD
634000	Boost/Guidance	36,800	58,000	52,100	Cont	TBD
634001	Reentry Phenomenology	22,900	5,904	31,300	Cont	TBD
634002	Defense Penetration	41,900	5,000	12,444	Cont	TBD
	Total	139,780	69,904	100,344	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Advanced Strategic Missile Systems (ASMS) is the sole Air Force program conducting advanced development, including flight testing, of new ICBM system and subsystem concepts to maintain deterrent/warfighting capabilities while reducing costs of acquisition, operations and support. ASMS ensures the readiness of new ICBM technology applications for full scale development, providing SAC with demonstrated options to respond to changing Soviet target structure and offensive/defensive force capabilities. ASMS coordinates ICBM research and development efforts in various laboratories, performs concept and feasibility studies, develops new hardware, and conducts ground and flight testing of hardware under development. ASMS is also heavily involved in ICBM-related START technical issues. A vigorous ASMS program maintains U.S. "R&D Deterrence," improving ICBM force flexibility for U.S. security options within a changing global environment. ASMS support of these ICBM force planning objectives is divided into technical application areas covering the phases of the ICBM mission--Survive/Endure/Launch, Boost/Guidance, Reentry Phenomenology/Defense Penetration, and Target Kill. In addition, ASMS maintains overall program and testing support.

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

1. (U) 633996, Survive/Endure/Launch (S/E/L):
S/E/L technology and system/subsystem solutions increase ICBM pre-launch survivability and endurance. Specific study areas include basing technology to increase Minuteman system hardness, improved physical security for mobile missiles, and increased endurance through development of low-power semi-dormant electronics and advanced batteries with increased storage capacity. Future plans include evaluation and validation testing of basing and security system upgrade options, plus studies for

Program Element: #0603311F Budget Activity: #3 - Strategic Programs
PE Title: Advanced Strategic Missile Systems

improvements to ICBM Battle Management/C^3 (BM/C^3). These studies may provide concepts for integrating ICBM C^3 with components of the SDI battle management architecture to improve survivability.

(U) FY 1989 Accomplishments:
- (U) Evaluated operational concepts for hardened Minuteman (MM) silos.
- (U) Completed conceptual design trades for MM III canisterization.
- (U) Investigated mobile basing vulnerability to location/tracking by implant/tag devices.
- (U) Initiated studies to improve current physical security measures.

(U) FY 1990 Planned Program:
- (U) Complete MM III canisterization and hardened silo studies.
- (U) Initiate implant sweep system/physical security exploratory development.
- (U) Initiate concept studies for upgraded battery/energy storage systems.
- (U) Initiate requirements analysis for BM/C^3 improvements to mobile strategic communications and strategic decision-aid software.
- (U) Improve phenomenology modeling of ICBM flyout through dust, ice, etc.

(U) FY 1991 Planned Program:
- (U) Conduct limited ground testing validating models of ICBM flyout through dust, ice, etc.
- (U) Fabricate and test implant sweep/physical security components.
- (U) Continue battery/power generation concept trade studies.
- (U) Initiate BM/C^3 concept exploration studies.

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

(U) Work Performed By: The responsible Air Force agencies are the Ballistic Systems Division, Norton Air Force Base, CA. ASMS funds effort at the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS and the Air Force Weapons Laboratory, Kirtland AFB, NM. Major contractors include: H.M. Technologies, Alexandria, VA; General Research Corp., Santa Barbara, CA; Boeing Aerospace, Seattle, WA; and TRW, Ballistic Systems Division, San Bernadino, CA (Systems Engineering/Technical Assistance (SE/TA).

(U) Related Activities:
- (U) Basing studies are coordinated with Defense Nuclear Agency.
- (U) Minuteman silo hardness studies are coordinated with Air Force Weapons Laboratory, Kirtland AFB, NM, Ogden Air Logistics Center, Hill AFB, UT and HQ SAC, Offutt AFB, NE.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

Program Element: # 0603311F Budget Activity: #3 - Strategic Programs
PE Title: Advanced Strategic Missile Systems

2. (U) 633997, Strategic Relocatable Target (SRT) Attack:
Current SRT concepts strive to hold at risk the increasing percentage of Soviet ICBMs that are mobile. Subsystem design studies set ICBM-compatible operating specifications and prepare technology development roadmaps for ICBM-carried sensors, sensor window materials, fuzing, high speed processors, and reentry guidance. SRT attack studies have focused on two ICBM-delivered concepts--a subsonic air breathing missile and a maneuvering reentry vehicle (MaRV) targeted from its sensor-equipped post boost vehicle.

(U) FY 1989 Accomplishments:
- (U) Explored requirements for ICBM/RV-carried sensors and demonstrated target imaging potential of a map-matching sensor.
- (U) Completed ground target image data reduction from high resolution synthetic aperature radar.
- (U) Completed concept definition and preliminary design for ICBM-delivered systems to attack Soviet mobile ICBMs.

(U) FY 1990 Planned Program:
- (U) The FY 90 program was not funded by the Congress. No FY 90 ASMS funds will be spent on Strategic Relocatable Target Attack efforts.

(U) FY 1991 Planned Program:
- (U) The FY 91 program in SRT is deferred due to Congressional concerns.

(U) Program to Completion:
- (U) The program may be restarted in FY 92 pending Congressional response to the ASMS Long Term plan required by the FY 90 Appropriations Conference language.

(U) Work Performed By: The responsible Air Force agency is the Ballistic Systems Division, Norton Air Force Base, CA. Major contractors include: Environmental Research Institute of Michigan, Ann Arbor, MI; Martin Marietta, Denver, CO; McDonnell Douglas Space Systems Company, Huntington Beach, CA; and TRW/Ballistic Systems Division, San Bernadino, CA (SE/TA).

(U) Related Activities:
- (U) Program Element #0603367F, Relocatable Target Capability Program, for coordination of efforts to develop an ICBM weapon to attack SRTs. ASMS is the responsible agency in this PE for all ICBM efforts. No funding from this PE has been allocated for any ICBM efforts. ASMS coordinates SRT efforts through the Strategic Relocatable Target Planning Group.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

Program Element: # 0603311F Budget Activity: #3 - Strategic Programs
PE Title: Advanced Strategic Missile Systems

3. (U) 663998. Earth Penetrating Weapons:
Deeply buried land based target efforts focus on advanced development of a reentry vehicle design to threaten deeply buried leadership and C^3 facilities. These studies and weapon effects analysis efforts support the DoD/ Department of Energy Phase 2 (feasibility) studies for a long term solution to the deeply buried target problem. The DoD/DOE Phase 2 studies will identify and recommend the best weapon concept to address this target class. If an ICBM solution is recommended, additional effort will be required.

(U) FY 1989 Accomplishments:
- (U) Completed Strategic Earth Penetrating Weapon program and selected a concept for potential flight testing.
- (U) Completed design/testing of sub-scale candidate vehicles.

(U) FY 1990 Planned Program:
- (U) The FY 90 program was not funded by the Congress. No FY 90 ASMS funds will be spent on Earth Penetration weapons efforts.

(U) FY 1991 Planned Program:
- (U) The FY 91 program in EPW is deferred due to Congressional concerns. No FY 91 funds will be spent on EPW efforts.

(U) Program to Completion:
- (U) The program may be restarted in FY 92 pending Congressional response to the ASMS Long Term plan required by FY 90 Appropriations Conference language and the outcome of the DoD/DOE Phase 2 study.

(U) Work Performed By: The responsible Air Force agency is the Ballistic Systems Division, Norton Air Force Base, CA. Major contractors include: General Electric, Reentry Systems Division, Philadelphia, PA (EPW and MaRV Technology); McDonnell Douglas Space Systems Company, Huntington Beach, CA (EPW and MaRV technology); Sandia National Laboratory, Albuquerque, NM and Livermore, CA (EPW); and TRW/Ballistic Systems Division, San Bernadino, CA (SE/TA).

(U) Related Activities:
- (U) EPW efforts are coordinated with the Department of Energy and support the DoD/DOE phase 2 (feasibility) study.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

4. (U) 633999. Multipurpose Ballistic Reentry Vehicle:
The Multipurpose Ballistic Reentry Vehicle (MBRV) project would demonstrate a concept to

Program Element: # 0603311F Budget Activity: #3 - Strategic Programs
PE Title: Advanced Strategic Missile Systems

(U) FY 1989 Accomplishments:
- (U) Completed requirements review and limited sub-scale testing.

(U) FY 1990 Planned Program:
- (U) The FY 90 program was not funded by the Congress. No FY 90 ASMS funds will be spent on MBRV efforts.

(U) FY 1991 Planned Program:
- (U) The FY 91 program in MBRV is deferred due to Congressional concerns. No FY 91 funds will be spent on the MBRV demonstration program.

(U) Program to Completion:
- (U) The program may be restarted in FY 92 pending Congressional response to the ASMS Long Term plan required by FY 90 Appropriations Conference language.

(U) Work Performed By: The responsible Air Force agency is the Ballistic Systems Division, Norton Air Force Base, CA. Major contractors include: SANDIA National Laboratory, Albuquerque, NM (MBRV); Textron Defense Systems, Wilmington, MA (MBRV); and TRW/Ballistic Systems Division, San Bernadino, CA (SE/TA).

(U) Related Activities:
- (U) MBRV efforts are coordinated with the DoE and Sandia Laboratory for warhead modifications and test capability development.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603311F
PE Title: Advanced Strategic Missile Systems
Project Number: 634000
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title / Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Boost/Guidance	36,800	58,000	52,100	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Advanced Strategic Missile Systems (ASMS) is the sole Air Force program conducting advanced development, including flight testing, of new ICBM system and subsystem concepts to maintain deterrent/warfighting capabilities while reducing costs of acquisition, operations and support. Guidance and control subsystems are major life cycle cost items for ICBMs. The goal of the advanced guidance program is to develop ICBM guidance systems, for the early 2000 time frame, that maintain current accuracy while dramatically reducing guidance acquisition and support costs for existing and future systems. Current advanced guidance development focuses on next generation solid state guidance systems and the Advanced Inertial Measurement Unit (AIMU). Solid state concepts include accelerometers with only 15 parts instead of current instruments which use 820 parts, potential next generation gyroscopes with only four moving parts, and external update schemes. AIMU was designed for use in maneuvering reentry vehicles, but also provides a basis for boost phase guidance concepts. The ASMS advanced guidance instrument work is focused in two efforts. One is to replace mechanical gyroscopes with ring laser gyroscopes possibly aided by a stellar sensor. Such an application would require only one highly accurate accelerometer per missile instead of the three currently used. The other effort is to develop a vibrating beam accelerometer (VBA) to replace the accurate but very complex accelerometers used in the Minuteman and Peacekeeper guidance system. Our current, most advanced guidance system is AIRS, which was developed in the early 1970s. It is employed in Peacekeeper and is planned for use in Small ICBM. Unit production cost for solid state guidance is estimated in the early 2000s to be 20-30 percent of current AIRS' costs. Unit repair costs are estimated to be 10-30 percent of current AIRS' repair costs and significantly reduce the number of maintenance personnel required. Such capability will require $800 million to $1 billion investment in advanced and full scale development.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Demonstrated feasibility of quick turn-on Ring Laser Gyro guidance concept through ground testing.
   - (U) Initiated advanced guidance architecture definition study.
   - (U) Developed preliminary design concepts for laser range finding and radar range finding update systems.

Program Element: # 0603311F
PE Title: Advanced Strategic Missile Systems

Project Number: 634000
Budget Activity: #3 - Strategic Programs

- (U) Fabricated and tested prototype VBA.
- (U) Delivered three zero lock gyros (ZLG) for future testing.
- (U) Initiated reentry-level radiation hardened designs of precision voltage reference (PVR) and stabilized amplifier for use in future guidance systems.
- (U) Completed advanced post-boost vehicle concept exploration.

2. (U) FY 1990 Planned Program:
   - (U) Begin radiation testing of ring laser gyros (RLG) for AIMU and deliver AIMU test units.
   - (U) Complete concept study of four candidate guidance architectures.
   - (U) Resolve case heading sensitivity of autonomous RLG.
   - (U) Deliver prototype VBA for testing and complete inversion transient studies.
   - (U) Initiate projects for advanced accelerometers and guidance update subsystems.
   - (U) Build and test radiation hard Chopper Stabilized Amplifier (CSA) and Precision Voltage Reference parts to support hardened guidance electronics needs.

3. (U) FY 1991 Planned Program:
   - (U) Initiate development of guidance system test bed to test next generation modular guidance systems.
   - (U) Begin development of engineering test unit for next generation modular guidance designs.
   - (U) Radiation test VBAs built in FY 90.
   - (U) Build update subsystem breadboard.
   - (U) Begin performance testing of AIMU.
   - (U) Produce breadboards of advanced guidance accelerometers and other instruments.
   - (U) Begin development of boost-level radiation hardened memories, processors, and other key components for AIMU and VBA.

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

D. (U) WORK PERFORMED BY: The responsible agency is the Ballistic Systems Division, Norton Air Force Base, CA. Major contractors include: C.S. Draper Laboratory, Cambridge, MA (guidance systems development); Delco, Goleta, CA (advanced gyro development); General Electric, Pittsfield, MA (guidance systems development); Harris, Melborne, FL (radiation hardened parts); Honeywell, Inc., Clearwater, FL (guidance system development); Kearfott Guidance and Navigation Corp., Fairfield, NJ (VBA development); Litton, Woodland Hills, CA (ZLG development and guidance systems development); MicroSemi Corp., Phoenix, AZ (radiation hardened parts); Northrop, Hawthorne, CA (guidance systems development); Raytheon, Worcester, MA (radiation hardened parts); Rockwell International, Autonetics Division, Anaheim, CA (guidance systems development); Sundstrand Data Control, Inc., Redmond, WA (VBA development); Texas Instruments, Dallas, TX (radiation hardened parts); and TRW, Ballistic Systems Division, San Bernadino, CA (Systems Engineering/Technical Assistance). The ASMS program makes extensive use of government laboratories.

Program Element: # 0603311F
PE Title: Advanced Strategic Missile Systems

Project Number: 634000
Budget Activity: #3 - Strategic Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES:
   - (U) Added effort to resolve case heading sensitivity of autonomous RLG.
   - (U) Initiated advanced guidance architecture definition study.
   - (U) Increased effort to address AIMU issues in FY 90 and FY 91.
   - (U) Initiated activities to procure development of advanced accelerometer, radiation hardened parts, and update subsystems.
   - (U) Enhanced VBA effort and accelerated development.
2. (U) SCHEDULE CHANGES: Extended AIMU testing.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION: None.

G. (U) RELATED ACTIVITIES:
- (U) Coordinates with Ogden Air Logistics Center, Hill AFB, UT concerning Minuteman III guidance issues.
- (U) Coordinates with both Army (Strategic Defense Command) and Navy on sharing of basic guidance technology.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

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

J. (U) MILESTONE SCHEDULE: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603311F
PE Title: Advanced Strategic Missile Systems
Project Number: 634001
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title Reentry Phenomenology

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Reentry Phenomenology	22,900	5,904	31,300	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Advanced Strategic Missile Systems (ASMS) is the sole Air Force program conducting advanced development, including flight testing, of new ICBM system and subsystem concepts to maintain deterrent/warfighting capabilities while reducing costs of acquisition, operations and support. Reentry Phenomenology research provides new reentry vehicle materials, aerodynamics characterization, and sensor integration for reentry vehicles and decoys. Reentry phenomology is furthered by the development of both analytic tools and state-of-the-art materials for reentry environment survival. Three-dimensional antenna window ablation codes will be developed and validated along with testing of new window materials on Maneuvering Systems Technology (MaST) and Technology Development Flight (TDF) tests. Four- and five-directional weave carbon-carbon nose tips have been developed and are also scheduled for flight testing. Thermal protection systems and heatshield technology are being advanced through the development of low thermal conductivity Polyacrylonitrile (PAN) fibers. These advanced materials will all be tested in an underground experiment in 1990. Development of advanced maneuvering reentry vehicle control concepts will be started in FY 91.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed ground testing of actively cooled nose tip designs.
   - (U) Initiated preliminary design of advanced maneuvering reentry vehicle (MaRV).
   - (U) Conducted flight test design review of Technology Development Flight (TDF) vehicle #1.

2. (U) FY 1990 Planned Program:
   - (U) Validate codes and test RV antenna window system design.
   - (U) Manufacture and test low thermal conductivity PAN fibers for RV heatshields.
   - (U) Conduct flight and underground nuclear tests of nosetip, heatshield, and antenna window materials.
   - (U) Perform trade/assessment studies of advanced MaRV concepts.
   - (U) Initiate upgrades to computational codes required to develop MaRVs.
   - (U) Begin concept subsystem definitions (electronics, MaRV configuration, thermal protection systen (TPS)) for advanced flight test bed vehicle.

Program Element: #0603311F
PE Title: Advanced Strategic Missile Systems
Project Number: 634001
Budget Activity: #3 - Strategic Programs

3. (U) FY 1991 Planned Program:
   - (U) Complete concept subsystem definitions for advanced flight test bed vehicle.
   - (U) Complete upgrade of computational codes.
   - (U) Begin detailed design of test bed vehicle electronics and thermal protection systems.

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

D. (U) WORK PERFORMED BY: The responsible agency is the Ballistic Systems Division, Norton Air Force Base, CA. Major contractors include: ATSS, San Bernadino, CA; FMI, Biddeford, ME; Fiberite, Winona, MN; Ford Aerospace, Costa Mesa, CA; General Electric, Reentry Systems Division, Philadelphia, PA (MaRV technology); Hercules, Salt Lake City, UT; Hypersonics, Sunnyvale, CA; Lockheed Space and Missile, Sunnyvale, CA; McDonnell Douglas Space Systems Company, Huntington Beach, CA; PDA, Costa Mesa, CA; Southern Research Institute, Birmingham, AL; Textron Defense Systems, Boston, MA; and TRW, Ballistic Systems Division, San Bernadino, CA (Systems Engineering/Technical Assistance). The ASMS program makes extensive use of government laboratories.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: MaST flight test rescheduled for second quarter FY 90.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC SON 16-82, Mar 83
- (U) SAC SON 009-84, Jan 87
- (U) SAC SON 01-85, Jun 86

G. (U) RELATED ACTIVITIES:
- (U) Extensive coordination with Air Force Materials and Astronautics Laboratories, MIT Lincoln Laboratory, and Strategic Defense Initiative Organization.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

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

J. (U) MILESTONE SCHEDULE: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603311F
PE Title: Advanced Strategic Missile Systems
Project Number: 634002
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title Defense Penetration

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Defense Penetration	41,900	5,000	12,444	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Advanced Strategic Missile Systems (ASMS) is the sole Air Force program conducting advanced development, including flight testing, of new ICBM system and subsystem concepts to maintain deterrent/warfighting capabilities while reducing costs of acquisition, operations and support. The Defense Penetration project develops penetration aid technology and demonstrates systems for defeating the current radar and projected optical Soviet ABM threats. The Pyrotechnic Phase II flight test program will validate the infrared signature of the new pyrotechnic propellant developed during phase I and verify the Pyro system concept. The Pyro II program, along with the Endo Jammer Technology, Broad Area Optics (BAO), and Gossamer structures programs, are designed to demonstrate technologies that could defeat existing radar and optical Soviet ABM capability. An RV-dispensed jammer design can confuse threat radar tracking in the endoatmosphere. Thin film materials are being produced in the BAO and Glossamer programs for optical and radar masking of decoys and RVs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Initiated concept definition of BAO exoatmospheric countermeasures.
   - (U) Initiated Pyro flight test program.
   - (U) Completed fabrication of Endo Jammer breadboard components.
   - (U) Completed Glossamer material development and initiated flight test hardware selection/testing.
   - (U) Completed Phase I of Evader Replica program.

2. (U) FY 1990 Planned Program:
   - (U) Fabricate Pyrotechnics test flight vehicle #1.
   - (U) Conduct flight test design review of Pyrotechnics flight test vehicle.

3. (U) FY 1991 Planned Program:
   - (U) Conduct first flight test of Pyrotechnic penetration aid devices.
   - (U) Fabricate Pyro flight test vehicle #2.
   - (U) Conduct joint evaluations with SDIO of potential discrimination counters.

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

Program Element: # 0603311F
PE Title: Advanced Strategic Missile Systems

Project Number: 634002
Budget Activity: #3 - Strategic Programs

D. (U) WORK PERFORMED BY: The responsible agency is the Ballistic Systems Division, Norton Air Force Base, CA. Major contractors include: Acurex Corporation, Mountain View, CA (radar and optical penetration aids); Ford Aerospace, Costa Mesa, CA; General Electric, Reentry Systems Division, Philadelphia, PA (MaRV technology); Hercules, Salt Lake City, UT; Hypersonics, Sunnyvale, CA; Lockheed Space and Missile, Sunnyvale, CA; PDA, Costa Mesa, CA; Southern Research Institute, Birmingham, AL; Textron Defense Systems, Boston, MA; and TRW, Ballistic Systems Division, San Bernadino, CA (Systems Engineering/Technical Assistance). The ASMS program makes extensive use of government laboratories.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES:
- (U) Phase II of the Evader Replica program was not initiated in 1989.
- (U) Endo Jammer project stopped after 1989 for lack of funds.
- (U) Glossamer materials project stopped after 1989 for lack of funds.
- (U) Broad Area Optics effort cancelled after FY 89 for lack of funds.

2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC SON 16-82, Mar 83

G. (U) RELATED ACTIVITIES:
- (U) Extensive coordination with MIT Lincoln Laboratory and Strategic Defense Initiative Organization.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

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

J. (U) MILESTONE SCHEDULE: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603320F Budget Activity: #4 - Tactical Programs
PE Title: Low Cost Seeker

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1 Low Cost Seeker	12,191	7,632	-0-	-0-	76,174

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides funds for the development of the High Speed Antiradiation Missile (HARM) Low Cost Seeker (LCS) project. The increased sophistication, concentration, and lethality of enemy ground based radar guided missile and antiaircraft artillery systems threaten the ability of tactical aviation to accomplish its mission and survive. Antiradiation missiles provide a lethal counter to this threat. The Tactical Air Forces require a system that enhances aircraft survivability during mission accomplishment. HARM is being acquired by the Navy and Air Force to meet an immediate need for an upgraded capability against current threats. The LCS seeker is designed to be interchangeable with the advanced seeker (Block IV) being developed by Texas Instruments and will compete for production beginning in FY93.

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

1. (U) Project XXX1, Low Cost Seeker

(U) FY 1989 Accomplishments:
- (U) Continued Full Scale Development (FSD).
- (U) Completed transfer of software design from Naval Weapon Center (NWC), China Lake CA to the contractor.
- (U) Performed component and seeker level testing.
- (U) Started Development Test and Evaluation.

(U) FY 1990 Planned Program:
- (U) Complete delivery of 45 production prototype models.
- (U) Conduct Development Test and Evaluation (DT&E).
- (U) Conduct Initial Operational Test and Evaluation (IOT&E).
- (U) Start fabricating pilot production units.

Program Element: #0603320F Budget Activity: #4 - Tactical Programs
PE Title: Low Cost Seeker

(U) FY 1991 Planned Program: Not Applicable. Program completes in FY 1990.

(U) Work Performed By: The Air Force program management is provided by the Munitions Systems Division, Eglin AFB FL. Government facilities used include the following: Aeronautical Systems Division, Wright-Patterson AFB OH; Naval Weapons Center, China Lake CA; and the Air Force Flight Test Center, Edwards AFB CA. Air Force participation in joint operational testing will be conducted by the Air Force Operational Test and Evaluation Center, Kirtland AFB NM. The prime contractor for this program is Ford Aerospace and Communications Corporation, Newport Beach CA.

(U) Related Activities:
- (U) Program Element #0207317F, HARM Improved Seeker.
- (U) Program Element #0207162F, Tactical Air-to-Ground Missiles.
- (U) Program Element #0207136F, F-4G Wild Weasel Squadrons.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Missile Procurement (BA 4, P-1 Line Item 16)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	-0-	17,403	30,315	-0-	47,718
Quantity		50	120	-0-	170

(U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603363F Budget Activity: #2. Advanced Technology Development
Title: Armament Technology Integration

A. (U) RDT&E RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 ACTUAL	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2718 Air-to-Surface Armament Technology Integration	5,521	1,834	1,074	Cont	TBD
3254 Advanced Air-to-Air Missile Technology Integration	*0	103	145	Cont	TBD
TOTAL	5,521	1,937	1,219	Cont	TBD

*Air-to-Air Missile Technology Integration will transition from PE 0602602F, PE 0603601F and other appropriate PEs beginning in FY 90.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the Air Force's primary advanced development program for integration of air-to-surface and air-to-air conventional weapons technologies. Advanced technologies are fully integrated into a test bed and evaluated (ground, captive and free flight tests) under realistic mission conditions to determine their suitability for further development. This program matures technologies for future demonstration/validation and full scale development of conventional weapons vital to force survivability and the conventional deterrent posture of the United States.

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

1. (U) Project 2718: Air-to-Surface Armament Technology Integration. This project developes and procures advanced air-to-surface armament technologies and flight hardware for integration/ demonstration and potential incorporation into advanced weapon systems and pre-planned product improvements of current systems. The Air-to-Surface Armament Technology Integration (ASATI) effort will procure advanced subsystems to demonstrate technical performance and potential operational value. Candidate subsystems include: HAVE SLICK advanced dispenser, Autonomous Synthetic Aperture Radar Guidance, Hard Target Ordnance Technology, Smart Submunition, Advanced Techology LADAR System, Dual Mode Seeker, and other advanced guidance, navigation and control technologies. The Hypervelocity Weapon (HVW) Technology Demonstration effort incorporates a small, low cost missile with a hit-to-kill capability against the full spectrum of battlefield vehicles with missile guidance provided by the host aircraft. Payoffs include multiple kills per pass and low unit cost. The payoff will be enhanced lethality of air-to-surface weapons against advanced targets, coupled with reduced cost and risk.

(U) FY 1989 Accomplishments:
- (U) Completed ground launches of HVW missiles.
- (U) Initiated planning for HVW follow-on program.

Program Element: #0603363F Budget Activity: #2 - Advanced Technology Development
PE Title: Armament Technology Integration

- (U) Prepared an Implementation Plan for the ASATI program.

(U) FY 1990 Planned Program:
- (U) Initiate critical risk reduction efforts to support HVW follow-on program.
- (U) Initiate HVW missile adaptation study to determine feasibility of Army variant to satisfy Air Force requirements.
- (U) Begin tradeoff study between technology maturity, cost and performance; prioritize ASATI subsystem technologies.

(U) FY 1991 Planned Program:
- (U) Continue HVW missile adaptation study.
- (U) Complete HVW risk reduction program.
- (U) Select ASATI subsystems based upon simulation trade studies and tri-service coordination.

(U) Work Performed by: The ASATI project is managed by the Air Force Armament Laboratory, Eglin AFB FL, except HVW effort which is managed by the Munitions Systems Division, Eglin AFB FL. Test facilities at the Munitions Systems Division and at White Sands Missile Range NM support this program.

(U) Related Activities:
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0602602F, Conventional Munitions
- (U) PE 0603313A, Missile/Rocket Components
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology
- (U) PE 0603792N, Advanced Technology Demonstrations
- (U) PE 0603611M, Mobile Protected Gun System
- (U) The USA/USAF/USMC Memorandum of Agreement on Hypervelocity Missile development, dated 10 Oct 84, applies.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 3254: Air-to-Air Missile Technology Integration (AAMTI). This project integrates and demonstrates advanced air-to-air missile technologies to establish their performance and operational value for incorporation into advanced missile systems and pre-planned product improvements of current systems. The payoff from this project includes: improved performance, enhanced operational flexibility, increased reliability and affordability, and reduced cost and risk.

(U) FY 1989 Accomplishments:
- (U) Prepared an Implementation Plan detaling program requirements.

Program Element: #0603363F Budget Activity: #2 - Advanced Technology Development
PE Title: Armament Technology Integration

(U) FY 1990 Planned Program:
- (U) Review candidate subsystem technologies, incorporating tri-service inputs.
- (U) Begin tradeoffs between technology maturity, cost and performance; prioritize subsystem technologies.

(U) FY 1991 Planned Program:
- (U) Initiate acquisition process for integration/demonstration program.
- (U) Select subsystem technologies based upon simulation trade studies and tri-service coordination.

(U) Work Performed by: This in-house program is managed by the Air Force Armament Laboratory, Eglin AFB FL. Test facilities at the Munitions Systems Division, Eglin AFB FL, support this program.

(U) Related Activities:
- (U) PE 0602602F, Conventional Munitions
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology
- (U) PE 0603792N, Advanced Technology Demonstrations
- (U) The USA/USN/USAF Memorandum of Understanding on Advanced Missile Technology Integration, dated 23 Feb 87, applies.
- (U) The USN/USAF Memorandum of Agreement on Tactical Air-to-Air Missiles, dated 26 May 88, applies.
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603367F Budget Activity: #3-Strategic Programs
PE Title: Relocatable Target (RT) Capability

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3729 Relocatable Target (RT) Capability					
Total	19,133	6,357	7,049	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT:
Soviet initiatives for their strategic forces include a large increase in mobile relocatable forces including intercontinental ballistic missiles (SS-24 rail mobile and SS-25 road mobile.) The Strategic Air Command

This program is designed to focus and mature technology for transfer to RT weapon system applications in order to prosecute the growing Soviet RT threat. This program with its relatively small budget actually exploits over $100M of basic technology and directs promising concepts toward RT programs. This program is the foundation for Air Force RT programs.

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

(U) Project Number, Project Title: 3729 RT Capability Program
This project develops technology for transfer to applications intended to hold RTs at risk. Specific initiatives being pursued include target signature measurement and modeling, sensor test and evaluation, automatic target cueing (ATC) applications, and weapon system operator performance evaluation. Surveys the broad technology base to provide support for virtually all the Air Force RT programs.

(U) FY 1989 Accomplishments:
- (U) Surveyed the technology base to transfer promising technology towards RT applications
- (U) Flight test and evaluation of sensors
- (U) Data collection and signature analysis
- (U) Automatic target cueing development
- (U) Weapon system operator performance testing
- (U) Produced a technology "road map" to coordinate efforts and insure timely technology transfer
- (U) Completed configuration trade studies in support of a special access application

Program Element: #0603367F Budget Activity: #3-Strategic Programs
PE Title: Relocatable Target (RT) Capability

(U) FY 1990 Planned Program:
- (U) Continue to survey the technology base to transfer promising technology towards RT applications
- (U) Complete state-of-the-art survey and performance assessment of ATC algorithm technology with intent to down selection algorithms for transfer to weapon system applications
- (U) Evaluation and test of sensors with increased emphasis on near to mid term applications which can detect targets in a severe concealment environment
- (U) Data collection and target signature analysis
- (U) Initiate engineering evaluation of collected Glitter Pageant imagery to assess target signatures and rank performance of detection sensors
- (U) Weapon system operator performance testing
- (U) Develop improved target signature data base
- (U) Explore and mature high speed processing technology

(U) FY 1991 Planned Program:
- (U) Continue FY 1990 evaluations with emphasis on specific needs of RT application programs
- (U) Integration analysis of sensors in order to develop complementary sensor suites
- (U) Development of improvements to ATC applications and initiate development of algorithms which blend multi-sensor signatures to enhance target detection and reduce false alarms
- (U) Conduct target and background data collections to continue sensor testing, ATC evaluations and weapon system operator training
- (U) Analysis of target signatures and continued development of signature data base
- (U) Develop improved processing and data storage for use on onboard weapon system RT applications
- (U) Human factors evaluations to quantify operator ability to recognize targets versus false alarms

(U) Work Performed By: Wright Research and Development Center, Rome Air Development Center, Aeronautical Systems Division, Human Systems Division, Defense Advanced Research Projects Agency.

Program Element: #0603367F Budget Activity: #3-Strategic Programs
PE Title: Relocatable Target (RT) Capability

(U) Related Activities:
- (U) Program Element #0603227E, RT Detection Technology
- (U) Program Element #0602301E, Strategic Computing
- (U) Program Element #0603253F, RF Sensor Technology
- (U) Program Element #0603203F, ATC/ATR Technology
- (U) Program Element #0602204F, ATR and Targeting Technology
- (U) Program Element #0603231F, ADSACS - Human Factors
- (U) Program Element #0602202F, RITSA - Human Factors
- (U) Program Element #0603260F, Recce Exploration
- (U) Program Element #0602702E, Target Acquisition and Weapons Technology
- (U) The Department of Defense Relocatable Target Steering Panel is insuring there is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2181 Advanced Space Computer Technology	5,034	5,462	8,750	Cont	TBD
2198 Advanced Space Technology Assessments	234	175	200	Cont	TBD
3784 Advanced Space Communications Technology	617	1,037	1,523	Cont	TBD
3834 Advanced Spacecraft Technology Integration	255	0	250	Cont	TBD
3977 Thermionic Space Power	0	8,520*	0	0	8,520
682J Advanced Space Power Technology	1,807	1,482	2,300	Cont	TBD
Total	7,947	16,676	13,023	Cont	TBD

* A space nuclear power project added under Congressional direction.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This generic satellite technology program is the Air Force's primary source of advanced satellite subsystems. Efforts are focused on three high-leverage technologies: radiation hardened microelectronics; assured, secure space communications; and compact, survivable space power generation and storage. Our technology assessments evaluate space technology programs government-wide and focus our investment strategy.

Our space computer technology project will supply the baseline computing system for programs #0603220C, #0303603F, #0305160F, #0305165F, and several classified programs. We've accelerated its development to meet their technology insertion windows in FY 91-93. We've also expanded the project's scope to include a time urgent satellite survivability demonstration that will prove prototype space computers and other state-of-the-art survivability and autonomy technologies in cooperation with DARPA's Advanced Satellite Technology Program. In addition, we've added a new integration project that will join electric arcjet and ion thrusters with survivable solar panels and demonstrate the flight, navigation, and survival of a 9-12 month payload transfer from low-earth orbit to geosynchronous orbit. Potential payoffs include saving between $75-90 million per launch or launching 17-23 percent more payload on the same heavy launch vehicle. Together, these demonstrations will transition innovative spacecraft technologies to operational use much sooner than traditional methods and explore new ways of streamlining the acquisition process.

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

1. (U) Project 2181, Advanced Space Computer Technology: This Advanced Technology Transition Demonstration will show we can manufacture

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

high-speed, radiation hardened VHSIC chipsets, and standardize them for most Air Force and SDI missions at acceptable cost. Our main thrust is the Advanced Spaceborne Computer Module (ASCM) that integrates several joint Air Force/SDIO efforts including our 16-bit Generic VHSIC Spaceborne Computer (GVSC) and a 32-bit Advanced Technology Insertion Module (ATIM). ASCM will be 10-30 times faster and 100 times more radiation hard than current space computer technology. ASCM will also reduce the cost of a rad-hard VHSIC device from $3000 to $450, saving roughly $50 million per satellite. ASCM is baselined in programs #0603220C, #0303603F #0305160F, #0305165F, and in several classified programs. We've accelerated its development to meet their technology insertion windows in FY 91-93. We've also expanded this project's scope to include a time urgent satellite survivability demonstration that will prove prototype space computers and other state-of-the-art survivability and autonomy technologies in cooperation with DARPA's Advanced Satellite Technology Program.

(U) FY 1989 Accomplishments:
- (U) Completed fabrication of GVSC chipsets and 64K memories.
- (U) Delivered and tested 1.2 micron GVSC breadboard, and demonstrated compliance with user specifications.
- (U) Planned Technology for Autonomous Operational Survivability (TAOS) space demonstration.

(U) FY 1990 Planned Program:
- (U) Design 16-bit ASCM Control Processor Module (CPM) using GVSC chipsets.
- (U) Develop method to "pack" GVSC chipsets and memory cards and reduce CPM weight by one-half.
- (U) Design 32-bit Advanced Technology Insertion Module (ATIM).
- (U) Develop CPM prototype and software for TAOS.

(U) FY 1991 Planned Program:
- (U) Integrate main-memories, input/output devices, and power converters into CPM forming a single functional unit to manage satellite sensor and communications data.
- (U) "Pack" CPM into increasingly denser forms for eventual fabrication on a single wafer, reducing ASCM weight an additional 2-4 times.
- (U) Validate "Qualified Manufacturers List" (QML) approach to space qualifying rad-hard VHSIC devices by qualifying a contractor's processing line rather than thousands of individual parts.
- (U) Reduce rad-hard VHSIC device cost from $3,000 to $450 using QML, saving roughly $50 million per satellite.
- (U) Assemble, test, and space qualify first CPMs and deliver to users.
- (U) Design a 256K reprogramable memory that will allow "adaptive" satellites to rewrite their "hard" memories,

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

and change their missions or housekeeping routines.
- (U) Complete ATIM design and begin prototype fabrication.
- (U) ATIM producibility demonstrations end in FY 93. Our CPM, 256K reprogammable memmory, and SDIO funded 32-bit computer and digital immage processors are planned ATIM building blocks.
- (U) Integrate prototype CPM and software into TAOS bus.

(U) Work Performed By: Air Force Space Technology Center (AFSTC), Kirtland AFB NM managed effort. The two contractors are: Honeywell Inc, Clearwater FL and IBM, Manassas VA.

(U) Related Activities:
- (U) DARPA Strategic Computing Initiative (VHSIC Program).
- (U) Program Element #0602601F, Advanced Weapons.
- (U) Program Element #0603220C, Boost Srv & Track Sys.
- (U) Program Element #0303603F, MILSTAR Sat Comm Sys.
- (U) Program Element #0305160F, Def Meteorological Sat Sys.
- (U) Program Element #0305165F, NAVSTAR Global Pos Sys.
- (U) Program Element #0603438F, Satellite Sys Survivability.
- (U) Program Element #0603226E, Expt Eval Mjr Innovative Tech.
- (U) There is a draft Memorandum of Agreement between DARPA and the Air Force Space Technogy Center covering TAOS and DARPA's Advanced Satellite Subsystem Technology Demonstration. TAOS will fly on a DARPA Standard Small Launch Vehicle and demonstrate several "Lightsat" supplied technologies. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2198, Advanced Space Technology Assessments: This project develops and coordinates the Air Force Science and Technology space and missile investment strategy. We compile Air Force mission requirements, concepts, and technology drivers by technical area and compare them with ongoing technology programs government-wide. Careful analysis identifies weakness in our technology base or potential technology breakthroughs. Independent organizations, both inside and outside the government, critique our results.

(U) FY 1989 Accomplishments:
- (U) Completed ground terminal and space sensor assessments.

(U) FY 1990 Planned Program:
- (U) Complete satellite autonomy and space environment assessments.

(U) FY 1991 Planned Program:
- (U) Complete satellite thermal control and information

processing assessments.
- (U) Begin guidance, navigation, and control assessment.

(U) Work Performed By: AFSTC, Kirtland AFB NM managed effort. The two contractors are: Advanced Sciences Inc., Albuquerque NM; Aerospace Corporation, El Segundo CA.

(U) Related Activities:
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 3784, Advanced Space Communications Technology: This project develops solid state Extremely High Frequency (EHF) subcomponents. These devices are the "guts" of modern satellite receivers and transmitters. Efforts support DSCS follow-on or other survivable wideband satellite upgrades and will result in significant weight and power reduction while increasing performance. Work is coordinated under the Assistant Secretary of Defense for C3I and develops enabling technology for The Alternative MILSATCOM Architecture (TAMA).

(U) FY 1989 Accomplishments:
- (U) Began design of solid state EHF (44 GHz) satellite uplink receiver subcomponents.

(U) FY 1990 Planned Program:
- (U) Continue 44 GHz uplink receiver work.
- (U) Start 60 GHz crosslink receiver device development.
- (U) Complete 60 GHz crosslink transmitter diode development.

(U) FY 1991 Planned Program:
- (U) Fabricate and test 44 GHz and 60 GHz receiver devices. Demonstrate 2-3 times better performance to reduce satellite and ground terminal power usage, size, and cost.
- (U) Test 60 GHz diodes for reliability. Reduce reliance on heavy, unreliable tube transmitter technology.

(U) Work Performed By: AFSTC, Kirtland AFB NM managed effort. Rome Air Development Center, Griffiss AFB NY supplies technical and contractural support. The three contractors are: General Electric, Valley Forge PA; Ratheon Research Division, Lexington MA; David Sarnoff Research Center, Princeton NJ.

(U) Related Activities:
- (U) Canadian Defense Program D6470, EHF SATCOM R&D.
- (U) Program Element #0305314A, C3 Advanced Technology.
- (U) Program Element #0603790D, NATO Research and Development.

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

- (U) Program Element #0602702F, Command/Control/Communications.
- (U) Program Element #0603250F, Lincoln Laboratory.
- (U) Program Element #0603789F, Tactical C3 Adv Development.
- (U) Program Element #0303110F, Defense Sat Comm Sys (DSCS).
- (U) Program Element #0603226E, Expt Eval Mjr Innovative Tech.
- (U) AFSTC manages DARPA's EHF "Lightsat" technology program. There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Annex D-88-CA-001 Master Data Exchange Agreement Between the DOD (USA) and DND (CAN)--DSCS Follow-on; Letter of Intent signed by HQ Air Force Space Systems Division Los Angeles AFB and the National Defense Research Center, Ottawa, CAN.

4. (U) Project 3834, Advanced Spacecraft Technology Integration (ASTI): This project demonstrates innovative space technologies and operational concepts. Our lead-off experiment is the Electric Insertion Transfer Experiment (ELITE). ELITE will demonstrate highly efficient electric propulsion, lightweight solar arrays, and autonomous navigation and control. ELITE can either increase the payload we can push from low-earth orbit to geosynchronous orbit by 17-23 percent or be used to replace a Titan IV with a Titan III booster, saving between $75-$90 million per launch. Preliminary estimates show we might save nearly $1 billion over ten launches using ELITE derived vehicles to place satellite constellations in final orbit.

(U) FY 1989 Accomplishments:
- (U) Supported satellite survivability space demonstration (TAOS) within Project 2181.

(U) FY 1990 Planned Program: Not Applicable.

(U) FY 1991 Planned Program:
- (U) Detail ELITE mission and experimental objectives.
- (U) Critique experiment using Independent Evaluation Group.

(U) Work Performed By: Experiment planning done by Astronautics Laboratory, Edwards AFB CA.

(U) Related Activities:
- (U) Program Element #0603302F, Space & Msl Rocket Propulsion.
- (U) Program Element #0603402F, Space Test Program.
- (U) ELITE is a proposed joint AF-NASA-SDIO program.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

(U) International Cooperative Agreements: None.

5. (U) Project 3977, Thermionic Space Power: This project will conduct a ground demonstration of thermionic space nuclear power as directed by Congress.

(U) FY 1989 Accomplishments: Not Applicable.

(U) FY 1990 Planned Program:
- (U) Develop technology investment plan.
- (U) Conduct ground demonstration of critical thermionic technologies.

(U) FY 1991 Planned Program: Not Applicable.

(U) Work Performed By: Air Force Space Technology Center, Kirtland AFB NM managed effort. Industry involvement TBD.

(U) Related Activities: There is an ongoing related space nuclear power project (SP-100) run jointly by DOE, SDIO, and NASA. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 682J, Advanced Space Power Technology: This project develops compact, survivable, non-nuclear satellite power generation, storage, and processing systems. Work is focused on less costly, less sophisticated solar array alternatives such as our "throw away" solar panel that could simply "roll out" additional solar panel material if damaged by lasers or nuclear debris. Another design could eliminate exposed arrays altogether. This project also life tests Nickel-Hydrogen (NiH2) and Sodium-Sulfur (NaS) spacecraft batteries offering 50 and 100 percent weight reduction over current technology and long operational life (7-10 years). Our NiH2 batteries will transition to programs #0303603F, #0305160F, and #0305165F beginning FY 92.

(U) FY 1989 Accomplishments:
- (U) Completed Survivable Concentrating Photovoltaic Array (SCOPA) test module integration and transitioned to SDIO's "SUPER" program (PE #0603220C).

(U) FY 1990 Planned Program:
- (U) Complete NiH2 life test three-year data.
- (U) Space test high-efficiency Gallium-Arsenide solar cells (developed in FY86) on the Air Force-NASA Combined Release and Radiation Effects Satellite (CRRES) and transition to Program Elements #0305160F and #0305165F.

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

- (U) Investigate advanced solar array designs.

(U) FY 1991 Planned Program:
- (U) Continue NiH2 life test (five year program).
- (U) Begin next generation Sodium-Sulfur battery life test to reduce power storage subsystem weight by an additional 50 percent over NiH2 batteries.
- (U) Develop a "throw away" array using amorphous Silicon or Copper Indium Diselinide solar cells that are 6-20 times lighter and 10-20 times cheaper than arrays using concentrators or crystalline solar cells.
- (U) Develop a survivable Optical Waveguide System that funnels light through optical fibers from external collectors to solar cells protected within a satellite's body, saving 2-4 times more weight than comparable concentrator systems.
- (U) Strengthen 28 Volt spacecraft power circuitry to handle 100's of Volts to meet future space power demands.

(U) Worked Performed By: Astronautics Laboratory, Edwards AFB CA managed effort. Work performed by NASA's Jet Propulsion Laboratory, Pasadena CA and the Naval Weapons Support Center, Crane IN. The only contractor is ASTRON R&E, Sunnyvale CA.

(U) Related Activities:
- (U) Program Element #0602203F, Aerospace Propulsion.
- (U) Program Element #0602302F, Rocket Propulsion.
- (U) Program Element #0303603F, MILSTAR Sat Comm Sys.
- (U) Program Element #0305160F, Def Meteorological Sat Sys.
- (U) Program Element #0305165F, NAVSTAR Global Pos Sys.
- (U) Program Element #0603226E, Expt Eval Mjr Innovative Tech.
- (U) Astro Lab manages DARPA's "Lightsat" inflatable solar array program. There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603402F
PE Title: Space Test Program (STP)

Budget Activity: #6 Defense Wide Mission Support

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2617 Free-Flyer Spacecraft Missions	29,280	29,281	38,934	Cont	TBD
2618 Quick Response Shuttle Missions	290	290	290	Cont	TBD
2620 Shuttle Sortie Missions	18,417	19,380	12,300	Cont	TBD
TOTAL	43,391	48,951	51,524	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Space Test Program (STP) advances DOD technology by providing spaceflight missions for experiments that demonstrate new space systems technologies, concepts and designs and determine space environmental effects on DOD space systems. This tri-Service program provides the only substantial spaceflight capability to perform fly-before-buy demonstrations of advanced technologies. STP experiments are flown by priority based on relevance to existing military requirements and the availability of cost effective means of spaceflight on expendable launch vehicles or Shuttle. STP is also the pathfinder for exploiting the Shuttle as a manned DOD space laboratory to expedite the infusion of new technology into space systems through the use of simpler, incrementally designed, man-aided experiments. Experience gained from this approach is key in fully defining military man's role in space.

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

1. (U) Project 2618, Quick Response Shuttle Missions: This STP project supports the flight of Quick Response Shuttle Payloads (QRSPs) which account for 97% of all tri-Service ranked secondary experiments (no QRSPs are primary experiments). Due to the simplified integration involved, QRSP experiments maximize the use of near-term flight opportunities on both DOD and NASA Shuttle missions. QRSP experiments make use of Shuttle middeck and aft flight-deck lockers, Get-Away special (GAS) canisters, and hitchhiker mounting systems. Available experiment carrying capabilities are acquired through close coordination with NASA's GAS and Hitchhiker programs. The Military Man-In-Space (MMIS) effort will resume in FY 92 to develop and evaluate equipment and human tasking in the space environment for specific military applications.

(U) FY 1989 Accomplishments:

- (U) Twenty-five STP experiments were flown on Shuttle.

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Program Element: #0603402F
PE Title: Space Test Program (STP)

Budget Activity: #6 Defense Wide Mission Support

(U) FY 1990 Planned Program:

- (U) Continue manifesting backlogged experiments and support new experiments as much as Shuttle capacity allows.

(U) FY 1991 Planned Program:

- (U) Continue supporting new experiments and manifest flights as much as the Shuttle capacity permits.

(U) Work Performed By:

Air Force Systems Command, Space Systems Division, Los Angeles AFB, CA, NASA/Johnson Space Center, Houston, TX. The Aerospace Corporation, El Segundo, CA; Goddard Spaceflight Center, Greenbelt MD.

(U) Related Activities:

- (U) Program Element #0305171F (Space Shuttle Operations)
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: The AF Technical Application Center's GAS experiment HIEN-LO contains a sensor developed by the Max-Plank Institute, Munich, West Germany.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603402F
PE Title: Space Test Program (STP)
Project Number: 2617
Budget Activity: #6 Defense Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title Free-Flyer Spacecraft Missions

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	29,280	29,281	38,934	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This STP project advances DOD space technology by providing for the spaceflight of DOD prioritized experiments on STP developed free-flyer spacecraft. 76% of all tri-Service ranked "primary" experiments are serviced by this project. These flights are used for the demonstration of new system technologies, concepts and designs and for determining space environmental effects on military space systems. In addition, this project supports the spaceflight of "piggyback" payloads on non-STP free-flyer host spacecraft and on expendable launch vehicles. In FY 1990, 40% of the 45 ranked experiments can be satisfied by small satellite (100 to 500 pound class) missions, 31% require medium satellite (500 to 4,000 pounds) missions, 13% can potentially use "piggyback" missions, and the remaining 16% require Shuttle sortie missions (Project 2620). Currently, the Free-Flyer project supports spacecraft development and on-orbit operations for the joint DOD/NASA Combined Release and Radiation Effects Satellite (CRRES) P86-1 mission, Stacksat P87-2 mission, the Passive Radio Frequency Interference Location Experiment (PROFILE), the Independent Space Experiment system (ISES), the Stellar Horizon Attitude Determination SHAD (SHAD), ant the the Space Test Experiment Program (STEP).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:

- (U) Conducted source selection for STEP.
- (U) Completed CRRES modifications and reintegrated 26 DOD instruments.
- (U) Secured flight opportunity for Air Force Geophysics Laboratory's (AFGL) Automated Charge Control at Geosynchronous altitude (CHARGE CON-GEO) experiment on NOAA's GOES-I.
- (U) Obtained spaceflight approval for AFGL's Shuttle Potential and Return Electron Experiment (SPREE) on the joint NASA/Italian Tethered Spacecraft Mission aboard the Shuttle.
- (U) Approved Pegasus mission for RADC'S Radiation Experiment (REX) and Los Alamos National Laboratory's Array of Low Energy X-ray Imaging Sensors (ALEXIS) experiment flown aboard P89-1 ISES.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603402F
PE Title: Space Test Program (STP)
Project Number: 2617
Budget Activity: #6 Defense Wide Mission Support

2. (U) FY 1990 Planned Program:

- (U) Approved Scout mission for the flight of ONR's Passive Radio Frequency Interference Location Experiment (PROFILE).
- (U) Complete system testing and launch P86-1 CRRES and P87-2 Stacksat.
- (U) Award Space Test Experiment Platform (STEP) contract.
- (U) Approve the P89-D, Advanced Radio, Clock and Solar (ARCAS) mission for flight of AFTAC's Advanced Radio Frequency Test and Evaluation Measurement Interpretation System (ARTEMIS) experiment and the Naval Research Laboratory's (NRL's) Advanced Clock and Ranging Experiment (ACRE).
- (U) Continue programs P89-1 ISES, P87-2 Stacksat, P86-1 CRRES, CHARGE-CON GEO.
- (U) Continue to evaluate potential experiments for flight.
- (U) Approve Pegasus launch of SHAD.

3. (U) FY 1991 Planned Program:

- (U) Support CRRES flight operations and science data collection.
- (U) Support SPREE experiment integration on Tethered Spacecraft Shuttle mission.
- (U) Support data recovery for the Navy experiments Magnetospheric Atmospheric X-ray Imaging Experiment (MAXIE) and Energetic Heavy Ion Composition (EHIC) upon launch of the TIROS-I mission.
- (U) Support launch of PROFILE.
- (U) Launch REX and ALEXIS experiment aboard ISES.
- (U) Exercise contract option for second STEP mission.

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

D. (U) WORK PERFORMED BY: Air Force Systems Command, Space Division, Los Angeles AFB, CA, The Aerospace Corporation, El Segundo, CA. Office of Naval Research, Washington, D.C.; Defense Systems, Inc., McLean, VA; NASA/Goddard Space Flight Center, Greenbelt, MD; NASA/Marshall Spaceflight Center, Huntsville, AL; Naval Research Laboratory, Washington, D.C.; and Ball Space Systems Division, Boulder, CO; TRW, Redondo Beach, CA; Orbital Sciences Corporation, VA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) Technical Changes: None

2. (U) Schedule Changes: The P87-2 Stacksat mission schedule was changed from 1Q FY 1990 to 3Q FY 1990 due to payload delivery delays caused by a Defense Investigative Service investigation.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603402F
PE Title: Space Test Program (STP)
Project Number: 2617
Budget Activity: #6 Defense Wide Mission Support

3. (U) Cost Changes:

(a) (U) Funding and management responsibility for procurement of small (Pegasus) launch vehicles for STP were transferred to PE 0305119F, Space Boosters.

(b) (U) As part of an overall RDT&E adjustment in the amended FY 90/91 budget, $17.6 million was removed from FY 90 and $15.0 million from FY 91, delaying secondary payload capability on the Titan II launch vehicle and new secondary missions.

F. (U) PROGRAM DOCUMENTATION:

- (U) Tri-Service Regulation (AFR 80-2/AR 70-43/OPNAVINST 3913.1), STP Management, 30 November 1984.

G. (U) RELATED ACTIVITIES:

- (U) Program Element #305171F (Space Shuttle Operations) supplies Launch support tasks.
- (U) Program Element #305119F (Space Boosters) procures launch vehicles and their corresponding launch support for STP.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: An MOA exists between STP and ONR to secure secondary capacity on the French SPOT-3 spacecraft for ONR's Polar Ozone and Aerosol Measurement (POAM II) experiment.

J. (U) MILESTONE SCHEDULE:

(U)	Atlas-E launch of P87-2 "Stacksat" mission	3Q FY 1990
(U)	Atlas-I/Centaur launch of P86-1, CRRES	4Q FY 1990
(U)	TIROS launch of Navy MAXIE and EHIC experiments	2Q FY 1991
(U)	Pegasus launch of REX and ALEXIS spacecraft	2Q FY 1991
(U)	Scout launch of PROFILE	2Q FY 1991
(U)	Shuttle launch of Tethered Sat/SPREE	3Q FY 1991
(U)	Launch of ISES with REX and ALEXIS	3Q FY 1991
(U)	Ariane launch of POAM-II	3Q FY 1992
(U)	Space Test Experiment Platform (STEP P90-1)	1Q FY 1993

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603402F
Title: Space Test Program (STP)

Project Number: 2620
Budget Activity: #6 Defense Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title: Shuttle Sortie Missions

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	18,417	19,380	12,300	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:
This STP project supports approximately 16% of the tri-Service "primary" experiment spaceflight requirements and approximately 3% of the "secondary" experiment spaceflight requirements. The project advances DOD space technology by flying experiments on Shuttle sortie missions (payloads/experiments which are returned) which demonstrate new technologies, concepts and designs and for determining space environmental effects on military space systems and personnel. Using generic reusable, standard STP Shuttle experiment support equipment, STP accomplishes its pathfinder role of exploiting the Shuttle as a manned DOD space laboratory. The project develops the capability to control payloads in the payload bay from the aft flight deck as well as the capability to store data and perform payload experiments on the aft and mid flight decks. This project provides for the procurement of generic reusable experiment support equipment; integration of sortie mission payloads with the Shuttle experiment support equipment and the integration of the combination into the Shuttle; mission/payload specialist training on STP hardware; launch support; on-orbit support; and science data retrieval. As an extension of the present project, new capabilities are being studied to use future NASA Space Station and commercial space platforms for supporting spaceflight and retrieval of STP experiments. The project supports the AFP-675 mission which includes the following experiments: Air Force Geophysic Laboratory's (AFGL) Cryogenic Infrared Radiance Instrument for Shuttle (CIRRIS)-1A, Naval Research Laboratory's (NRL) Far Ultraviolet Camera (FAR UV) and AFGL's Horizon Ultraviolet Photometer (HUP) and Quadropole Ion Neutral Mass Spectrometer (QUINMS).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:

- (U) Continued AFP-675 spacecraft and experiment integration, system test and ground operations planning for a FY 1991 flight.
- (U) Continued integration of experiments aboard the Spartan carrier.

2. (U) FY 1990 Planned Program:

- (U) Continue flight opportunity feasibility studies.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603402F
Title: Space Test Program (STP)

Project Number: 2620
Budget Activity: #6 Defense Wide Mission Support

3. (U) FY 1991 Planned Program:

- (U) If scheduled, support the AFP-675 sortie Shuttle flight on STS-39, associated mission operations, post-flight recovery and data distribution.
- (U) Continue feasibility studies for the NASA Space Station and other commercial space platforms to host STP experiments.

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

D. (U) WORK PERFORMED BY: Air Force Systems Command, Space Division, Los Angeles AFB, CA and NASA Johnson Space Center, Houston, TX; The Aerospace Corporation, El Segundo, CA; NASA Goddard Space Flight Center, Greenbelt, MD; Lockheed Space and Missile Company, Sunnyvale,CA.

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

1. (U) Technical Changes: None

2. (U) Schedule Changes: NASA deletion of STS-39 jeopardizes fligh of AFP-675 experiments.

3. (U) Cost Changes: Reduced budget forced termination of Spartan support.

F. (U) PROGRAM DOCUMENTATION:

- (U) Tri-Service Regulation (AFR 80-2/AR 70-43/OPNAVINST 3913.1), STP Management, 30 November 1984.

G. (U) RELATED ACTIVITIES:

- (U) Program Element #305171F (Space Shuttle Operations) supplies Launch support tasks.
- (U) There is no unnecessary duplication of effort within the Air Force of the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603410F Budget Activity: #2 - Advanced Technology Development
Title: Space Systems Environmental Interactions Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2821	Space Systems Design and Test Standards	663	690	620	Cont	TBD
2822	Interactions Measurement Payloads	2,746	2,490	3,022	Cont	TBD
2823	Charge Control System	500	660	610	Cont	TBD
Total		3,909	3,840	4,252	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This advanced technology development program provides demonstrated, cost-effective solutions to counter the effects of those space environmental interactions which adversely impact spacecraft operations and reduce the reliability and survivability of Air Force space systems. Energetic particles routinely cause loss of valuable data from the Defense Meteorological Satellite System's primary mission sensor. Electrostatic discharges induce phantom commands in systems of our geosynchronous satellites, and have caused major subsystem failures. The Space Shuttle glow reveals a potential source of sensor contamination which must be understood and mitigated. Impact from orbital debris is becoming more likely as our activity in space increases. Operations continue without adequate understanding of these effects and how to alleviate them. Trends show that these problems will worsen with larger and more complex Air Force systems of the future. For example, the environmental constraints of high-voltage operations on new space power technologies are currently unknown. The payoff of this work is development of housekeeping sensors to warn about and mitigate the degrading effects or new ways to operate around the environmental problems. It will also be possible to develop new ways to engineer around these effects during system design.

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

1. (U) Project 2821, Space Systems Design and Test Standards: This project integrates the results of experiments conducted under Project 2822, Interactions Measurement Payloads, into tools that are useful to Air Force space systems operators and designers. Results are provided in the form of handbooks, standards, or computer-aided engineering (CAE) tools, as applicable. For example, a recently developed computer graphics package shows the design engineer where electric charge builds up, given a particular spacecraft design. Spacecraft contamination effects will be characterized and modeled for computer-aided identification and mission assessment tools.

Program Element: #0603410F Budget Activity: #2 - Advanced Technology Development
Title: Space Systems Environmental Interactions Technology

(U) FY 1989 Accomplishments:
- (U) Completed report of environmental effects on spacecraft materials.

(U) FY 1990 Planned Program:
- (U) Deliver military standards/handbook on space environment specifications.
- (U) Begin military standards/handbook on spacecraft charging.
- (U) Begin military standards/handbook on radiation testing of microelectronic components.

(U) FY 1991 Planned Program:
- (U) Continue work on the surface charging standards and handbook.
- (U) Begin contamination characterization for computer-aided spacecraft identification and mission assessment tools.
- (U) Begin work on single event upset (SEU)/cosmic ray characterization model.

(U) Work Performed By: This project is managed by AFSC's Geophysics Laboratory, Hanscom AFB MA. The four contractors are S-Cubed, Inc., La Jolla CA; Southwest Research Institute, San Antonio TX; Aerospace Corp., El Segundo CA; and the University of Chicago, Chicago IL.

(U) Related Activities:
- (U) Agreement for NASA-USAF Space Interdependency on Spacecraft-Environment Interaction.
- (U) NASA/USAF Space Technology Interdependency Group coordinates efforts and reviews programs annually.
- (U) Program Element 0602101F, Geophysics.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2822, Interactions Measurement Payloads: The primary focus is to determine the environmental constraints of high-voltage operations on new space power technologies. In-space experiments will gather data and diagnose environmental conditions under which interactions occur. A series of experiments will characterize the contamination cloud enveloping spacecraft and determine how the contamination and spacecraft environment will interact. Other experiments will characterize the low altitude spacecraft charging hazard. Results of these experiments will be transitioned under Project 2821, Space Systems Design and Test Standards.

Program Element: #0603410F Budget Activity: #2 - Advanced Technology Development
Title: Space Systems Environmental Interactions Technology

(U) FY 1989 Accomplishments:
- (U) Completed testing of component sensors for Shuttle Potential and Return Electron Experiment (SPREE).
- (U) Completed initial chamber simulations of low-altitude spacecraft charging.
- (U) Completed assembly and testing of Auroral Photography Experiment, Version B (APE-B), designed to obtain visible imagery and data on the Shuttle glow.

(U) FY 1990 Planned Program:
- (U) Complete fabrication and testing of Photovoltaic Array Space Power Plus Diagnostics (PASP Plus) Experiment.
- (U) Complete fabrication of SPREE instrument and begin flight integration.
- (U) Complete design of low-altitude spacecraft charging experiment.
- (U) Fly APE-B and obtain spectra and images of Shuttle glow and thruster plumes.
- (U) Test and integrate Shuttle Glow (GLO) ultraviolet contamination imager and spectrograph.

(U) FY 1991 Planned Program:
- (U) Complete fabrication of dosimeters for PASP Plus experiment.
- (U) Complete fabrication of all hardware for the low-altitude spacecraft charging experiment.
- (U) Launch SPREE instrument on joint NASA-Italian Space Agency Tethered Space Satellite.
- (U) Validate Spacecraft Contamination Code by comparing with data from APE-B and GLO experiments.

(U) Work Performed By: This project is managed by AFSC's Geophysics Laboratory, Hanscom AFB MA. The three contractors are the Jet Propulsion Laboratory, Pasadena CA; SRI International, Menlo Park CA; and Amptek Inc., Bedford MA.

(U) Related Activities:
- (U) Agreement for NASA-USAF Space Interdependency on Spacecraft-Environment Interaction.
- (U) NASA/USAF Space Technology Interdependency Group coordinates efforts and reviews programs annually.
- (U) Program Element 0602101F, Geophysics.
- (U) Program Element 0603401F, Advanced Spacecraft Technology.
- (U) Program Element 0603438F, Satellite Systems Survivability.
- (U) Program Element 0603402F, Space Test Program.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0603410F Budget Activity: #2 - Advanced Technology Development
Title: Space Systems Environmental Interactions Technology

3. (U) Project 2823, Charge Control System (CCS): This project will develop a CCS technology demonstration for geosynchronous applications that automatically controls electric charge buildup on spacecraft. Follow-on developments will be technology demonstrations of a compact environmental anomaly sensor for low- and mid-earth orbit applications.

(U) FY 1989 Accomplishments:
- (U) Completed fabrication of CCS flight hardware.
- (U) Completed accomodation study for flight of CCS on the Defense Satellite Communications System (DSCS) spacecraft.

(U) FY 1990 Planned Program:
- (U) Complete laboratory testing and upgrading of CCS.
- (U) Begin modification of CCS for DSCS flight.
- (U) Initiate contract for the Compact Environmental Anomaly Sensor Experiment (CEASE).

(U) FY 1991 Planned Program:
- (U) Complete modification of CCS and deliver for DSCS integration.
- (U) Complete feasibility study and preliminary design of CEASE.

(U) Work Performed By: This project is managed by AFSC's Geophysics Laboratory, Hanscom AFB MA. Fabrication was performed by Hughes Research Laboratories, Malibu CA, the only contractor.

(U) Related Activities:
- (U) Agreement for NASA-USAF Space Interdependency on Spacecraft-Environment Interaction.
- (U) NASA/USAF Space Technology Interdependency Group coordinates efforts and reviews programs annually.
- (U) Program Element 0602101F, Geophysics.
- (U) Program Element 0603402F, Space Test Program.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603428F
PE Title: Space Surveillance Technology
Budget Activity: 3 - Strategic Programs

A. (U) RDT&E RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Program	To Complete	Total Program
3820 Space Based Surveillance	0	0	34,138	Cont	TBD

B. (.) BRIEF DESCRIPTION OF ELEMENT: In support of the NORAD and fleet defense missions, this effort provides Tactical Warning and Attack Assessment (TW/AA) of atmospheric attack against North America and Carrier Battle Groups/Surface Action Groups through wide area space based atmospheric and surface surveillance. This wide-area surveillance capability is designed to complement existing or planned strategic surveillance sensors and tactical organic assets.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Approved MNS (Favorable Milestone 0 on December 12, 1988).
   - (U) Supported the development/validation of Space-Based Wide Area Surveillance (SBWAS) Combatant Command Requirements (CCRs).
   - (U) Continued to resolve international participation/cost-sharing.
   - (U) Performed requirements analyses and technical/cost/performance tradeoffs and sensitivity analyses in support of Milestone I Cost and Operational Effectiveness Analysis (COEA).

2. (U) FY 1990 Planned Program:
   - (U) Conclude COEA activities.
   - (U) Develop preferred system concept(s).
   - (U) Conduct joint Milestone I program review (with Navy).
   - (U) Establish a Joint/International Space-Based Wide Area Surveillance Program Office at Air Force Space Division.
   - (U) Conclude Memorandum of Agreement with Canada on cooperative SBR technology development.

Program Element: #0603428F
PE Title: Space Surveillance Technology

Budget Activity: 3 - Strategic Programs

4. (U) FY 1991 Planned Program:
   - (U) Develop system specification and Request-for-Proposals for demonstration/validation contracts.
   - (U) Conduct competitive source selection and award contracts for concept demonstration/validation.
   - (U) Continue enabling technology efforts to mitigate program risk.

5. (U) Program to Completion:
   - (U) Posture for Full Scale Development decision in FY 93.
   - (U) This is a continuing program.

D. (U) Work Performed By: Air Force program management for the space-based surveillance effort is provided by Air Force Systems Command. The Joint Program Office will be established at Air Force Space Division coincident with the award of the Concept Definition contracts. Previous Concept Exploration Studies were jointly funded by the Air Force, Navy, and the Defense Support Project Office and managed by Air Force Space Division. These 12-month studies were conducted by five contractor teams (led by General Electric, Grumman, Lockheed, Martin-Marietta, and TRW). [redacted] Two or more teams will be awarded competitive contracts for concept demonstration/validation. Work planned in preparation for an FSD decision will concentrate on technical risk and cost reduction including brassboard/breadboard demonstrations and validation of transmit/receive module performance and manufacturing producibility, electronically-steered subscale antenna arrays, and ECCM processing. The Canadian government previously approved $50 million for cooperative, coordinated, and non-redundant SBR technology development in Canada. Canada has also identified and fenced approximately $1 billion for follow-on co-development/co-production.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: None.
   3. (U) COST CHANGES: The FY 1991 Budget Request has been increased to reflecting the change from basic technology by including funds required to enter demonstration/validation of selected concepts.

F. (U) PROGRAM DOCUMENTATION:
   - (U) Multi-Command Required Operational Capability (MROC) 2-87
   - (U) Mission Need Statement (MNS), JROC-SM-88-083, 28 Nov 88
   - (U) SBWAS Combatant Command Requirements (CCRs), 13 Oct 89.

G. (U) RELATED ACTIVITIES:
   - (U) Air Defense Initiative (ADI), Program Element 0603741D, partially funded FY 1989 space-based surveillance technology and concept definition efforts ($14.9 million). Beginning with the FY 1988 Appropriation, ADI combined several related Program Elements into one program. This included the content from Program Element 0603424F, Cruise Missile Surveillance Technology (CMST) which had funded past space-based effort.

Program Element: #0603428F
PE Title: Space Surveillance Technology

Budget Activity: 3 - Strategic Programs

- (U) Additional FY 1990/1991 technology/concept demonstration/ validation funds may be provided through Nunn Amendment cooperative R&D.
- (U) The Navy is also examining alternative space-based surveillance technology in preparation for a joint FY 1990 Milestone I under Tactical Space Operations, Program Element 0603451N.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: A Data Exchange Agreement (DEA) has been signed with Canada on space based surveillance. A similar Information Exchange Program (IEP) data sharing agreement has been signed with the United Kingdom.

J. (U) MILESTONE SCHEDULE:

1. (U)	Milestone 0/Entered Concept Exploration	December 1988
2. (U)	Milestone I/Demonstration-Validation Phase	March 1990
3. (U)	Milestone II/Full Scale Development Phase	4Qtr FY1993

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603438F Budget Activity: #6- Defense Wide Mission Suppport
PE Title: Satellite Systems Survivability

A. (U) RESOURCES ($ in Thousands)

Project Number	Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2611	Survivability Planning and Analysis	200	1,016	1,008	Cont	TBD
2612	Satellite Survivability	4,673	9,250	9,500	Cont	TBD
2613	Ground Station/Link Survivability	0	0	50	Cont	TBD
TOTAL		4,873	10,266	10,558	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program performs survivability planning and analysis and develops the necessary prototype hardware, software, technology, operational procedures, strategy, and tactics that will provide generic survivability capabilities for the military space systems of the United States. The program is structured to provide balanced survivability between all space systems elements: satellites, data/command links, ground stations. Space systems are required to provide critical strategic and tactical support to national decision makers and military force commanders at all levels of conflict. They specifically provide missile attack warning, strategic and tactical navigation, surveillance, [ ] communications, and meteorological information. These systems provide support to strategic, tactical, and Rapid Deployment Forces on a global basis. The Soviet capabilities to interfere with our data links and ground stations, the potential use of their operational anti-satellite (ASAT), and their advances in developing a ground-based laser which, under optimum conditions, could be used against our satellites represent major threats to our effective use of U.S. space systems. Failure to protect our space systems will result in the denial of their critical support to the National Command Authorities and our military forces during crisis and conflict. The major development effort within this program is the Satellite On-Board Attack Reporting System (SOARS) - an attack detection characterization and reporting system which is planned for incorporation into all upcoming satellite block-changes. Survivability technologies under this program are made available to all satellite program offices for system level implementation.

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

1. (U) Project 2611, Survivability and Planning Analysis: Performs analysis and planning to meet space survivability requirements.

(U) FY 1989 Accomplishments:
- (U) Survivability Roadmap update and implementation
- (U) Continued analyses of evolution of the threat, technology needs, development priorities, and operational requirements.

Program Element: #0603438F Budget Activity: #6-Defense Wide Mission Support
PE Title: Satellite Systems Survivability

(U) FY 1990 Planned Program:
- (U) Initiate Survivability Roadmap implementation
- (U) Continuing analyses of evolution of the threat, technology needs, development priorities, and operational requirements.
- (U) Begin analysis of designs for small tactical satellite and implications of deployment

(U) FY 1991 Planned Program:
- (U) Annual update of Survivability Roadmap
- (U) Continuing analyses of evolution of the threat, technology needs, development priorities, and operational requirements
- (U) Continue analysis of small tactical satellites

(U) Work Performed By: The Air Force Systems Command's Space Systems Division, Los Angeles AFS, CA., has overall responsibility for program management. Space Systems Division executes the program, has responsibility for contractor overview and performs technical analysis in support of all projects.

(U) Related Activities:
- (U) Program Element #063224C, Survivability, Lethality, and Key Technologies
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

2. (U) Project 2612, Satellite Survivability: Develops satellite survivability technologies in support of space system program offices. Satellite On-Board Attack Reporting System (SOARS) and Technology for Autonomous Satellite Survivability (TAOS) are the current major efforts.

(U) FY 1989 Accomplishments:
- (U) Awarded Lockheed the SOARS Phase II contract to design, build integrate and test a SOARS package.
- (U) Delivered SOARS A-specs developed under Phase I to satellite developers to transition the technology
- (U) Initiated laser sensor test program

(U) FY 1990 Planned Program:
- (U) Complete laser sensor testing.
- (U) Continue SOARS development thru Preliminary Design Review (PDR) in 2Q FY90.
- (U) Evaluate need for new detection sensors based on current threat projections.
- (U) Continue development of TAOS experiment

Program Element: #0603438F Budget Activity: #6-Defense Wide Mission Support
PE Title: Satellite Systems Survivabilty

(U) FY 1991 Planned Program:
- (U) Continue SOARS development thru Critical Design Review (CDR) in 2Q FY91
- (U) Continue sensor analysis/development based on evolving threat.
- (U) Complete development of TAOS payloads and initiate testing of integrated satellite

(U) Work Performed By: The SOARS contract is with Lockheed, Sunnyvale, CA. The TAOS payload contracts are with Microcosm, GTE, Honneywell, Rockwell, and Sandia National Laboratory. The Aerospace Corporation, Los Angeles, CA, provides system engineering support.

(U) Related Activities:
- (U) Program Element #0602601F, Advanced Weapons
- (U) Program Element #0604711F, Systems Survivability
- (U) Program Element #0603224C, Survivabiity, Lethality, and Key Technologies
- (U) Program Element #0603401F, Advanced Spacecraft Technology
- (U) Program Element #0603431F, Advanced Space Communications Capabilities
- (U) Program Element #0603211F, Aerospace Structures and Materials
- (U) There is no unnecesssary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

3. (U) Project 2613, Ground Station/Link Survivability: Develops techniques to improve survivability of satellite ground stations and communications links.

(U) FY 1989 Accomplishments:
- (U) Not applicable.

(U) FY 1990 Planned Program:
- (U) Not applicable.

(U) FY 1991 Planned Program:
- (U) Initiate study of ground/link survivability.

(U) Work Performed By: Not applicable.

(U) Related Activity:
- (U) Program Element #0603431F, Advanced Space Communications Capabilities
- (U) There is no unnecesssary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

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FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603601F Budget Activity: #2 - Advanced Technology Development
Title: Conventional Weapons Technology

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
670A Ordnance Technology	16,334	12,533	14,174	Cont	TBD
670B Air-to-Surface Guidance Technology	8,106	11,205	14,823	Cont	TBD
670E Air-to-Air Guidance Technology	400	450	500	Cont	TBD
TOTAL	24,840	24,188	29,497	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the primary Air Force advanced technology development program for air-to-surface and air-to-air weapons including guidance, ordnance, and aeromechanics technologies. Hardware/software for advanced technologies are developed and evaluated to determine feasibility, effectiveness, and potential operational value. This program serves as the basis for follow-on advanced prototyping and system development. This program develops the innovative technologies that produce superior conventional weapons--the type needed to defeat the ever-increasing and more survivable threat forces.

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

(U) Project 670E: AIR-TO-AIR GUIDANCE TECHNOLOGY. This project develops and demonstrates the feasibility, effectiveness and potential operational value of advanced air-to-air guidance technologies for Air Force short- to medium-range weapons against future threats with evading/maneuvering characteristics and low observable threats. Objectives include: standoff delivery/threat avoidance through preprogrammed autonomous seeker operation and advanced threat target acquisition, precision terminal guidance with increased accuracy, all weather operation, increased tactical mission choices and survivability, target classification and identification and reliable operation and increased affordability. Efforts are focused at combining infrared and radio frequency (RF) guidance technologies to meet these objectives.

(U) FY 1989 Accomplishments:
- (U) Integrated a high performance processor (VHSIC hardware and Ada software) with an advanced active/passive RF seeker.
- (U) Conducted characterization tests of the integrated processor and seeker using simulated target information.
- (U) Tested reconfigurability of system by installing additional processor components and software.

Program Element: #0603601F Budget Activity: 2 - Advanced Technology Development
PE Title: Conventional Weapons Technology

- (U) Tested integrated system in anechoic chamber against simulated missile intercept scenarios.

(U) FY 1990 Planned Program:
- (U) Complete testing of integrated processor and RF seeker in anechoic chamber.
- (U) Analyze results of Advanced Processor Technology for Air-to-Air Missiles project and publish final report.
- (U) Initiate planning for Multi-Mode Air-to-Air Seeker that transitions from PE 0602602F, Conventional Munitions where passive and active infrared guidance technologies along with active and passive RF technologies (including bi-static radar) are being pursued.
- (U) In-house studies and analyses will be initiated to determine which are the best exploratory development infrared and RF guidance technologies to defeat the projected air-to-air threat.

(U) FY 1991 Planned Program:
- (U) Define threat and develop basic system requirements including aircraft interface requirements for a multi-mode air-to-air missile seeker.
- (U) Initiate in-house support activities for concept definition and development of a captive flight capable multi-mode air-to-air seeker.
- (U) Continue development of in-house multi-mode simulation and analysis capability to support program initiation and subsequent evaluation of multi-mode seeker performance.

(U) Work Performed By: Air Force Armament Laboratory, Eglin AFB FL, is the responsible technical activity. The test facilities at Munitions Systems Division, Eglin AFB FL, support this program. The current contractor is Raytheon Co, Bedford MA. Contractors for the multi-mode seeker development effort have not been selected.

(U) Related Activities:
- (U) PE 0602602F, Conventional Munitions
- (U) PE 0603363F, Armament Technology Integration
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology
- (U) PE 0603792N, Advanced Technology Demonstrations
- (U) The Joint Navy/Air Force Memorandum of Agreement on Tactical Air-to-Air Missiles, dated May 1988, applies.
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603601F
PE Title: Conventional Weapons Technology

Project Number: 670A
Budget Activity: 2 - Advanced Technology Development

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

Project Title: Ordnance Technology

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Ordnance Technology	16,334	12,533	14,174	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project develops and demonstrates the feasibility, effectiveness and operational value of conventional (non-nuclear) ordnance technologies for current and future air-delivered weapons. Project includes ordnance technologies for: fuzes, insensitive and less sensitive explosives, hard target warheads, explosives, bombs, submunitions and their dispensing mechanisms, guns and ammunition, air-to-surface composite weapon airframes, smart submunitions, and weapon ordnance subsystems. Objectives include: increased munitions and transportation safety and increased on-base ordnance storage through qualification of Insensitive High Explosives (IHE); demonstration of an advanced medium range dispenser for increased operational effectiveness against high value buried and hardened targets; effective enemy airfield denial; increased aircraft gun effectiveness; multiple kills per pass; advanced combat ammunition; more effective submunition dispensing; low cost manufacturing techniques; low drag composite weapons airframes; and increased tactical mission choices.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed ground test demonstration of an advanced aircraft gun and telescoped ammunition.
   - (U) Conducted full scale tests of contractor developed IHE for MK-80 series general purpose and Improved 2000-pound bombs.
   - (U) Fabricated hard target penetrators and conducted sled impact tests with hard target programmable and settable delay fuzes.
   - (U) Completed small scale testing of a TNT and nitro-triazol-one melt-cast explosive formulation to meet IHE classification.
   - (U) Conducted scale model separation testing & fabricated vehicles for ground and flight tests of advanced dispenser airframe.
   - (U) Initiated development of an advanced ordnance package incorporating new target detection device, electronic safe arm and fire and warhead technologies for Advanced Medium Range Air-to-Air Missile PrePlanned Product Improvement and future advanced air-to-air missiles.

Program Element: #0603601F
PE Title: Conventional Weapons Technology
Project Number: 670A
Budget Activity: 2 - Advanced Technology Development

2. (U) FY 1990 Planned Program:
- (U) Complete free flight testing and demonstration of an advanced dispenser to provide a 50 percent payload increase, multiple kills per pass, low radar cross section, and 50 percent increase in aircraft range over conventional designs.
- (U) Conduct trade studies and program planning for smart submunition technologies to provide capability to destroy advanced heavy armor, mobile light armor, and enemy missile sites.
- (U) Conduct additional sled impact tests of hard target penetrator and fuzes for hard target ordnance package.
- (U) Conduct static rocket motor firing tests and dispenser mechanism tests for hard target ordnance package.
- (U) Design and develop an advanced ordnance package to defeat post-1995 airborne threat.
- (U) Complete development and initiate full scale evaluation of melt cast explosive that meets IHE hazard classification requirements.
- (U) Develop plastic bonded insensitive formulations for MK-80 series general purpose bombs and Improved 2000-pound Bomb.
- (U) Initiate high energy IHE explosive development for the multi-mode warhead.
- (U) Initiate program planning for medium range dispenser program.
- (U) Validate advanced gun ammunition technical data package.

3. (U) FY 1991 Planned Program:
- (U) Conduct preliminary qualification tests for melt cast and plastic bonded explosives for IHE hazard classification.
- (U) Conduct scale up tests using one thousand pound (MK 84) bombs.
- (U) Conduct component fabrication/testing of smart submunition technologies.
- (U) Complete integration and test of technologies designed to defeat heavily hardened targets, demonstrating technology required for transition to the Boosted Penetrator full-scale development program.
- (U) Complete requirements definition and technology assessment, develop ordnance package concept and design components for the advanced ordnance package.
- (U) Conduct system level sled tests of the hard target ordnance package tri-pack in a GBU-15 (dispenser version) test vehicle.
- (U) Begin development of anti-armor combat ammunition.
- (U) Conduct integration trade studies for medium range dispenser.
- (U) Begin development of individually guided smart submunition for use against all ground-mobile and fixed missile site targets.
- (U) Conduct integration trade studies of powered, low drag, low observable, medium range air-to-ground dispensers.

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

Program Element: #0603601F
PE Title: Conventional Weapons Technology
Project Number: 670A
Budget Activity: 2 - Advanced Technology Development

D. (U) WORK PERFORMED BY: Air Force Armament Laboratory, Eglin AFB FL is responsible for program management and technical activity. Test facilities at Munitions Systems Division, Eglin AFB FL; Arnold Engineering Development Center, TN; 6585th Test Group, Holloman AFB NM; and the Naval Weapons Center, China Lake CA, support this program. Major contractors are: McDonnell-Douglas, St Louis MO; Lockheed Inc, Sunnyvale, CA; Motorola Inc, Scottsdale, AZ; General Electric Co, Burlington VT; and Aerojet Inc, Sacramento, CA.

E. (U) COMPARISON WITH AMENDED FY 1990/91 DESCRIPTIVE SUMMARY:

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

F. (U) PROGRAM DOCUMENTATION:

- (U) TAF GOR 302-78, Wide Area Anti Armor Munitions (WAAM), 13 Feb 78
- (U) TAF SON 306-79, Airfield Attack Munitions, 8 Mar 79
- (U) TAF ROC 311-75, Improved Cluster Munitions, 28 May 75
- (U) SAC SON 18-82, Strategic Conventional Standoff Capability, 19 Jun 84
- (U) AFLC SON 02-83, Munitions Hazard Reduction, 20 May 85
- (U) TAF SON 306-85, Multi-Purpose All-Up Round Development, 24 Mar 87
- (U) TAF SON 309-88, Reducing the Risk of Munitions Operations, 22 May 89

G. (U) RELATED ACTIVITIES:

- (U) PE 0602602F, Conventional Munitions
- (U) PE 0604602F, Armament Ordnance Development
- (U) PE 0604314F, Advanced Medium Range Air-to-Air Missile
- (U) PE 0603363F, Armament Technology Integration
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology
- (U) PE 0603792N, Advanced Technology Demonstrations
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- (U) Complete development of dispenser weapon airframe	FY 1990
- (U) Qualification tests of insensitive explosives	FY 1990
- (U) Complete development of hard target technologies	FY 1991
- (U) Heavy armor defeat testing	FY 1991
- (U) Hard Target Ordnance Technology demonstration	FY 1992
- (U) Medium range dispenser sub-system integration	FY 1993

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603601F
PE Title: Conventional Weapons Technology
Project Number: 670B
Budget Activity: 2 - Advanced Technology Development

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

Project Title: Air-to-Surface Guidance Technology

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Air-to-Surface Guidance	8,106	11,205	14,823	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project develops and demonstrates the feasibility, effectiveness, and potential operational value of advanced midcourse and autonomous, all-weather, near-zero circular error probability terminal guidance technologies. Objectives include: standoff delivery/threat avoidance through preprogrammed autonomous seeker operation and longer range target acquisition; precision terminal guidance with increased accuracy, all-weather operation, and increased tactical flexibility; enhanced target classification and identification; improved countermeasures-resistant seeker capability; increased affordability; and increased tactical mission choices.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed initial captive flight tests of the Advanced Synthetic Aperture Radar Guidance (ASARG) concept seeker.
   - (U) Completed testing of the low cost tactical laser radar seeker.
   - (U) Began planning activities for development of Advanced Technology Laser Radar System (ATLAS) to detect and classify fixed, high value, maneuvering and stationary mobile targets.

2. (U) FY 1990 Planned Program:
   - (U) Complete medium-speed flight testing of ASARG seeker.
   - (U) Expand ASARG seeker capability to provide midcourse position updating for conventional cruise missile applications. Conduct captive flight tests of ASARG seekers to demonstrate midcourse and terminal guidance performance.
   - (U) Award dual contracts for ATLAS to develop a guidance system which has low susceptibility to detection and substantially increases the targeting of autonomous weapons.
   - (U) Define system requirements for the Joint Air Force/Army Millimeter Wave/Infrared Seeker (JAAMIS) program to develop dual mode seeker technology for autonomous acquisition and tracking of ground mobile armored targets and air defense units. Seeker transitions from PE 0602602F, Conventional Munitions.

Program Element: #0603601F | Project Number: 670B
PE Title: Conventional Weapons Technology | Budget Activity: 2 - Advanced Technology Development

3. (U) FY 1991 Planned Program:
   - (U) Develop and flight test midcourse position update, terrain following and obstacle avoidance capability Synthetic Aperature Radar (SAR) seekers under ASARG to demonstrate applications to the Long Range Conventional Standoff Weapon (LRCSW).
   - (U) Modify and conduct tests (captive flight) of ASARG seeker against high value fixed targets, mobile missile launchers and massed armored targets.
   - (U) Conduct utility analysis, mission planning, target acquisition algorithm development and advanced guidance study to support the ATLAS seeker system.
   - (U) Complete the design and fabrication phase of the ATLAS program.
   - (U) Conduct initial ATLAS captive flight testing to demonstrate application to LRCSW.
   - (U) Award four JAAMIS contracts with planned down select after an initial nine month design phase to reduce program risk.

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

D. (U) WORK PERFORMED BY: Air Force Armament Laboratory, Eglin Air Force Base FL, is the responsible technical activity. Test facilities at Munitions Systems Division, Eglin Air Force Base FL support this program. The two prime contractors are: Raytheon Co, Bedford MA; Loral, Phoenix AZ.

E. (U) COMPARISON WITH AMENDED FY 1990/91 DESCRIPTIVE SUMMARY:

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

F. (U) PROGRAM DOCUMENTATION:

- (U) TAF SON 306-79, Airfield Attack Munitions, 8 Mar 79
- (U) TAF ROC 311-79, Self-Protection Weapon, 30 Mar 79
- (U) TAF SON 3133-81, Communications/Jammer Killer, 24 May 82
- (U) TAF SON 311-75, Improved Cluster Munitions, 28 May 75
- (U) SAC SON 18-82, Strategic Conventional Standoff Capability, 19 Jun 84
- (U) TAF SON 314-82, Standoff Attack Weapon, 17 Aug 82.

G. (U) RELATED ACTIVITIES:

- (U) PE 0602602F, Conventional Munitions.
- (U) PE 0603363F, Armament Technology Integration.
- (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology
- (U) PE 0603792N, Advanced Technology Demonstrations
- (U) PE 0604407D, Joint Standoff Weapon
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

Program Element: #0603601F Project Number: 670B
PE Title: Conventional Weapons Technology Budget Activity: 2 - Advanced Technology Development

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- (U) Complete advanced processor integrated test	FY 1990
- (U) ASARG captive flight testing	FY 1991
- (U) Complete design and fabrication of laser radar seeker	FY 1991
- (U) ASARG technologies demonstration	FY 1992
- (U) Complete JAAMIS seeker hardware fabrication	FY 1992
- (U) ATLAS laser radar seeker demonstration	FY 1993
- (U) Complete JAAMIS seeker hardware fabrication	FY 1993
- (U) Initiate the Dual Role Seeker program	FY 1993

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603605F Budget Activity: #2 - Advanced Technology Development
PE Title: Advanced Weapons Technology

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3150 High Energy Laser and Optics Technology	1,817	2,300	4,978	Cont	TBD
3151 Phased Integrated Laser Optics Technology (PILOT)	18,940	18,128	18,477	Cont	TBD
3152 High Power Microwave Technology	7,129	8,454	9,410	Cont	TBD
3277 Systems Survivability	0	323	478	Cont	TBD
3647 Ground Based Laser Technology	60,525	36,900	22,561	Cont	TBD
Total	88,411	66,105	55,904	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the advanced technology development program for directed energy (DE) concepts for Air Force applications. Major technology breakthroughs in removing optical atmospheric distortions, fabricating small phased arrays of laser diodes, building high power microwaves devices, and using nonlinear optics have been demonstrated and further development will continue. Emphasis is on ground based laser antisatellite technology, high resolution long range optical imaging, high power microwave effects, and laser diode arrays. A new project started in FY 1990 to develop technologies to protect Air Force systems from nuclear effects.

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

1. (U) Project 3150: HIGH ENERGY LASER AND OPTICS TECHNOLOGY. This project concentrates on nonlinear optics (NLO) and phased multiple telescopes (optical systems used to focus the laser beam on the target or to collect light in an imaging system). NLO can correct optical non-uniformities/distortions and facilitate coupling and pointing both low power laser diode arrays (Project 3151) and high energy laser beams very efficiently without conventional, high cost optics and processing systems. Coupling efficiently combines several independent laser devices. The attributes of NLO also permit a significant breakthrough in optical imaging. Multiple telescope systems allow the replacement of large imaging and beam pointing optics by integrated and phased small, off-the-shelf optical telescopes. An imaging subsystem is required in a high energy laser to allow accurate placement and maintenance of the beam on target and to perform damage assessment.

This Page Unclassified.

Program Element: #0603605F Budget Activity: #2 - Advanced Technology Development
PE Title: Advanced Weapons Technology

(U) FY 1989 Accomplishments:
- (U) Completed studies on coupling two diodes using NLO.
- (U) Multiple phased telescope imaging system designed and performance simulated on a computer.
- (U) Imaging testbed consisting of 4 moderate sized laboratory telescopes was assembled.

(U) FY 1990 Planned Program:
- (U) Transition NLO imaging brassboard to field tests.
- (U) Design full scale multiple telescope imaging optics.
- (U) Demonstration of concept of modularly combined telescopes with the performance of an equivalent single telescope.
- (U) First demonstration of high resolution imaging using an optically phased array of telescopes.
- (U) Couple linear diode array (single bar of many diodes) via NLO for the PILOT program to simplify fabrication.

(U) FY 1991 Planned Program:
- (U) Demonstrate optimal processing and telescope control on scaled "operational" testbed of next generation space-based imaging sensor.
- (U) Demonstrate advanced ground based, multiple telescope optical imaging for space objects.
- (U) Couple two dimensional diode arrays (stacks of linear arrays) via NLO for PILOT.
- (U) Complete system design for next generation of national space-based imaging sensor.

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM conducts major in-house research efforts and manages the project. The top five contractors are: Rockwell Power Services Co, Albuquerque, NM; R&D Associates, Marina del Rey, CA; Hughes Aircraft Co, Electro-Optical & Data Systems Group, El Segundo, CA; Martin Marietta Corp, Denver Aerospace, Denver, CO; and BDM Corp, McLean, VA.

(U) Related Activities:
- (U) Program Element 0602601F, Advanced Weapons.
- (U) Program Element 0603221C, Directed Energy Weapons.
- (U) Program Element 0602102F, Materials.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 3152: HIGH POWER MICROWAVE TECHNOLOGY. This project supports development of high power microwave (HPM) generation technologies and a susceptibility/vulnerability/lethality (S/V/L) data base which will identify potential vulnerabilities of US

Program Element: #0603605F Budget Activity: #2 - Advanced Technology Development
PE Title: Advanced Weapons Technology

systems to HPM threat parameters and will provide a basis for future weaponization decisions. HPM has a great potential/threat as a weapon targeting the sophisticated electronics on which many current weapon systems depend. Representative systems/subsystems will be tested to determine their susceptibilities. The Office of Secretary of Defense coordinates efforts in this project with the Army, Navy, Department of Energy, and other defense agencies.

(U) FY 1989 Accomplishments:
- (U) Completed tests on infrared (IR) Maverick and F-16 shell.
- (U) Initiated tests on foreign systems.
- (U) Began development of solid state, low volume/weight, repetitive-pulse (rep-pulse), phased array HPM device.

(U) FY 1990 Planned Program:
- (U) Complete TriService Test Methodology Demonstration on Maverick.
- (U) Initiate High Energy Research and Test Facility (HERTF) construction.
- (U) Begin development of F-16 aircraft HPM testbed from two wrecked aircraft.
- (U) Complete 1 kilojoule rep-pulse HPM device (10 times current capability).

(U) FY 1991 Planned Program:
- (U) Complete solid state HPM source module.
- (U) Begin operation of new High Energy Microwave Laboratory with anechoic chamber and data acquisition system.
- (U) Complete F-16 HPM testbed and begin low power HPM testing.
- (U) Begin development of pulsed power subsystem for airborne HPM application.
- (U) Begin susceptibility tests on
- (U) Initiate 10 kilojoule HPM source development (100 times current capability).

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM performs major in-house research and manages this program. The top five contractors are: Rockwell International Corp, Rocketdyne Division, Canoga Park, CA; Maxwell Laboratories, San Diego, CA; Mission Research Corp, Santa Barbara, CA; Verac Inc, Ball Systems Engineering Division, San Diego, CA; and Kaman Sciences Corp, Dikewood Division, Albuquerque, NM.

(U) Related Activities:
- (U) Program Element 0602601F, Advanced Weapons.
- (U) Program Element 0602120A, Electronic Survivability and Fuzing Technology.

Program Element: #0603605F Budget Activity: #2 - Advanced Technology Development
PE Title: Advanced Weapons Technology

- (U) Program Element 0602111N, Anti-Air Warfare/Anti-Surface Weapon Technology.
- (U) Program Element 0602202F, Human Systems Technology.
- (U) Program Element 0602204F, Aerospace Avionics.
- (U) Program Element 0603270F, Electronic Combat Technology.
- (U) Program Element 0603224C, Survivability, Lethality, Key Technologies (SLKT).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (MILCON)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	10,900	-	-	0	10,900

(U) International Cooperative Agreements: None.

(U) FY 1989 Accomplishments: Not Applicable.

3. (U) Project 3277: SYSTEMS SURVIVABILITY. This project started in FY 1990 and develops technologies to protect systems against effects of nuclear attack and methodologies to test system survivability.

(U) FY 1990 Planned Program:
- (U) Begin major redesign of electromagnetic pulse (EMP) test equipment to comply with DoD standard environments.

(U) FY 1991 Planned Program:
- (U) Begin to develop hardening techniques against EMP for ground systems.
- (U) Continue redesign of EMP test equipment.
- (U) Transition DoD standards for composite aircraft to B-2.

(U) Work Performed By: The Weapons Laboratory, Kirtland Air Force Base, NM manages the program. No contracts are yet awarded.

(U) Related Activities:
- (U) Program Element 0602601F, Advanced Weapons.
- (U) Program Element 0604711F, Systems Survivability.
- (U) Program Element 0602715H, Defense Nuclear Agency.
- (U) Program Element 0604747F, Electromagnetic Radiation Test Facilities.
- (U) Program Element 0603224C, SLKT.
- (U) Program Element 0604312F, ICBM Modernization.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603605F Project Number: 3151
PE Title: Advanced Weapons Technology Budget Activity: #2 - Advanced Technology Development

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

Project Title: Phased Integrated Laser Optics Technology (PILOT)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
PILOT	18,940	18,128	18,477	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
PILOT is a

Due to their semiconductor nature, these diodes can be designed for specific applications. Using a concept developed in-house, this project attempts to

This is done by

The PILOT program has provided the great majority of the funding in gallium arsenide (GaAs) laser diodes and has allowed the development of individual laser diodes with a 10 fold increase in power. This technology is already seeing transitions. It has also greatly advanced several special fabrication techniques which will be used in industry. Potential applications range from

Current PILOT array technology is available only in the infrared (IR) wavelengths that are very close to the visible. Some military applications require additional wavelengths.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed design of 50 watt module for demonstration of scaling potential. Began hardware fabrication.
   - (U) Completed design of 80 watt Technology Demonstrator which will couple 16 small independent modules. Began hardware fabrication.
   - (U) Completed fabrication of the first 2.3 micron (almost mid-IR) diode.

2. (U) FY 1990 Planned Program:
   - (U) Begin studies for technology transition of low power PILOT systems to users.

Program Element: #0603605F Project Number: 3151
PE Title: Advanced Weapons Technology Budget Activity: #2 - Advanced Technology Development

- (U) Begin development of mid-IR (3-4 microns) laser diode modules.
- (U) Begin advanced external cavity development for near term reduction of system volume.
- (U) Begin high intensity heat exchanger development to remove the excess heat from the very densely packed laser sources.
- (U) Begin effort to increase fabricability (reduce numbers of defects and cost) of GaAs wafers which can have 100s of thousands of diodes on them.

3. (U) FY 1991 Planned Program:
   - (U) Demonstrate large scale producibility of linear modules.
   - (U) Complete intermediate Technology Demonstration by combining three modules together.
   - (U) Complete high intensity heat exchanger for dense PILOT modules.
   - (U) Complete low power external cavity proof of principle for near term volume reduction.
   - (U) Begin an effort to fabricate a two dimensional module on a single GaAs wafer.

4. (U) Program to Completion:
   - (U) This is a continuing program.
   - (U) Transition technology to low and medium power applications.
   - (U) Develop one cubic-foot system.
   - (U) Develop one cubic-foot mid-IR system.

D. (U) WORK PERFORMED BY: The Weapons Laboratory, Kirtland Air Force Base, NM manages this project and conducts the in-house research effort. The top five civilian contractors are: McDonnell Douglas, St Louis, MO; SRI, David Sarnoff Research Center, Princeton, NJ; TRW, Redondo Beach, CA; and Spectra Diode Laboratories Inc, San Jose, CA; and Hughes Research Laboratories, Malabu, CA.

E. (U) COMPARISON WITH AMENDED FY 1990/1991 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: Not Applicable.
   2. (U) SCHEDULE CHANGES: Not Applicable.
   3. (U) COST CHANGES: Not Applicable.

F. (U) PROGRAM DOCUMENTATION:
   - (U) SON Aerospace Defense Command 03-79, 30 Nov 79.
   - (U) SON SAC 09-81, 22 Sep 81.
   - (U) SON SAC 13-81, 28 Sep 81.

G. (U) RELATED ACTIVITIES:
   - (U) Program Element 0602601F, Advanced Weapons.
   - (U) Program Element 0602204F, Aerospace Avionics.
   - (U) Program Element 0603250F, Lincoln Laboratory.

Program Element: #0603605F Project Number: 3151
PE Title: Advanced Weapons Technology Budget Activity: #2 - Advanced Technology Development

- (U) Representatives from Army, Navy, Strategic Defense Initiative Office, national laboratories, and Air Force using commands are members of the government review team for PILOT.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- (U) Low power external cavity demo	FY 1991
- (U) Moderate power external cavity demo	FY 1992
- (U) Low power module transitions begin	FY 1992
- (U) Integrated technology demonstrator	FY 1993
- (U) 100 watt class demonstrations	FY 1993
- (U) One cubic-foot system	FY 1994
- (U) One cubic-foot mid-IR system	FY 1995

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603605F Project Number: 3647
PE Title: Advanced Weapons Technology Budget Activity: #2 - Advanced Technology Development

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

Project Title: Ground Based Laser (GBL) Technology

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
GBLT	60,525	36,900	22,561	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project develops and demonstrates technology and conducts detailed system assessments needed to support a ground based laser antisatellite (ASAT) Defense Acquisition Board (DAB) Milestone I decision in FY 1991. The project will develop the detailed system concepts, establish satellite target vulnerability, and demonstrate the required technologies for: (1) scalable laser devices; (2) specific optical components; and (3) required laser beam control to efficiently compensate and propagate the laser radiation through the atmosphere to a target in space. Correcting the laser beam for atmospheric disturbances is the key technology. This project concentrates on two wavelengths: near infrared, represented by chemical oxygen iodine laser (COIL); and visible, represented by excimer lasers. Development of single pulsed excimer (SPE) device and other required technologies for SPE systems was added for FY 1989. The concept evaluation for the FY 1991 decision will also include the SDI/Army Free Electron Laser (FEL) which operates in the same wavelength range as the COIL, and longer wavelength deuterium fluoride (DF) chemical lasers like the Mid-Infrared Advanced Chemical Laser (MIRACL). Efforts to support the DAB Milestone I decision also include comprehensive mixed force studies to define the optimum mix of kinetic energy and directed energy weapon systems in performing the ASAT missions. Due to the lack of space relay mirrors and the vastly different scenarios, the earliest and optimum ASAT system concepts are significantly different from current SDI systems concepts.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed repetitive pulsed excimer laser (i.e. EMRLD) experiments.
   - (U) Began SPE technology development.
   - (U) Began fabrication of a 3.5 meter telescope designed for low power atmospheric compensation and other related experiments.

2. (U) FY 1990 Planned Program:
   - (U) Perform subscale atmospheric compensation experiments to demonstrate performance at wavelengths of interest.
   - (U) Conduct experiments to improve COIL performance.
   - (U) Conduct field experiments to evaluate and demonstrate baseline satellite tracking concepts.

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Program Element: #0603605F Project Number: 3647
PE Title: Advanced Weapons Technology Budget Activity: #2 - Advanced Technology Development

- (U) Complete system performance trades.
- (U) Develop initial satellite vulnerability assessments for 6 top-priority targets.

3. (U) FY 1991 Planned Program:
   - (U) Perform scaling experiments for laser optics and devices.
   - (U) Complete system definition and cost/risk optimizations.
   - (U) Complete coupled resonator experiment to establish scaling methodology for modular laser devices.
   - (U) Install and activate the 3.5 meter telescope to support full scale beam control development and demonstration.
   - (U) Evaluate concepts and demonstrate performance of atmospheric compensation technology through low-power uplink experiments to the SDI diagnostics satellite (LACE).
   - (U) Complete update of satellite vulnerability assessments, supported by experimental validation of satellite component and subsystem damage mechanisms and thresholds.
   - (U) Provide support for DAB Milestone I decision for GBL development.

4. (U) Program to Completion:
   - (U) This is a continuing program.
   - (U) Further develop specific technologies for selected system concepts.

D. (U) WORK PERFORMED BY: The Weapons Laboratory, Kirtland Air Force Base, NM, manages the project and performs major in-house research. The five top civilian contractors are: AVCO Everett Research Laboratory, Everett, MA; Rockwell Power Service Company, Albuquerque, NM; R&D Associates, Marina del Rey, CA; Rocketdyne Division, Rockwell International, Canoga Park, CA; The Optical Sciences Company, Placentia, CA.

E. (U) COMPARISON WITH AMENDED FY 1990/1991 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: Air Force participation in MIRACL/SLBD upgrades descoped.
   2. (U) SCHEDULE CHANGES: DAB Milestone I decision in FY 1991.
   3. (U) COST CHANGES: Not Applicable.

F. (U) PROGRAM DOCUMENTATION:
   - (U) Mission Need Statement (MNS) for Space Control Antisatellite Capability, 19 May 1988, (S).
   - (U) Acquisition Decision Memorandum (ADM), Antisatellite Systems, 6 March 1989, (S).
   - (U) USSPACECOM Antisatellite Concept of Operations (CONOPS), 12 Oct 1989, (S).
   - (U) Requirements for an ASAT Program, MJCS 201-86, Joint Chiefs of Staff, 22 September 1988, (S).

Program Element: #0603605F Project Number: 3647
PE Title: Advanced Weapons Technology Budget Activity: #2 - Advanced Technology Development

- (U) USSPACECOM Multicommand Required Operational Capability (MROC) 03-87 for a Space Control ASAT Capability, Joint Chiefs of Staff, SM-77-88, 5 February 1988, (S).

G. (U) RELATED ACTIVITIES:
- (U) Program Element 0602601F, Advanced Weapons.
- (U) Program Element 0102424F, SPACETRACK.
- (U) Program Element 0603314A, Directed Energy.
- (U) Program Element 0603221C, Directed Energy Weapons.
- (U) Program Element 0603224C, Survivability, Lethality, Key Technologies.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- (U) EMRLD testing complete	FY 1989
- (U) SPE development	FY 1990
- (U) Active satellite tracking experiments	FY 1990
- (U) Satellite assessment complete	FY 1991
- (U) COIL/FEL/excimer/DF concept evaluations complete	FY 1991
- (U) 3.5 m telescope activation	FY 1991
- (U) Atmospheric compensation uplink demo	FY 1991
- (U) DAB Milestone I decision for high power development and integration	FY 1991

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
PE Title: Command, Control & Communications (C3) Applications

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2314* Tactical Air Surveillance	0	1,156	1,711	Cont	TBD
2317* Tactical Air Information Production & Distr.	0	1,795	1,820	Cont	TBD
2321* Tactical Battle Information Management	0	3,045	3,521	Cont	TBD
3804* Tactical Air Forces Systems Integration	0	1,830	1,169	Cont	TBD
Total	0	7,826	8,221	Cont	TBD

* Transferred from PE 0603789F beginning in FY 1990

B. (U) BRIEF DESCRIPTION OF ELEMENT: Rapidly transitions developments in the Science and Technology base to existing C3 programs or directly to warfighting commands. Projects are directly responsive to operational requirements for improved battle management, communications, and surveillance capability. Takes advantage of advanced technology developments throughout the services and industry as well as off-the-shelf technology. Products are primarily advanced development models, rapid prototype efforts, and software.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2314, Tactical Air Surveillance: Develops advanced technology and demonstrates equipment improvements to the Tactical Air Control System (TACS).

(U) FY 1989 Accomplishments:
- (U) Initiated cost/performance trade-off analysis for an improvement program for the AN/TPS-75 radar versus development of a new microwave frequency radar.
- (U) Initiated investigation of non-radar and/or adjunct radar sensors to address TAF surveillance, detection, and tracking requirements not satisfied by an active radar.

(U) FY 1990 Planned Program:
- (U) Provide the TAF results of the cost/performance trade-off analysis for an improvement program for the AN/TPS-75 radar versus development of a new microwave radar.
- (U) Continue investigation of non-radar/adjunct-radar sensors.

(U) FY 1991 Planned Program:
- (U) Start risk reduction efforts to prototype AN/TPS-75 improvements providing a solid-state transmitter.
- (U) Continue prototype efforts for non-radar and/or adjunct radar sensors resulting from the previous investigations.

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
PE Title: Command, Control & Communications (C3) Applications

(U) Work Performed By: The Rome Air Development Center, Griffiss AFB, NY, conducts project efforts. MITRE Incorporated, Bedford, MA, provides engineering support. Westinghouse Electric, Baltimore, MD; Raytheon Co, Wayland, MA and Precision Science Application Inc, Arlington, VA, support the radar trade-off studies.

(U) Related Activities:
- (U) Program Element #0603789F, Tactical Air Command, Control, and Communications Advanced Development.
- (U) Program Element #0603742F, Combat Identification Technology.
- (U) Program Element #0207411F, Overseas Air Weapons Control Systems.
- (U) Program Element #0207412F, Tactical Air Control System (TACS).
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project: 2317, Tactical Information Distribution: This project transitions Advanced Communications Technology to the TACS.

(U) FY 1989 Accomplishments:
- (U) Started prototype efforts for the Enhanced Multinet Gateway (EMG) to provide a multi-level secure data switch.
- (U) Completed plan for a TAF multi-level secure laboratory.

(U) FY 1990 Planned Program:
- (U) Continue prototype of the EMG.
- (U) Determine re-certification requirements for EMG with NSA.
- (U) Complete test plans and preparation of test sites at TAC and RADC.

(U) FY 1991 Planned Program:
- (U) Complete prototypes of the EMG and deliver three to TAC and three to RADC.
- (U) Start EMG testing
- (U) Start re-certification of EMG at TAC site.

(U) Work Performed By: The Rome Air Development Center (RADC), Griffiss AFB, NY, conducts project efforts.

(U) Related Activities:
- (U) PE #0602702F, Command, Control, and Communications.
- (U) PE #0303126F, Long Haul Communications (DCS)
- (U) PE #0603789F, Tactical Command, Control, and Communications Advanced Development.
- (U) PE #0207411F, Overseas Air Weapons Control Systems.
- (U) PE #0207412F, Tactical Air Control Systems.
- (U) PE #0207423F, Advanced Communication Systems.
- (U) PE #0603790D, NATO Research and Development.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
PE Title: Command, Control & Communications (C3) Applications

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project: 2321, Tactical Battle Information Management: This project prototypes an Advanced Planning System (APS) decision aid.

(U) FY 1989 Accomplishments:
- (U) Delivered Command, Control and Communications Countermeasures Planning Analysis (CPA) and Identification of Command and Control Nodes (ICON) to the TAF for evaluation.
- (U) APS analysis and design completed.
- (U) APS design prototype demonstrated to TAF.

(U) FY 1990 Planned Program:
- (U) Develop and deliver to the Tactical Testbed four APS evaluation prototypes (EPs).
- (U) Initiate APS Independent Verification and Validation (IV&V).
- (U) Initiate CPA and ICON into APS if required.

(U) FY 1991 Planned Program:
- (U) Deliver APS Functional Common Core to HQ TAC.
- (U) Continue APS IV&V.

(U) Work Performed By: The Rome Air Development Center, Griffiss AFB, NY, manages the program. UNISYS, St Paul, MN is the prototype contractor.

(U) Related Activities:
- (U) PE #0602702F, Command, Control, and Communications.
- (U) PE #0207411F, Overseas Air Weapons Control Systems
- (U) PE #0207421F, Tactical Air Control System.
- (U) PE #0207423F, Advanced Communication Systems.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements:
- (U) USAFE will negotiate an agreement with NATO prior to incorporating APS into the Eifel system.
- (U) PACAF will negotiate an agreement with the Republic of Korea prior to incorporating APS into the Constant Watch system.

4. (U) Project: 3804, TAF System Integration: Provides integration and engineering support for TAF Battle Management Programs.

(U) FY 1989 Accomplishments:
- (U) Initiated system level security analysis of the Wing Command and Control System (WCCS).
- (U) Provided hardware and software architectural analysis to TAC for the Contingency TACS Automated Planning System (CTAPS) and the Mission Support System (MSS).

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
PE Title: Command, Control & Communications (C3) Applications

(U) FY 1990 Planned Program:
- (U) Complete security analysis of the Wing Command and Control System (WCCS).
- (U) Analyze intelligence systems and databases needed for Advanced Planning System (APS) theater deployments.

(U) FY 1991 Planned Program:
- (U) Identify communications requirements to move intelligence data for all concepts of employment for the APS.
- (U) Identify off-the-shelf multi-level security technology for application to tactical local network deficiencies.
- (U) Accomplish long-term multi-level security insertion plan for TAC and the development community.

(U) Work Performed By: The Rome Air Development Center, Griffiss AFB, NY, manages the project. MITRE Incorporated, Bedford MA, provides engineering support.

(U) Related Activities:
- (U) PE #0602702F, Command, Control, and Communications.
- (U) PE #0603789F, Command, Control, and Communications Advanced Development.
- (U) PE #0207411F, Overseas Air Weapons Control Systems.
- (U) PE #0207412F, Tactical Air Control System.
- (U) PE #0207423F, Advanced Communications Systems.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603707F Budget Activity: #2 - Advanced Technology Development
Title: Weather Systems Advanced Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1	Weather Systems (Advanced Development)	5,247	5,494	5,622	Cont	TBD
Total		5,247	5,494	5,622	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This advanced technology development program provides demonstrated technologies to improve Air Weather Service's (AWS) environmental support, contributing directly to the success of the Air Force and Army combat mission. The main thrust is improving our ability to gather, integrate, and interpret target weather information in data-denied battle areas. We intend to show that weather parameters critical to the success of tactical missions can be gathered from manned or unmanned reconnaissance platforms. We will develop electro-optical tactical decision aids (EOTDAs) to account for how weather conditions affect the ability of television, infrared, or radar sensors to find a target. These computer models and algorithms will provide us the capability to put smart weapons on target in spite of poor weather conditions. Technology demonstrations will show that we can automate weather observations for the Automated Weather Distribution System (AWDS). This will allow real-time alerting of significant weather events in support of operations at both fixed and mobile sites. We will develop new radar analysis techniques for the WSR-88D Doppler Weather Radar (formerly known as the Next Generation Weather Radar (NEXRAD)). This technology promises a dramatic improvement in our ability to observe and forecast severe weather such as wind shear, hail, and tornadoes and will allow us to better protect valuable combat assets. This program addresses shortfalls in AWS's operational analysis and forecasting support by developing technology for the Environmental Technology Transition (ETT) program. New operational forecasting tools for the earth's atmosphere, ionosphere, and magnetosphere will improve our support to weapon systems operating in an unfriendly natural environment. For example, the solar storms which occurred in 1989 caused many spacecraft anomalies and tracking difficulties, and even caused a low-orbiting satellite to reenter the earth's atmosphere.

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

1. (U) Project XXX1, Weather Systems (Advanced Development): Develops demonstrated solutions to improve environmental support to Air Force and Army operational commands, and other DOD agencies.

Program Element: #0603707F Budget Activity: #2 - Advanced Technology Development
Title: Weather Systems Advanced Development

(U) FY 1989 Accomplishments:
- (U) Incorporated Army and Navy sensors, and bunker, dam, and oil refinery models into EOTDAs.
- (U) Completed tornado probability forecasting tool for WSR-88D.
- (U) Began computer models of high-altitude atmospheric density.
- (U) Completed high-latitude, polar cap ionospheric model.

(U) FY 1990 Planned Program:
- (U) Complete concept validation of battlefield weather sensors.
- (U) Complete hail-size forecasting tool for WSR-88D.
- (U) Complete computer specification models of the earth's magnetosphere.
- (U) Complete global ionospheric specification model for ETT.
- (U) Complete small-scale wind shear algorithm for WSR-88D.
- (U) Begin integrated space environment modeling/forecasting system for ETT.

(U) FY 1991 Planned Program:
- (U) Demonstrate automated visibility sensor for AWDS.
- (U) Complete physical model of generic building target, and continue modeling other targets, sensors, and backgrounds for EOTDAs.
- (U) Continue development of automated cloud detection sensors for AWDS.
- (U) Begin small-scale weather forecasting tools for ETT.
- (U) Complete moisture-to-cloud conversion algorithm for ETT.

(U) Work Performed By: This project is managed by AFSC's Geophysics Laboratory, Hanscom AFB MA. High-value target modeling is being done by Wright Research and Development Center, Wright-Patterson AFB OH. The top five contractors are Lockheed Missile and Space Co., Inc., Huntsville AL; Dynamics Research Corp., Wilmington MA; ST Systems Corp., Lanham MD; University of California at San Diego, San Diego CA; and Rice University, Houston TX.

(U) Related Activities:
- (U) Program Element 0602101F, Geophysics.
- (U) Program Element 0604707F, Weather Systems Engineering Dev.
- (U) Program Element 0305111F, Weather Service.
- (U) Program Element 0305160F, Defense Meteorological Satellite System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603723F
PE Title: Civil & Environmental Engineering Technology
Budget Activity: 2-Advanced Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2103 Environmental Quality Technology	2,222	1,226	1,630	Cont	TBD
2104 Civil Engineering Technology	3,545	4,603	6,202	Cont	TBD
3037 Noise and Sonic Boom Impact Technology	1,800	1,839	2,338	Cont	TBD
Total	7,567	7,668	10,170	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program supports advanced technology developments to (1) enhance an air base's ability to survive and recover from an enemy chemical/biological or conventional attack; (2) solve Air Force-unique environmental problems in order to comply with state/national/international law and allow the Air Force to maintain readiness, conduct realistic combat training, and deploy new weapon systems; and (3) apply cost-effective advances in civil engineering technologies to peacetime air base operations. The Environmental Quality Technology enables 50% reduction in generation of selected hazardous waste resulting in $13 million per year savings in Air Force operations and maintenance costs; cost-effective control technology for industrial emissions from aircraft painting operations resulting in a $6 million savings annually; 95% faster emergency downwind hazard corridor prediction for disaster response. The Civil Engineering Technology enables wartime survivability of mission-critical air base facilities and utilities; air base battle damage assessment in minutes instead of hours; rapid repair of essential air base facilities, utilities, and operating surfaces; and 100% improvement in post-attack fire suppression and crash rescue. The Noise Sonic Boom Impact Technology will enable rapid environmental impact assessment for Air Force flying operations.

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

1. (U) Project 2103, Environmental Quality Technology: This project develops advanced technologies and validates systems to solve environmental restoration problems, reduce hazardous weapon systems emissions, minimize industrial waste, and eliminate toxic pollutant releases from Air Force operations.

Program Element: #0603723F Budget Activity: 2-Advanced Technology Development
PE Title: Civil & Environmental Technology

(U) FY 1989 Accomplishments:
- (U) Developed model for characterizing the physical and chemical interaction of fuels during rocket explosions--95% faster emergency hazardous corridor prediction, saving lives near disaster site.
- (U) Identified effective biodegradable solvents and cleaners. Replaced toxic aircraft paint strippers which will save up to $4 million annually.

(U) FY 1990 Planned Program:
- (U) Develop cost-effective control technology for emissions from aircraft painting/de-painting--$6 million annual savings.
- (U) Develop innovative electroplating processes to eliminate hazardous wastes generated by current technologies.
- (U) Evaluate ways to reduce hazardous waste generated by depleted uranium munitions tests--$450,000 annual savings.

(U) FY 1991 Planned Program:
- (U) Develop ways to reduce toxic waste generated by chromium electroplating of aircraft parts by 80,000 gallons/year.
- (U) Develop metals recycling technology to recover metals from industrial sludges--eliminates the discharge of toxic metals by 100% and saves $550,000 per year per Air Logistics Center in hazardous waste disposal costs.
- (U) Develop in-process system for treating and recycling electroplating bath solutions--reduce hazardous waste production from electroplating by 75%.

(U) Work Performed By: Project managed by the AF Engineering and Services Lab, Tyndall AFB FL. The four contractors are EG&G, Idaho Falls ID; Technology Management Systems Inc., Burlington MA; ACUREX, Mountain View CA; Martin Marietta, Denver CO.

(U) Related Activities:
- (U) Program Element (PE) #0602102F, Materials.
- (U) PE#0602202F, Human Systems Technology.
- (U) PE#0602203F, Aerospace Propulsion.
- (U) PE#0602206F, Civil Engineering and Environmental Quality.
- (U) PE#0603211F, Aerospace Structures.
- (U) PE#0604708F, Other Operational Equipment.
- (U) No unnecessary duplication of effort within USAF and DoD.

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: None.

2. (U) Project 2104, Civil Engineering Technology: This project develops advanced technologies and validates systems to build air base facilities and utilities that can survive chemical/ biological and conventional weapons attack; construct and repair

Program Element: #0603723F Budget Activity: 2-Advanced Technology Development
PE Title: Civil & Environmental Technology

runways; air mobile structures; perform air base battle damage assessment and repair; perform crash rescue and suppression of aircraft and air base post-attack fires; and perform critical peacetime civil engineering construction, maintenance and repair.

(U) FY 1989 Accomplishments:
- (U) Automated repair functions of prototype rapid runway repair excavator to reduce crater repair time by 33%.
- (U) Assessed vulnerability of air base fuel distribution systems--aided design of survivable fuel system design.

(U) FY 1990 Planned Program:
- (U) Initiate battle damage assessment and repair of air base facilities--post-attack assessment in minutes instead of hours.
- (U) Initiate development of anti-penetration layered system to protect hardened facilities for point penetrating weapons.
- (U) Develop environmentally safe, nontoxic firefighting agents--reduce stratospheric ozone depletion.

(U) FY 1991 Planned Program:
- (U) Rapid repair of air base facilities--air base recovery.
- (U) Identify the response of air base structures to enhanced blast weapons--leading to design of next-generation hardened aircraft shelter.
- (U) Develop method to reduce runway bomb crater upheaval--decrease large crater repair time by 30%.

(U) Work Performed By: Project managed by Air Force Engineering and Services Lab, Tyndall AFB FL. Top contractors are Applied Research Associates, Albuquerque NM; New Mexico Engineering Research Institute, Albuquerque NM; University of North Carolina, Raleigh NC; ODETICS, Anaheim CA; and EG&G, Idaho Falls ID.

(U) Related Activities:
- (U) PE#0602102F, Materials.
- (U) PE#0602202F, Human Systems Technology.
- (U) PE#0602206F, Civil Engineering and Environmental Quality.
- (U) PE#0603231F, Crew Systems and Personnel Protection.
- (U) PE#0603307F, Air Base Operability Advanced Development.
- (U) PE#0604617F, Air Base Operability.
- (U) PE#0604703F, Aeromed/Chem Defense Systems Development.
- (U) PE#0604708F, Other Operational Equipment.
- (U) No unnecessary duplication of effort within USAF and DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

Program Element: #0603723F Budget Activity: 2-Advanced Technology Development
PE Title: Civil & Environmental Technology

3. (U) Project 3037, Noise and Sonic Boom Impact Technology: This project develops an assessment and prediction capability to evaluate the impact of noise from subsonic and supersonic aircraft operations. Directed by the National Environmental Policy Act, environmental impacts for Air Force flying operations must be assessed. Today this takes two to five years to complete. Improving this capability is essential to respond to public concerns in a responsible and timely fashion, prepare accurate environmental impact statements, and reduce the effects of aircraft noise. The Air Force is the lead DoD agency for conducting noise and sonic boom research.

(U) FY 1989 Accomplishments:
- (U) Refined the sonic boom prediction model for single aircraft maneuvers to account for nonstandard atmospheric conditions
- (U) Developed methods for evaluating unconventional structures (adobe dwellings and archaeologic sites) for environmental impact assessments.
- (U) Developed interim response model for birds of prey and domestic animals common on low altitude flying routes.

(U) FY 1990 Planned Program:
- (U) Integrate environmental planning methods with noise information retrieval system to estimate noise impacts.
- (U) Develop predictive models to assess subsonic flight on humans and animals.
- (U) Develop model to predict ground vibration impact on structures due to sonic booms.

(U) FY 1991 Planned Program:
- (U) Integrate prediction models of subsonic and supersonic aircraft noise into an automated retrieval system.
- (U) Validate noise impact prediction models resulting in accurate impact identification.
- (U) Complete feasibility assessment for prospective epidemiologic study on human health effects of aircraft noise--determine human health effects can be addressed.

(U) Work Performed by: Project managed by Human Systems Division, Brooks AFB TX. Prime contractor is BB&N, Canoga Park CA.

(U) Related Activities:
- (U) PE#0602202F, Human Systems Technology.
- (U) PE#0602203F, Aerospace Propulsion.
- (U) PE#0602206F, Civil Engineering and Environmental Quality.
- (U) No unnecessary duplication of effort within USAF and DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603726F
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

Budget Activity: #2-Advanced Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2478 Tactical C3 Architecture	150	0*	0*	0*	TBD
2810 Cartographic Applications for Tactical and Strategic Systems (CATSS)	1,485	1,255	1,718	Cont	TBD
2863 Integrated Photonics	4,172	4,110	5,061	Cont	TBD
3192 Tactical Optical Disk System (TODS)	2,164	2,100	2,667	Cont	TBD
Total	7,971	7,465	9,446	Cont	TBD

* Project 2478 transferred to PE 0603617F in FY 1990.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program develops, demonstrates and validates C3I technologies in digital cartographic database structures for mission planning, navigation, targeting weapons delivery; photonics technology to replace electronic technology in tactical and strategic systems; digital optical disk storage for operations, intelligence and reconnaissance information collection and distribution.

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

1. (U) Project 2810, Cartographic Applications for Tactical and Strategic Systems (CATSS): CATSS is the single program to develop, demonstrate and transition techniques and software to meet all Air Force weapon system requirements for digital cartographic (terrain mapping) data for mission planning, navigation, targeting, terrain analysis, and related intelligence functions. The focus of this program is standardization of Air Force maintenance/exploitation of cartographic information. Consolidated development of cartographic software and databases is highly effective in creating/implementing DOD standards, ensuring interoperability and compatibility, eliminating duplication and reducing costs. Project milestones, demonstrations and technology transitions are directly responsive to validated requirements of Air Force users and system developers.

(U) FY 1989 Accomplishments:
- (U) Demonstrated cartographic data to support Joint STARS in identification of ground targets behind enemy lines.
- (U) Transitioned standard digitized data and applications support to the Air Force special operations forces program.
- (U) Transitioned cartographic software to Tactical Air Forces to merge cartographic and unit intelligence information.
- (U) Transitioned tc SAC the line-of-sight and terrain profiling software for vulnerability analysis of Soviet C2 systems.

Program Element: #0603726F
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

Budget Activity: #2-Advanced Technology Development

(U) FY 1990 Planned Program:
- (U) Initiate development of software to interface a digital cartographic database into the SAC intelligence network.
- (U) Transition digital cartographic applications software to Electronic Security Command and Foreign Technology Division for analysis of electronic signal intelligence.
- (U) Transition to TAC the software for application of cartographic data to unit-level flight planning.

(U) FY 1991 Planned Program:
- (U) Demonstrate fully transportable software to generate sensor and threat displays for intelligence and mission planning.
- (U) Demonstrate expert systems techniques and neural networks to cartographic database queries, applications, and validation.
- (U) Demonstrate at HQ SAC the database/software interface for wide distribution of host node cartographic data to all analyst agencies on the SAC Intelligence Network.
- (U) Transition to SAC and TAC the cartographic software for DOD standardized image display for intelligence analysis.

(U) Work Performed By: Project managed by RADC, Griffiss AFB, NY. The three contractors are PAR Technology, New Hartford, NY; Grumman Data System, Woodbury, NY; Digicomp Research, Ithaca, NY.

(U) Related Activities:
- (U) PE 0602702F, C3
- (U) PE 0603260F, Intelligence Advanced Development.
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2863, Integrated Photonics: Current electronic systems are susceptible to electromagnetic interference, electromagnetic pulse and radio frequency interference. Size constraints, speed and reliability also limit traditional electronic systems. Photonics based systems, that process information in the form of light (photonics) signals, will provide major improvements in tactical and strategic C3I systems by providing small size, high performance, high capacity, survivable alternatives to electronic based systems. This program develops and validates advanced hardware technology in optical signal processing, adaptive processing, optical control of phased arrays, integrated electro-optic networks, optical transmission, and nonlinear optical processing.

(U) FY 1989 Accomplishments:
- (U) Fabricated and tested a high speed laser transceiver for ground and space environments doubling bandwidth for analog and increasing digital data rates by forty times.

Program Element: #0603726F
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

Budget Activity: #2-Advanced Technology Development

- (U) Designed and fabricated an analog fiber optic link for distortion-free communication transmission from 2 to 500MHz.
- (U) Demonstrated high-density optical interconnects between device circuitboards using optical holography to increase signal speed, reduce signal loss and reduce electromagnetic emissions for radar and communications signal processors.
- (U) Demonstrated intrusion-detection for optical cables allowing secure communications without encryption devices.

(U) FY 1990 Planned Program:
- (U) Develop intrusion-detection optical communication systems for multiplexed signal cables and for network security.
- (U) Design and develop a coherent optical transmission system to replace microwave waveguide, increasing distances between transmitter and antenna, while operating with wider bandwidth and higher frequencies.
- (U) Develop an optical signal processor and optical time/phase shift network for radar and communications phased arrays.
- (U) Initiate development of all-optical repeater, multiplexer, and frequency synthesizer to increase speed and capacity of communications and surveillance systems, and allow automatic signal identification in signal intelligence.

(U) FY 1991 Planned Program:
- (U) Fabricate an optical processor for beam steering in phased array antennas to improve surveillance radar performance.
- (U) Design a tactical, multibeam, phased array radar based upon optical processing and memory components.
- (U) Demonstrate an optical signal processor and optical time/phase shift network for improved performance, efficiency and antijam of radar and communications phased arrays.
- (U) Develop a photonic signal processor for automatic signal identification in signal intelligence collection.
- (U) Design a one trillion operations-per-second optical signal processor to prove the ultra-high speed necessary for combat identification of ground and airborne targets with multispectral surveillance systems.

(U) Work Performed By: Project managed by RADC, Griffiss AFB, NY. Contractors are Hughes, Fullerton, CA; Westinghouse, Baltimore, MD; Martin Marietta, Denver, CO; TRW, Redondo Beach, CA.

(U) Related Activities:
- (U) PE 0602702F, C3
- (U) PE 0602728F, Advanced Computer Technology
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

Program Element: #0603726F
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

Budget Activity: #2-Advanced Technology Development

3. (U) Project 3192, Tactical Optical Disk Systems (TODS):
Present C3I systems do not have data storage capacity and performance required for advanced operations and near-real-time sensor inputs. Optical disk storage systems offer the high capacity and high speed input/output needed. Commercial optical storage systems cannot operate in the military environment and meet the required throughput for storage capabilities. This project develops TODS, a family of high capacity, reliable, erasable data storage systems for severe operational environments. TODS includes a single 5.25-inch optical disk recorder/player, a single 14-inch optical disk recorder/player and a ten-disk automated jukebox. The 5.25-inch TODS is for fighter aircraft for airborne access to mission-oriented data and the digital terrain system. The 14-inch TODS is for on-board sensor data storage in electronic surveillance aircraft. The jukebox will provide mass storage at intelligence centers, TR-1 ground stations, SAC deployable C2 centers and SAC Headquarters Emergency Relocation Team.

(U) FY 1989 Accomplishments:
- (U) Fabricated a functional model 5.25-inch TODS to demonstrate record, playback and erase. Tested it in an F-16 aircraft to prove reliable operation in high performance flight.
- (U) Began development of the 14-inch TODS for high capacity data collection and retrieval for airborne sensor data storage.

(U) FY 1990 Planned Program:
- (U) Transition the 5.25-inch TODS to full scale development and integration into the F-16 aircraft.
- (U) Demonstrate critical components for read/write/erase capability for the 14-inch optical disk system.
- (U) Demonstrate TODS effectiveness in flight planning and control for close air support during the AFTI/F-16 demonstration.

(U) FY 1991 Planned Program:
- (U) Design the optical disk jukebox for forty-times increase in storage capacity-limit for SAC intelligence centers.
- (U) Demonstrate end-to-end system operation for the 14-inch TODS to double capacity-limit of digital storage.
- (U) Design 14-inch TODS advanced development model for improved recording speed and capacity for airborne signal intelligence.

(U) Work Performed By: Project managed by RADC, Griffiss AFB, NY. The two contractors are Sundstrand, Remond, WA and GE, Camden, NJ.

(U) Related Activities:
- (U) PE 0602702F, C3.
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603728F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Computer Technology

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2527 Software Life Cycle Tools	1,454	2,005	3,151	Cont	TBD
2529 Computer Architecture Applications	557	0	0	Cont	TBD
2530 Distributed Systems Reliability and Survivability	2,412	3,124	2,900	Cont	TBD
2532 Knowledge-Based Systems	2,556	2,478	3,022	Cont	TBD
Total	6,979	7,607	9,073	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This advanced technology development program develops and demonstrates technologies that control cost, reduce risk, and increase efficiency and effectiveness of software and computers required in combat systems (mission critical). This program develops distributed processing technology for improved weapon system capability, fault tolerance, reliability and survivability. It also focuses on applying Artificial Intelligence (AI) technology to software development and selected Air Force system applications.

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

1. (U) Project 2527, Software Life Cycle Tools: The increased use of digital computers has raised the cost of software exponentially. Current software generation capabilities are insufficient to develop and maintain the software required in projected military weapon systems. This project develops, demonstrates, evaluates, and transitions new software engineering technology that reduces cost, increases programmer productivity, and improves the quality of Air Force Mission Critical Software Systems in all phases of the software's life cycle. The project develops software/system life cycle environments by incorporating commercial off-the-shelf and advanced prototype tools. These environments offer software quality measurement and assessment, requirements engineering for reducing system errors, and innovative software engineering technology for high performance computers.

(U) FY 1989 Accomplishments:
- (U) Demonstrated an Ada Test and Verification System which allows programmers to detect errors in Ada code and verify the execution coverage of test data.
- (U) Demonstrated Software Life Cycle Support Environment

(SLCSE), a framework for integrating commercial and government developed support tools which assist in producing and maintaining weapon system software.
- (U) Initiated development of a Requirements Engineering Environment (REE) for system/software prototyping and the production of high quality, error free specifications to improve productivity by a factor of 2.

(U) FY 1990 Planned Program:
- (U) Develop a software quality specification, measurement, and assessment capability for validating the software quality requirements of Air Force programs. Improve the software development process and merge software quality assessment with Total Quality Management process improvements.
- (U) Develop a Project Management System for SLCSE to enable Air Force developers and support activities to effectively manage software acquisition and maintenance.
- (U) Evaluate and identify knowledge-based enhancements to the SLCSE toolset, database, and user interface to provide tailored capabilities for specific user needs.

(U) FY 1991 Planned Program:
- (U) Initiate development of an automated C3I scenario generation capability for the REE to reduce the time required to prototype mission specific applications.
- (U) Integrate the REE into the SLCSE to enable system/software prototyping and the production of high quality, error free specifications.
- (U) Implement automatic software quality data collection and analysis for determining optimum metrics for managing software deveopments.
- (U) Initiate program to develop capabilities for automatic production of software code from high level application oriented specifications.

(U) Work Performed By: Rome Air Development Center manages this program. Primary contractors are: General Research Corporation, Santa Barbara, CA; Software Productivity Sol, Melbourne, FL; Martin Marietta, Denver, CO; Harris Corporation, Melbourne, FL; IITRI, Lanham, MD.

(U) Related Activities:
- (U) PE #0602702F, Command, Control and Communications (C3).
- (U) PE #0603756E, DoD Consolidated Software Initiative.
- (U) PE #0604740F, Computer Resources Management.
- (U) PE #0701112F, Embedded Support Improvement.
- (U) There is no unnecessary duplication of effort within the Air Force or the DoD.

(U) Other Appropriation Funds: Not Applicable.

Program Element: #0603728F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Computer Technology

(U) International Cooperative Agreements: Pending Data Exchange Agreement with Australia on Software for Embedded Systems.

2. (U) Project 2529 - Computer Architecture Applications: Today's weapon systems performance relies on the integration of multiple dissimilar computers into an "architecture" to achieve overall/distributed system performance, fault tolerance and reliability. Due to higher priority requirements in other Air Force programs, this project was zero-funded in FY 90 and FY 91.

3. (U) Project 2530 - Distributed Systems Reliability and Survivability: Survivability is critical to strategic, tactical, and space command and control systems. Providing processing and communication reconfiguration capabilities for physically dispersed and mobile command centers are key elements to increasing command and control (C2) survivability. This project develops data processing and Distributed Operating System (DOS) technologies to provide interoperability among dispersed command centers (fixed, airborne and mobile), thus allowing commanders immediate access to information at any location.

(U) FY 1989 Accomplishments:
- (U) Developed prototype multi-host DOS which responds in milliseconds.
- (U) Developed a survivable, distributed computing system to support replanning the Single Integrated Operation Plan (SIOP), the single, multi-service plan for utilizing strategic assets.

(U) FY 1990 Planned Program:
- (U) Demonstrate the interconnection between multiple command center locations to provide coordinated battle management data.
- (U) Demonstrate a distributed architecture incorporating sequential and parallel processing for high performance strategic Command, Control, Communication and Intelligence (C3I) computing.

(U) FY 1991 Planned Program:
- (U) Develop a C3I DOS network with increased data transmission and processing speeds reducing the planning of mission assets from days to hours.
- (U) Develop a distributed database system that can be physically dispersed for survivability.
- (U) Demonstrate multiprocessor DOS which responds in microseconds with automated fault recovery.

(U) Work Performed By: Rome Air Development Center manages this program. Primary contractors are: Bolt Berenak and Neumann,

Cambridge, MA; Honeywell, Minneapolis, MN; Carnegie Mellon University, Pittsburg, PA; General Electric, Valley Forge, PA; SRI International, Menlo Park, CA; Xerox Corp, Falls Church, VA; McDonnell Douglas, Huntington Beach, CA.

(U) Related Activities:
- (U) PE #0602702F, Command, Control and Communication.
- (U) PE #0603756E, DoD Consolidated Software Initiative.
- (U) PE #0604740F, Computer Resources Management.
- (U) PE #0701112F, Embedded Support Improvement.
- (U) There is no unnecessary duplication of effort within the Air Force or the DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

4. (U) Project 2532 - Knowledge-Based Systems: Knowledge-based computer systems provide the capability to automatically solve reasoning problems which would otherwise require a human expert. This project develops computer systems which automate the problem solving process associated with human thought. It demonstrates and validates increased cost-effectiveness in such diverse applications as weapon system maintenance, logistics planning, tactical and strategic decision support systems, resource allocations, situation assessment and intelligence analyses.

(U) FY 1989 Accomplishments:
- (U) Developed a prototype SIOP planning tool to be hosted on survivable distributed computing system demonstrated in Project 2530.
- (U) Began integration of several Knowledge-Based Software Assistant (KBSA) modules, including the Project Management Assistant and Requirements Assistant, into a partial life cycle support system to help automate portions of the software development process.
- (U) Demonstrated a tool capable of understanding the semantics of real world software requirements specification.

(U) FY 1990 Planned Program:
- (U) Demonstrate semantic tool for requirements specification.
- (U) Develop a portable mission planning system to quickly allocate mission resources anywhere, anytime.
- (U) Use the integrated modules to demonstrate the KBSA concept.

(U) FY 1991 Planned Program:
- (U) Demonstrate large-scale AI system technology for Air-Land tactical battle management.
- (U) Develop a knowledge-based module which aids the designer in translating user's requirements directly into software

specifications.
- (U) Integrate enhanced software development modules into the KBSA system to expand its capabilities, thus enabling coverage of the entire software life cycle.
- (U) Develop a laboratory testbed to serve as a vehicle for design, integration, and evaluation of large scale knowledge-based systems.

(U) Work Performed By: Rome Air Development Center manages this program. Primary contractors are: Kestrel Development Corp., Palo Alto, CA; Advanced Decision Systems, Mountain View, CA; SAIC, San Diego, CA; Syracuse University, Syracuse, NY; BBN Laboratories, Inc, Cambridge, MA.

(U) Related Activities:
- (U) PE #0602702F, Command, Control and Communication (C3).
- (U) PE #0602702E, Strategic Computing Program.
- (U) PE #0603756E, DoD Consolidated Software Initiative.
- (U) PE #0604740F, Computer Resources Management.
- (U) PE #0701112F, Embedded Support Improvement.
- (U) There is no unnecessary duplication of effort within the Air Force or the DoD.

(U) Other Appropriation Funds. Not Applicable.

(U) International Cooperative Agreements: Pending Data Exchange Agreement with Australia on Software for Embedded Systems.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603742 Budget Activity: #4 - Tactical Programs
PE Title: Combat Identification Technologies

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2597 Noncooperative Identification Subsystems	1631	1559	1626	Cont	TBD
3765 Joint-Service Noncooperative ID Techniques	300	400	400	Cont	TBD
Total	1920	1959	2026	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element develops, demonstrates, and transitions, promising, new noncooperative target recognition (NCTR) technologies to provide high confidence, long-range, all-weather, jam-resistant, identification of airborne targets in all combat environments. These efforts are directed toward providing both direct [ ] and indirect [ ] NCTR capabilities, and will be coordinated with the other services for joint development and applications. |

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

1. ( ) Project 2597, Noncooperative Identification Subsystems: Engineering development, demonstration, and transition of advanced NCTR techniques/technologies for current/future USAF platforms, including [ ] Many of these efforts are jointly funded.

(U) FY 1989 Accomplishments:
- (U) Continued the NCTR technology investigations and demonstrations begun in FY 88 for tactical combat identification.
- (U) Initiated the development and tri-service coordination of the Tri-Service Combat Identification Master Plan.
- (U) Developed proposed Air Force NCTR investment strategy.

(U) FY 1990 Planned Program:
- (U) Complete the above NCTR technology demonstrations and select the most promising techniques for further development.
- (U) Identify and develop plans for accelerating transition of promising NCTR technologies to enter full scale development.

Program Element: #0603742 Budget Activity: #4 - Tactical Programs
PE Title: Combat Identification Technologies

- (U) Conduct [redacted] at a Green Flag/Red Flag Exercise.
- (U) Complete and publish the Tri-Service Combat Identification Master Plan.
- (U) Initiate NCIR military utility simulation/analysis effort at the Theater Air Command and Control Simulation Facility.
- (U) Initiate an annual NCIR User's Review.

(U) FY 1991 Planned Program:
- (U) Continue efforts to accelerate the transition of promising NCIR techniques to specific weapon platforms.
- (U) Continue annual updates of the Tri-Service Combat Identification Master Plan.
- (U) Continue NCIR military utility simulation/analysis effort at the Theater Air Command and Control Simulation Facility.
- (U) Initiate feasibility study for collecting and recording [redacted]
- (U) Initiate a study for instituting [redacted]

(U) Work Performed By: Managed by the Air Force Wright Research and Development Center/Avionics Laboratory, Wright-Patterson AFB, OH; and by Rome Air Development Center, Griffiss AFB, NY. Contractors include: Scope Electronics, Reston, VA; Boeing, Seattle, WA; Hughes Aircraft, Los Angeles, CA; Northrop Corp, Los Angeles, CA; Westinghouse Electronics, Baltimore, MD; Veda Incorporated, Dayton, OH; Raytheon, Bedford, MA.

(U) Related Activities:
- (U) PE #0604725F, Combat Identification Systems.
- (U) PE #0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE #0603267N, NATO Future Identification Systems.
- (U) PE #0603515N, Advanced Identification Techniques.
- (U) PE #0603706A, Identification Friend or Foe (IFF) Developments.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 3765, Joint-Service Noncooperative ID Technologies: Funds the Air Force share to support the Tri-Service Target Identification Program (TRI-TIP).

(U) FY 1989 Accomplishments:
- (U) Funds the USAF share of the Tri-service target [redacted]
- (U) Investigate methods to obtain target [redacted]

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Program Element: #0603742 Budget Activity: #4 - Tactical Programs
PE Title: Combat Identification Technologies

(U) FY 1990 Planned Program:
- (U) Continues the USAF share of the Tri-service
- (U) Investigate methods to obtain target

(U) FY 1991 Planned Program:
- (U) Continues support for the Tri-service

(U) Work Performed By:
- (U) The U.S. Navy is the lead service for the TRI-TIP.
- (U) USAF POCs include the Air Force Wright Research and Development Center/Avionics Laboratory, Wright-Patterson AFB, OH; and Rome Air Development Center, Griffiss AFB, NY.

(U) Related Activities:
- (U) PE #0604725F, Combat Identification Systems.
- (U) PE #0603203F, Advanced Avionics for Aerospace Vehicles.
- (U) PE #0603515N, Advanced Identification Techniques.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603789F
PE Title: C3I Technology Development

Budget Activity: #2-Advanced Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Various PE's*	5,397	0	0	0	TBD
2333 Surveillance Radar Technology	3,101	2,750	2,930	Cont	TBD
2335 Survivable Communications Technology	4,049	1,770	2,575	Cont	TBD
3433 Advanced Communications Techniques (LASERCOM)	6,000	4,007	4,123	Cont	TBD
Total	18,547	8,527	9,628	Cont	TBD

* Projects 2314, 2317, 2321 and 3804 transferred to PE 0603617 in FY 1990.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This advanced technology development program demonstrates and validates ground, air and space based command, control and communications (C3) technology required to maintain USAF capabilities in a sophisticated, high threat and intense jamming environment. This program also develops advanced technology to provide tactical battle managers uninterrupted and reliable C3. Advanced space laser communications techniques that provide secure anti-jam (A/J) and low probability of intercept (LPI) capabilities are being developed. Projects 2747, Advanced Communication and Network Techniques and 2748, Advanced High Frequency Technology were consolidated into project 2335.

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

1. (U) Project 2333, Surveillance Radar Technology: Current Air Force tactical surveillance systems (E3, TPS-43, TPS-75) are limited in their ability to counter the low observable target in today's electronic warfare environment. Surveillance radars must be able to restore surveillance capabilities in jammed radar sectors, track multiple and maneuvering targets, detect low observable/stealth targets, detect high mach missiles, detect helicopters, and provide positive identification of targets, while minimizing the radar's vulnerability to attack. This project develops and demonstrates advanced antenna nulling, adaptive electronic countercountermeasure (ECCM) processing, conformal array and passive radar surveillance technologies. This project will develop the technologies needed to design a conformal array radar antenna into the skin of an aircraft. It will validate the "SMART SKINS" concept which will integrate multi-band array antennas, sensors, monolithic circuits and controls into the external surface of aircraft and missiles.

(U) FY 1989 Accomplishments:

- (U) Conformal Array Radar Technology (CART) component design continued for the T/R modules, beamformers and patch radiators along with testing of breadboard versions.

Program Element: #0603789F
PE Title: C3I Technology Development

Budget Activity: #2-Advanced Technology Development

- (U) Data acquisition continued for advanced radar mainbeam ECCM techniques. Flight tests were conducted and nulls generated on moving jammers.

(U) FY 1990 Planned Program:
- (U) Complete off-line analysis and testing of advanced radar mainbeam nulling techniques to determine the achievable jamming cancellation levels.
- (U) Initiate on-line testing of advanced radar antenna nulling to validate off-line testing and perform real-time demonstrations.
- (U) Finalize the CART design and fabricate the antenna and RF front end for the technology demonstration model.

(U) FY 1991 Planned Program:
- (U) Complete the fabrication of the CART demonstrator and begin preliminary ground testing and analysis.
- (U) Initiate the development of smart jammer countermeasures techniques to counter jammers that are designed to confuse and overload a radar's processors or mask targets with other than noise jamming techniques.

(U) Work Performed By: RADC, Griffiss AFB, NY manages this program. The two contractors are GE, Utica, NY and SENSIS, Manlius, NY.

(U) Related Activities:
- (U) PE 0602204F, Avionics for Aerospace Vehicles.
- (U) PE 0602702F, Comand, Control and Communications.
- (U) PE 0603617F, C3 Applications.
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2335, Survivable Communications Technology: Dynamic, extremely hostile battlefield environments require a near instantaneous transmission of vast amounts of command, control, communications and intelligence (C3I) information for rapid, real-time decisions. Secure, survivable communications are fundamental to that task, yet current communications systems have significant survivability shortfalls in the areas of AJ, LPI, low probability of exploitation (LPE), hardening and interoperability. This project advances and demonstrates increased anti-jam and security of communications transmissions and "intelligent networking" technologies to insure connectivity and integrity of message security. Technology developments are pursued to meet increasing survivability requirements through the integration of advanced LPI/AJ/smart signal processing technologies

into communications radios and survivable multi-media communications among distributed C2, sensor, and intelligence facilities through local and wide area networks.

(U) FY 1989 Accomplishments:
- (U) The Jam Resistant Communications (JARECO) Terminals were completed and tested for AJ/LPI enhancements to JTIDS.
- (U) Implemented packet switching nodes, the foundation to critical demonstrations for survivable (robust) protocols.
- (U) Completed the system design for the digital error injectors which will produce realistic, stressed tactical C2 simulated environment.
- (U) Completed high frequency (HF) modem testing demonstrating compatability with ARC-190 radio and automatic communications processor.
- (U) Initiated HF communications improvements for the Tactical Air Control System (TACS).

(U) FY 1990 Planned Program:
- (U) Complete evaluation of the JARECO Terminals.
- (U) Complete media resource controller technology development.
- (U) Initiate tactical AJ signal processor development.
- (U) Continue HF modem antijam tests with the ARC-190 radio.

(U) FY 1991 Planned Program:
- (U) Complete development of the VHSIC speech enhancement unit and integrate into JARECO inceasing the radio's range.
- (U) Complete detailed hardware design and waveform optimization for acoustic charge transport (ACT) AJ/LPI transceiver.
- (U) Transition communication's multi-media resource controller (MRC) to follow-on tactical C3I application programs.
- (U) Complete advanced multi-media information distribution system (AMIDS)/enhanced multi-network gateway for use in tactical systems.

(U) Work Performed By: RADC, Griffiss AFB, NY manages this program. The three contractors are Litton, College Park, MD; Hughes Aircraft, Los Angeles, CA; and Gould, Glen Burnie, MD

(U) Related Activities:
- (U) PE 0602702F, Command, Control and Communications.
- (U) PE 0603617F, C3 Applications
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 3433, Advanced Communications Techniques (LASERCOM): The Air Force needs long range, very high data rate satellite communications links. Current radio frequency technology cannot

Program Element: #0603789F
PE Title: C3I Technology Development

Budget Activity: #2-Advanced Technology Development

meet the requirement in a fully practical way due to large antennas, high weight and power consumption, high cost and poor link reliability under stressed conditions. This project develops abrassboard "heterodyne" laser communications system that works like a common FM radio and is more efficient than current pulsed "Morse code" type systems. The system will ground demonstrate an inter-satellite data networking capability that can improve real-time global connectivity, reduce dependence on ground relay sites, increase coverage time for low orbit satellites, and enhance survivability through shared redundancy. Demonstrations will reduce the cost and technical risk of follow-on satellite packages. Technology extensions will yield more economical systems.

(U) FY 1989 Accomplishments:
- (U) Awarded subcontracts for mechanical and electrical components and begin brassboard fabrication.
- (U) Tested transmitter and diagnostic subsystems to flight qualification levels.
- (U) Integrated receiver and demodulator and measured signal acquisition and tracking performance.
- (U) Demonstrated high power (310 mW) semiconductor optical transmitter, a small fiber optics based bench, and ultra-high data rate (1 Gbps) experimental link.

(U) FY 1990 Planned Program:
- (U) Continue fabrication of brassboard subsystems and subject them to qualification tests as they become available.
- (U) Develop higher power transmitters, wideband detectors, and fiber optic subsystems for ultra-high speed systems.

(U) FY 1991 Planned Program:
- (U) Begin brassboard integration and system level testing.
- (U) Construct flight qualifiable ultra-high speed subsystems for a full send/receive system weighing less than 100 lbs using a 1 W transmitter and lightweight, modular, easy to integrate fiber optic components.

(U) Worked Performed By: Air Force Space Technology Center, Kirtland AFB, NM; MIT-Lincoln Laboratory, Hanscom AFB, MA; Perkin-Elmer, Garden Grove CA; Electrofusion, Fremont, CA.

(U) Related Activities:
- (U) Program Element #0303110F, Defense Sat Comm Sys (DSCS).
- (U) Program Element #0303605F, Advanced Radiation Technology.
- (U) Program Element #0603250F, Lincoln Laboratory.
- (U) Program Element #0603401F, Advanced Spacecraft Technology.
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2257 Standard Avionics/Joint Services Review Committee (JSRC) Initiatives	6,055	3,041	4,626	Cont	TBD
XXX1 Compass/Attitude & Heading Reference System (C/AHRS)	0	1,000	2,000	Cont	TBD
2258 Standard Inertial Navigation Unit (INU)	2,630	1,000	1,369	Cont	TBD
2297 Embedded Computer Software Standardization	1,068	1,520	2,100	Cont	TBD
2560 JOVIAL Language Control Facility (LCF)	430	400	400	Cont	TBD
2658 Avionics Architecture Implementation and Support (AAIS)	524	250	300	Cont	TBD
3264 Standard Flight Data Recorder (SFDR)	9,944	5,946	2,500	Cont	TBD
Total	20,651	13,157	13,295	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element explores and develops standard avionics architectures and equipment which will reduce acquisition and support costs, increase weapon system performance and availability, and foster technology evolution and insertion for operational force improvements. Reliability and Maintainability (R&M) play a major role in the identification of specific development efforts within this element as evidenced by the evolution of the Standard Inertial Navigation Unit, the Standard Central Air Data Computer, the Standard Flight Data Recorder and the Compass/-Attitude & Heading Reference System. Joint avionics development efforts are pursued through participation in and support of the Joint Service Review Committee (JSRC). Current JSRC initiatives include the Standard Flight Data Recorder, Compass/Attitude & Heading Reference System and Solid State Barometric Altimeter programs. Development, enhancement and maintenance of MIL-STD-1750/1815 embedded computer software support tools are also supported. Ongoing support activities such as the JOVIAL Language Control Facility and the Avionics Architecture Implementation and Support program to ensure credible standardization programs are also maintained.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

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

1. (U) Project 2257, Standard Avionics and Joint Services Review Committee (JSRC) Initiatives:
Project identifies/develops candidate systems for standardization in Air Force; through JSRC, identifies/develops candidate systems for joint services standardization; maintains and updates the Air Force Avionics Roadmap and Avionics database.

(U) FY 1989 Accomplishments:
- (U) Develop, maintain avionics data base.
- (U) Develop, publish annual Avionics Roadmap.
- (U) Continue Modular Avionics Systems Architecture (MASA) Program.
- (U) Develop, enhance and maintain Standardization Evaluation Program (STEP) life cycle cost model.
- (U) Initiate Standard Compass/Attitude & Heading Reference System (C/AHRS) Program; transition to program office.
- (U) Initiate Single Point Keying (SPK) feasibility study.
- (U) Continue support of JSRC initiatives.

(U) FY 1990 Planned Program:
- (U) Continue providing front-end activity needed to determine feasibility of standardizing selected avionics systems/ subsystems identified through Air Force and Joint Service avionics planning process.
- (U) Continue support of JSRC initiatives.
- (U) Continue MASA Line Replaceable Module (LRM) FSD definition
- (U) Conduct LRM major retrofit study.
- (U) Evaluate the standardization potential for SPK.
- (U) Initiate Solid State Barometric Altimeter Program.
- (U) Maintain/update Air Force Avionics Roadmap.
- (U) Evaluate potential development of a family of standard power supplies.
- (U) Complete development of STEP acquisition front-end.

(U) FY 1991 Planned Program:
- (U) Continue providing the front-end activity needed to determine feasibility of standardizing selected avionics systems/subsystems identified through Air Force and Joint Service avionics planning processes.
- (U) Continue support of JSRC initiatives.
- (U) Finalize evaluation on MASA/LRM investigation and major retrofit study.
- (U) Continue development of Single Point Keying standard(s).
- (U) Initiate development of power supply standards.
- (U) Maintain/update AF Avionics Roadmap and avionics database.
- (U) Continue development of Solid State Barometric Altimeter Program

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

- (U) Implement/test Avionics Life Cycle Cost Estimating System (ALCCES) (Merger STEP with Avionics Acquisition Cost Estimating System (AACES)).

(U) Work Performed By: Air Force Systems Command provides program management through Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contracts with Draper Labs, Cambridge, MA, ARINC Research Corp, Annapolis, MD, TASC, Fairborn, OH, and Atlantic Research Corp, Fariborn, OH.

(U) Related Activities:
- (U) PE #0603109F, INEWS/ICNIA.
- (U) PE #0603253F, Advanced Avionics Integration.
- (U) PE #0604609F, RAMTIP
- (U) PE #0708026F, PRAM
- (U) PE #64203N (US Navy).
- (U) PE #64201A (US Army).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agrements: Not Applicable.

2. (U) Project XXX1, Compass/Attitude & Heading Reference System (C/AHRS): Develops functional replacement systems for existing N-1, J-4, C-12 and MA-1 compass systems and the A/A24G-1A, A/A24G-5A, A/A24G-39 and ASN-75 AHRS in use in various Air Force and Navy aircraft.

(U) FY 1989 Accomplishments: Not Applicable; project formally established in FY 1990.

(U) FY 1990 Planned Program:
- (U) Prepare/complete C/AHRS baseline document, specification, acquisition plan and draft Request for Proposal (RFP).
- (U) Release draft RFP for industry review.
- (U) Update final RFP and release.
- (U) Initiate interface control documentation.

(U) FY 1991 Planned Program:
- (U) Award C/AHRS development contract
- (U) Initiate development test and evaluation.
- (U) Design and develop prototype for weapon system integration and initial flight testing.
- (U) Evaluate requirements and initial design for peculiar support equipment.

(U) Work Performed By: Air Force Systems Command provides program management through Aeronautical Systems Division, Wright-Patterson AFB, OH. Contract award expected in FY 1991.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

(U) Related Activities: Not Applicable. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 2258, Standard Inertial Navigation Unit (INU): Develops Air Force standard form, fit, function (F3) medium accuracy (0.8nm/hr) INUs for A-7, C-130, F/RF-4, F-15, F/EF-111, MH-53J and Army OV-1, and precision accuracy (0.2nm/hr) INUs for MC-130, AC-130 and Joint STARS; applying ring laser gyro (RLG) technology for Air Force standard F3 medium accuracy INU.

(U) FY 1989 Accomplishments:
- (U) Completed F-15 RLG INU qualification testing.
- (U) Revised medium/precision accuracy INU specifications.
- (U) Initiated INU logistics depot support activity.
- (U) Began work on program management responsibility transfer (PMRT).

(U) FY 1990 Planned Program:
- (U) Initiate INU logistics depot support capability.
- (U) Initiate INU PMRT and identify residual tasks.

(U) FY 1991 Planned Program:
- (U) Continue to establish INU logistics depot support capability.
- (U) Continue PMRT residual tasks.

(U) Work Performed By: Air Force Systems Command provides program management through Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contracts are with Honeywell, Clearwater FL, and Litton, Woodland Hills, CA (medium accuracy RLG INU); Kearfott, Little Falls, NJ (precision accuracy INU).

(U) Related Activities:
- (U) PE #0603109F, INEWS/ICNIA.
- (U) PE #0603253F, Advanced Avionics Integration.
- (U) PE #0602204F, Aerospace Avionics
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

4. (U) Project 2297, Embedded Computer Software Standardization: Maintains Embedded Computer Standardization Program Office; develops support software to permit implementation of standardization efforts such as MIL-STD-1815 (Ada Programming Language) and MIL-STD-1750A, (Air Force Standard 16 Bit Instruction Set Architecture Computer).

(U) FY 1989 Accomplishments:
- (U) Completed development of basic Ada/1750A production quality compilation system.
- (U) Completed studies to determine performance requirements for a multi-computer simulation/debugging system for advanced, modular avionics system software development programs.
- (U) Completed study to assist policy makers in determining next generation avionics computer standardization policies.

(U) FY 1990 Planned Program:
- (U) Complete work on Ada/1750A production quality compiler to permit use of 1750A expanded memory option.
- (U) Initiate addition of symbolic debugger capability to Ada/1750A production quality compiler.
- (U) Conduct studies to determine necessary enhancements to Ada/1750A production quality compiler.
- (U) Initiate program management responsibility transfer (PMRT) planning for production quality Ada/1750A compiler.
- (U) Establish program to technically describe next generation avionics computer standardization policies.

(U) FY 1991 Planned Program:
- (U) Complete addition of symbolic debugger capability to Ada/1750A production quality compiler.
- (U) Initiate long term support contract for Ada/1750A production quality compiler.
- (U) Complete PMRT planning and negotiate PMRT date (FY 92)
- (U) Prepare program management plans and request for proposal for next generation, open architecture avionics computer.

(U) Work Performed By: Air Force Systems Command provides program management through Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contracts are with Boeing Military Airplane Company (BMAC), Wichita, KS, with major subcontract to Intermetrics, Inc, Cambridge, MA.

(U) Related Activities:
- (U) PE #0602204F, Aerospace Avionics.
- (U) PE #0603226F and its successors, DoD Common Programming Language, Advanced Development.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

5. (U) Project 2560, JOVIAL Language Control Facility (LCF):
Controls and maintains the JOVIAL J73 Language Standard (MIL-STD-1589C); validates JOVIAL compilers; provides language assistance and training to JOVIAL users; and distributes JOVIAL information via a newsletter.

(U) FY 1989 Accomplishments:
- (U) Validated three JOVIAL compilers.
- (U) Published four issues of the Newsletter.
- (U) Completed development of version 1 of JOVIAL J73 Computer Based Training (CBT) course; distributed 24 copies of course.
- (U) Provided JOVIAL language consultation to AF organizations and their contractors.
- (U) Provided support to LANTIRN and ACM SPOs and to AFOTEC's F-16 MSIP office.

(U) FY 1990 Planned Program:
- (U) Validate four JOVIAL compilers.
- (U) Publish four newsletters.
- (U) Continue technical support to other AF organizations.

(U) FY 1991 Planned Program:
- (U) Validate four JOVIAL compilers.
- (U) Publish four newsletters.
- (U) Continue technical support to other AF organizations.

(U) Work Performed By: Air Force Systems Command provides program management through Aeronautical Systems Divison, Wright-Patterson AFB, OH.

(U) Related Activities: Not Applicable. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

6. (U) Project 2658, Avionics Architecture Implementation and Support (AAIS):
Support Systems Engineering Avionics Facility which provides and develops avionics architectural standards (e.g., MIL-STD-1553B and MIL-STD-1760A); performs validation testing/engineering support for new/existing architectures; investigates/develops new standards.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

(U) FY 1989 Accomplishments:
- (U) Performed MIL-STD-1553B testing for 7 subsystems.
- (U) Performed MIL-STD-1750 testing for 10 computers.
- (U) Completed update to MIL-STD-1553B Handbook.
- (U) Assisted NATO and Air Standardization Coordinating Committee (ASCC) in adoption of MIL-STD-1750.

(U) FY 1990 Planned Program:
- (U) Perform MIL-STD-1553B testing for 6 subsystems.
- (U) Perform MIL-STD-1750 testing for 14 computers.
- (U) Continue NATO STANAG and ASCC standard development.
- (U) Update MIL-STD-1750 Verification Software.
- (U) Begin development of MIL-STD-1760 Handbook.
- (U) Begin development of 32 bit computer architecture standard.

(U) FY 1991 Planned Program:
- (U) Perform MIL-STD-1553B testing for 5 subsystems.
- (U) Perform MIL-STD-1750 testing for 16 computers.
- (U) Continue MIL-HDBK-1760 development.
- (U) Continue development of 32 bit computer architecture standard.
- (U) Develop High Speed Fiber Optic Data Bus (HSFODB) standard.

(U) Work Performed By: Air Force Systems Command provides program management through Aeronautical Systems Division, Wright-Patterson AFB, OH.

(U) Related Activities:
- (U) PE #0603226F, DoD Common Programming Language, Advanced Development.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: NATO STANAG version of MIL-STD-1750 is in development. Supports information exchange with ASCC towards adoption of MIL-STD-1750.

7. (U) Project 3264, Standard Flight Data Recorder (SFDR):
A JSRC-sponsored initiative to develop a standard crash survivable flight data recorder.

(U) FY 1989 Accomplishments:
- (U) Developed core software.
- (U) Completed PDR and CDR on the F-16 and C-17.
- (U) Flight tested trial integration units on operational aircraft.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

(U) FY 1990 Planned Program:
- (U) Flight test trial integration units on operational aircraft.
- (U) Begin C-17, C-141, F-16A/B ADF SFDR production deliveries
- (U) Qualify follower for production units.

(U) FY 1991 Planned Program:
- (U) Flight test trial integration units on operational aircraft.
- (U) Begin T-38 and C-130 SFDR production deliveries.

(U) Work Performed By: Air Force Systems Command provides program management through Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contract is with Smiths Industries, Grand Rapids, MI.

(U) Related Activities: Not Applicable. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604211F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: Advanced Aerial Targets Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Actual	FY 1991 Estimate	To Complete	Total Program
2459 Target Payload Systems	3,631	3,248	7,179	Cont	N/A
3165 Full-Scale Aerial Target Systems	0	0	9,030	0	N/A
Total	3,631	3,248	16,209	Cont	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT: Aerial Targets are essential to insure air-to-air weapons effectiveness and mission proficiency of our tactical aircrews against enemy aircraft. The overall objective is to improve air-to-air weapon system accuracy and reliability by developing aerial target systems for Air Force weapon system test and evaluation. In addition, full-scale targets (QF-100 and QF-106) are used to support US Army air defense test and evaluation programs such as the Divisional Air Defense follow-on program, Stinger, Patriot, and Improved Hawk. The targets being developed provide a cost effective mix of full-scale and subscale aerial targets. Full-scale targets provide a fully representative target with realistic maneuvering performance, radar cross section, and afterburning engine infrared (IR) signature. Subscale targets are a lower cost supplement used when threat simulation fidelity is not as critical. The Target Payload Systems task increases target effectiveness by improving subsystems for missile scoring and by developing subsystems which will provide target representative radar and IR signatures. QF-4 development provides a follow-on to the QF-106 full-scale targets which will complete procurement in FY 1993.

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

1. (U) Project: 2459 - Target Payload Systems: Full scale and subscale targets require payload subsystems for missile and bullet scoring, electronic and IR countermeasures, and radar and IR signature augmentation. Current scoring systems provide only miss distance information. Systems under development provide missile path past the target and missile position and attitude relative to the target at point of closeat approach. Radar signature augmentation provides radar signatures for subscale targets representative of threat aircraft. IR signature augmentation on subscale targets provides a signature representative of threat military jet engines; however, these do not simulate an afterburning engine. Electronic and IR countermeasures include systems such as chaff and flare dispensers.

Program Element: #0604211F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: Advanced Aerial Targets Development

(U) FY 1989 Accomplishments:
- (U) Began FSD of the Missile End Game Scoring (MEGS), a vector scoring system to replace the current scoring system on both subscale and full scale targets
- (U) Concept exploration for afterburner IR source
- (U) QOT&E of the APC-4 on the MQM-107D completed

(U) FY 1990 Planned Program:
- (U) FSD of MEGS will continue
- (U) Concept exploration for afterburner IR source will continue
- (U) Threat assessment and state-of-the-art survey of electronic and IR countermeasures techniques for air weapons initiated
- (U) Initiate planning for the QF-4 program

(U) FY 1991 Planned Program:
- (U) Threat assessment and state-of-the-art survey of electronic and IR countermeasures techniques for air weapons continues
- (U) Development, integration, and testing of the MEGS will be completed and production will begin
- (U) Successful validation testing for an afterburner plume generator should result in an FSD start
- (U) MEGS development will be completed

(U) WORK PERFORMED BY: Motorola Inc, Government Electronic Gp, Scottsdale AZ (MEGS); Sverdrup Technology Inc, Tullahoma, TN, (Afterburner Simulator); and Northrup, Chicago, IL (ECM).

(U) Related Activities: Coordination among the services is insured by the Joint Logistics Commanders through the Joint Technical Coordinating Group for Aerial Targets. Formal coordination through the Department of Defense Armament/ Munitions Requirements, Acquisition, and Development Committee prevents unnecesary duplication within the Air Force or Department of Defense. Targets are procured under PE 0305116F.

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

	FY 1989	FY 1990	FY 1991	To	Total
Missile Procurement	Actual	Estimate	Estimate	Complete	Program
	28,274	24,292	51,144	Cont	N/A

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0604211F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: Advanced Aerial Targets Development

2. (U) Project: 3165 - Full Scale Aerial Target Systems: Full scale aerial targets are retired Air Force operational aircraft that have been converted for remote control operation. These targets realistically simulate threat aircraft performance, radar cross section, and infrared signature. The conversion to remote control operation includes installation of a primary and backup Automatic Flight Control System (AFCS) that controls the drone flight, a missile scoring system that scores missile miss distance, a destruct system that can terminate the drone during flight, a datalink that supports the RF interface between the drone control system and AFCS, and drone augmentation devices, such as chaff/flare dispensers, ECM systems, smoke systems, and continuous infrared pods. The QF-106 is currently in production, with the QF-4 planned as the follow-on full scale target.

(U) FY 1989 Accomplishments:
- (U) QF-106 production contract issued

(U) FY 1990 Planned Program:
- (U) QF-106 production continues
- (U) Planning for QF-4 initiated

(U) FY 1991 Planned Program:
- (U) FSD for QF-4 begins

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

(U) WORK PERFORMED BY: Honeywell Inc., Sperry Defense Systems Div, Albuerque, NM.

(U) Related Activities: Coordination among the services is insured by the Joint Logistics Commanders through the Joint Technical
Coordinating Group for Aerial Targets. Formal coordination through the Department of Defense Armament/Munitions Requirements, Acquisition, and Development Committee prevents unnecessary duplication within the Air Force or Department of Defense. Targets are procured under PE 0305116F.

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

Missile Procurement	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
PE 0305116F	28,274	24,292	51,144	Cont	N/A

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604212F Budget Activity: #4 - Tactical Programs
PE Title: Aircraft Equipment Development

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OA-10 Avionics Demonstration	1,979	0	0	0	1,979
1926 Aircraft Windshield Development	1,134	1,471	2,942	Cont	TBD
Total	3,113	1,471	2,942	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Develops, tests and evaluates subsystem equipment to satisfy operational needs for updating Air Force aircraft. Updates are required due to changing threats, equipment obsolescence and technical advancements, and to improve efficiency, effectiveness, and safety. This is the only engineering development program element which employs advanced state-of-the-art technology to develop windshield systems with improved hazard resistance and reduced cost of ownership.

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

(U) Project 1926, Aircraft Windshield Development: Applies the latest technology to improve high-speed birdstrike resistance of aircraft windshields, while maintaining high optical quality, durability, minimum weight and low life cycle cost. The threat of birdstrike is continuing to grow due to increasing emphasis on low-altitude, high-speed missions.

(U) FY 1989 Accomplishments:
- (U) Completed flight evaluation of A-7 windshield.
- (U) Completed evaluation of cause for structural degradation of F-111 and F-16 transparency systems.
- (U) Completed feasibility study for mission compatible F-16 and A-7 canopies.
- (U) Provided support to Air Logistic Centers for fleet retrofit of A-7 and F/RF-4 windshields.
- (U) Initiated flight evaluation of B-1B extended life windshields.
- (U) Developed and transitioned to operational use an alternate sealant for the F-111 transparency system that reduces change-out time from three days to half a day.

(U) FY 1990 Planned Program:
- (U) Fabricate and test full-scale improved canopy system for the F-16.
- (U) Evaluate subscale version of B-1B windshield that incorporates laser protection for the 1995-2000 mission.
- (U) Complete flight test B-1B extended life windshield.

Program Element: #0604212F Budget Activity: #4 - Tactical Programs
PE Title: Aircraft Equipment Development

- (U) Complete enhancement of the aircraft transparency durability test facility.
- (U) Use durability test facility to validate service life of prototype F-111 and B-1B transparencies.
- (U) Initiate development of alternative F-15 transparency.
- (U) Evaluate technology advancements for reducing cost-of-ownership for F-111 transparencies using dry seals and improved coatings.
- (U) Evaluate reducing T-38 cost-of-ownership by replacing magnesium windshield frame with a composite material frame.

(U) FY 1991 Planned Program:
- (U) Initiate full-scale test and evaluation of B-1B windshield for the 1995-2000 mission.
- (U) Continue test and evaluation of F-16 improved canopy.
- (U) Fabricate and test full-scale alternative A-7 canopy.
- (U) Initiate development of removal-for-cause criteria for service-aged transparencies.
- (U) Initiate quantification and validation of design/test criteria for vibration, moisture, ultraviolet light, pressure, temperature, static discharge and radar cross section film degradation effects on transparencies.
- (U) Continue test and evaluation of T-38 bird resistant windshield and composite material frame.

(U) Work Performed By: The contractors are Pittsburgh Plate Glass Co., Huntsville, AL; The University of Dayton Research Institute, Dayton, OH; and Technology Scientific Services, Inc., Dayton, OH. The program is managed at Aeronautical Systems Division, Wright-Patterson Air Force Base, OH.

(U) Related Activities:
- (U) Program Element 0602201F, Aerospace Flight Dynamics.
- (U) Program Element 0603203F, Advanced Avionics for Aircraft.
- (U) Program Element 0603211F, Aerospace Structural Materials.
- (U) Program Element 0604201F, Aircraft Avionics Equipment.
- (U) Program Element 0604226F, B-1B.
- (U) Program Element 0708026F, Productivity, Reliability, Availability and Maintainability.
- (U) There is no unnecessary duplication of effort in the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements:
- (U) Data Exchange Agreement AF-86-G-745 with the Federal Republic of Germany, Birdstrike Resistant Aircraft Component Design, Development and Evaluation.
- (U) Data Exchange Agreement AF-86-Aust-7010 with Australia, Birdstrike Resistant Aircraft Component Design, Development and Evaluation.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604218F
PE Title: Engine Model Derivative Program (EMDP)

Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Engine Model Derivative Program (EMDP)	935	450	1,019	Continuing	TBD
Total	935	450	1,019	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: EMDP is an engineering development program that provides the latest engine technology advances to current weapon systems and provides a framework for engine development for future systems. EMDP contributes to system life extension, reduced life cycle cost, and enhanced performance. Enhanced performance is required to counter increases in system weight and increased threat capability. EMDP demonstrates derivative engine concepts incorporating advanced technology and components from government funded programs and contractor Independent Research and Development. EMDP demonstrates technology in performance, durability, operability, supportability, reliability, maintainability, and unique capabilities, such as thrust reversing and vectoring nozzles. These demonstrations are in prototype engines prior to full scale development. EMDP also evaluates candidate engines (commercial or military engines either in use or in development) to provide competitive engine opportunities.

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

1. (U) Engine Model Derivative Program (EMDP) (No Project Number): Develops and demonstrates performance growth in existing baseline engines.

(U) FY 1989 Accomplishments:
- (U) Continued controls and accessories evaluation program for current and future engine systems.
- (U) Initiated a conceptual axisymmetric vectoring nozzle design for current and future Increased Capability Engines (ICE).
- (U) Initiated Special Operations Forces (SOF) C-130 re-engining life cycle cost study.
- (U) Maintained engine roadmaps in compliance with MAJCOM requirements.

(U) FY 1990 Planned Program:
- (U) Complete controls and accessories evaluation program.
- (U) Complete conceptual axisymmetric vectored nozzle design activity.
- (U) Complete SOF C-130 re-engining life cycle cost study.
- (U) Examine candidates and system needs in such areas as enhanced performance, operability, supportability, survivability, durability, reliability, maintainability, lower life cycle cost, and competition.
- (U) Maintain engine roadmaps in compliance with MAJCOM requirements.

Program Element: #0604218F
PE Title: Engine Model Derivative Program (EMDP)

Budget Activity: #4 - Tactical Programs

(U) FY 1991 Planned Program:
- (U) Initiate ICE design which includes thrust growth, axisymmetric vectoring nozzle, advanced controls and accessories and low observables capability for tactical aircraft.
- (U) Continue examination of engine candidates and system needs.
- (U) Maintain engine roadmaps in compliance with MAJCOM requirements.

(U) Work Performed By: EMDP is managed by the Deputy for Propulsion at Aeronautical Systems Division, Wright-Patterson AFB OH. The contractors (and engines) involved are: Pratt & Whitney (P&W), West Palm Beach FL (F100, F117, and V2500); General Electric Company (GE), Evendale OH (F101, F108, F110, and F118); Williams International, Walled Lake MI (FJ44 and F107); Allison, Indianapolis IN (RB211-535E4, 250 propfan, and T56); Teledyne CAE, Toledo OH (235 propfan and J69); and Garrett Corporation, Phoenix AZ (F109 and TFE1042/F124).

(U) Related Activities:
- (U) EMDP draws requisite technologies from the following program elements: PE #0603216F (Advanced Turbine Engine Gas Generator); PE #0603202F (Aircraft Propulsion Subsystem Integration); PE #0602203F (Aerospace Propulsion); PE #0708011F (Industrial Preparedness Program).
- (U) Activities conducted by the Army, the Navy, National Aeronautics and Space Administration, and propulsion industry in-house programs also constitute significant sources of technology.
- (U) PE #0604268F (Aircraft Engine Component Improvement Program) complements EMDP by addressing engine flight safety problems, service-revealed deficiencies and the achievement of durability goals.
- (U) The Air Force and the Navy have a broad memorandum of understanding for joint cooperative propulsion programs in areas of common interest.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #064222F
PE Title: Nuclear Weapons Support Budget Activity:#4 - Tactical Programs

A. (U) RESOURCES ($ in thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
5708 Nuclear Weapons Support	2,129	2,232	2,838	Cont	TBD
TOTAL	2,129	2,232	2,838	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Provides funds for salaries of the Air Force Weapons Laboratory (WL) Nuclear Systems and Surety Division (NTS) civilian nuclear weapon specialists who provide technical guidance to the Air Force (AF), Department of Energy (DOE) and direction to the North Atlantic Treaty Organization for fulfillment of Air Force responsibilities related to development and support of nuclear weapon systems. Includes funds to demonstrate weapon/warhead compatibility to delivery platforms. Supports Strategic Air Command (SAC) Required Operational Capability 16-71 (Peacekeeper), 12-76 (Air Launched Cruise Missile (ALCM)), 6-76 (B61 Strategic Bomb), 6-69 (B83 Modern Strategic Bomb), 15-83 (Short Range Attack Missile II (SRAM II)), 1-83 (Small Single Reentry Vehicle Intercontinental Ballistic Missile (SICBM)), Tactical Air Force Statement of Operational Need (SON) 306-86 (Nuclear Tactical Air Surface Missile (SRAM T)), SAC SON 002-85, (Aircraft Delivered Weapon to Counter Deeply Buried, Hardened Targets) and 009-84 (Weapon to Counter Deeply Buried Superhard Time-Urgent Targets).

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

(U) Project 5708, Nuclear Weapons Support: Funds AFWL civilians to technically support all new and fielded USAF Nuclear Systems.

(U) FY 1989 Accomplishments:
- (U) Supported nuclear capable and new aircraft integration and use control forums
- (U) W61 warhead risk reductions confirm compatability with carrier
- (U) B61-3/4/7, W80-1, and B-83 stockpile continues to increase
- (U) W84 (GLCM) warhead stockpile partially returned to inactive reserve
- (U) W89 entered Phase 4 Production Engineering
- (U) Advanced EPW continued in Phase 2
- (U) SRAM T completed Phase 2, entered Phase 2a and prepared for Phase 3
- (U) Maintained and updated documentation supporting nuclear stockpile and DOE/DOD agreements
- (U) Developed nuclear weapon tie down proceedures for C-17

Program Element: #064222F Budget Activity: #4 - Tactical Program
PE Title: Nuclear Weapons Support

(U) FY 1990 Planned Program:
- (U) Continue FY 1989 programs at the same level of effort
- (U) Reorganize WL/NTS into independent organization as AFSC is downscoped
- (U) Study older weapon safety issues as modernization programs slows
- (U) Prepare for stockpile adjustments required by DOE facilities shortfalls

(U) FY 1991 Planned Program:
- (U) Continue at increased level of effort
- (U) 20% funds increase plans for increased mission as NTS becomes an independent SPO-like organization
  - — (U) Direct reporting to AFSC
  - — (U) Increase conversion of military to civilian positions
  - — (U) Increased technical support and travel for nuclear surety due to AFSC funding shift, modernization slow down, reduced DOE production, and NATO changes
  - — (U) Assume warhead project lead from other program offices

(U) Program to completion:
- (U) This is a continuing program.

(U) Work Performed By: Weapons Laboratory (WL/NTS), Kirtland AFB, NM.

(U) Related Activities:

-(U) PE 0602601F Nuclear Safety
-(U) PE 0101219 (SICBM); PE 0604312F (ICBM Modernization).
-(U) PE 0101215 (Peacekeeper); PE 0101213 (MM II).
-(U) PE 0101213F (MM Squadrons).
-(U) PE 0604361F (ALCM); PE 0603319F (ACM).
-(U) PE 0603364F (SRAM II); PE 0207135F (SRAM T).
-(U) PE 0101113F (B-52 Offensive Avionics System).
-(U) PE 0101115F (FB-111B/C); PE 0101118F (SRAM A).
-(U) PE 0101126F (B-1B); PE 0604226F (B-1B).
-(U) PE 0101127 (B-2).
-(U) There is no unnecessary duplication of effort within the Air Force or Department of Defense

(U) Other Appropriation Funds: DOE nuclear weapon RD&T, production, and surveillance for AF systems are funded separately by DOE.

(U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604223F
PE Title: Alternate Fighter Engine (AFE)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
AFE	31,127	61,758	5,104	-0-	541,761

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The AFE Program funds the Full Scale Development (FSD) of the F100-PW-229 and F110-GE-129 Increased Performance Engines (IPEs). These two engines are derivatives of the F100-PW-220 and the F110-GE-100 Alternate Fighter Engines. IPEs will give F-15s and F-16s the capability to counter the evolving 1990s threat. The AFE Program also completes development and integration of the Configured Engine Bay (CEB) for F-15E aircraft, providing the capability to install either of the IPEs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed the qualification effort.
   - (U) Updated technical data for the F100 and F110 IPEs and supported integration flight test for IPEs in the F-15 and F-16 programs.
   - (U) Conducted F-15E CEB development testing.
   - (U) Conducted flight test of Initial Flight Release (IFR) configuration IPEs.
   - (U) Initiated Operational Capability Release (OCR) testing and continued OCR engineering activity.
   - (U) Completed Initial Service Release (ISR).
   - (U) Accepted first production engines.

2. (U) FY 1990 Planned Program:
   - (U) Complete residual tasks from the qualification effort.
   - (U) Continue OCR testing on production configured engines.
   - (U) Continue FSD for the F100 IPE with full life testing of the preproduction configurations.
   - (U) Perform Accelerated Mission Test (AMT) on production engines to verify full engine life.
   - (U) Support F-16 performance/qualification flight testing.
   - (U) Perform F-15E/F100 IPE performance qualification flight testing.
   - (U) Conduct update of engine maintenance and support procedures.
   - (U) Perform sea level development testing.
   - (U) Conduct F-15E CEB development testing.

3. (U) FY 1991 Planned Program:
   - (U) Complete F-15E/F100 IPE performance qualification (Engine/Airframe Integration).
   - (U) Complete F-15E CEB development testing.
   - (U) Complete OCR testing.

Program Element: #0604223F
PE Title: Alternate Fighter Engine (AFE)
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

4. (U) Program to Completion: Not Applicable, IPE development program complete in FY91.

D. (U) WORK PERFORMED BY: The Propulsion System Program Office (SPO) and the F-15 SPO, Aeronautical Systems Division, Wright-Patterson AFB OH, manage the engine program and the F-15/IPE Qualification Program, respectively. Contractors are: General Electric, Evendale OH, (F110-GE-129); Pratt and Whitney, West Palm Beach FL, (F100-PW-229); and McDonnell Douglas Corporation, St. Louis MO (F-15/IPE Qualification).

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: ISR milestones and full life AMT of production hardware have slipped to allow for redesign and test to solve technical problems discovered in development testing. No impact to deployment milestone.
3. (U) COST CHANGES: FY 89 funding was increased by $4.0M to address an unfunded OCR requirement and then reduced $.4M to support a higher priority program. FY 90 funding was reduced $2.0M due to fiscal constraints.

F. (U) PROGRAM DOCUMENTATION:
- (U) DEPSECDEF Memorandum, 23 Apr 84.
- (U) Asst SECAF Memorandum to AF/CV, 11 Apr 85.
- (U) Asst SECAF Memorandum to OUSDRE, 7 May 85.
- (U) USDRE Memorandum to DepSecDef, 8 May 85.

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0604218F (Engine Model Derivative Program) conducted preliminary development of F100 and F110 IPEs.
- (U) PE #0604268F (Aircraft Engine Component Improvement Program) complements AFE by addressing engine flight safety problems, service-revealed deficiencies and the achievement of durability goals.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:
- (U) Delegation of Disclosure Letters (DDLs) for the European Participating Governments (EPGs) and Japan have been developed due to potential future procurements of IPEs.

Program Element: #0604223F
PE Title: Alternate Fighter Engine (AFE)

Project Number: N/A
Budget Activity: # 4 - Tactical Programs

J. (U) MILESTONE SCHEDULE:

	F100-PW-229	F110-GE-129
- (U) Contract Go Ahead	Jun 85	Jun 85
- (U) Preliminary Design Review	Nov 85	Nov 85
- (U) Critical Design Review	May 86	May 86
- (U) Initial Flight Release	Mar 88	Apr 88
- (U) Production Readiness Review	Jun 88	May 88
- (U) First Production Engine Delivery	Dec 89	Nov 89
- (U) Functional Configuration Audit	Nov 89	Dec 89
- (U) Physical Configuration Audit	Nov 89	Dec 89
- (U) Initial Service Release	Dec 89	Dec 89
- (U) First Engine for Field Service Evaluation	Jan 90	Jan 90
- (U) Operational Capability Release	Jan 91	Jan 91
- (U) First Production Engine for F-15/16 Deployments.	Jan 91	Jan 91

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604227F
PE Title: Training Systems Development

Budget Activity: #6 - Defense-Wide Mission Support

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2325 Simulator Development Activities	1,769	2,846	3,500	Cont	TBD
2769 Simulator Update Development/Simulator Requirements Definition	8,285	6,850	1,550	Cont	TBD
2851 Standard DOD Simulator Data Base/Common Transformation Program	3,132	2,600	2,000	Cont	TBD
2901 B-1B Weapon Systems Trainer	6,206	3,000	3,370	1,998	132,465
2968 Modular Simulator Design	1,964	1,510	1,000	Cont	TBD
2998 LANTIRN Simulator	6,377	1,240	0	0	25,024
3135 Advanced Training System (ATS)	2,875	5,220	8,300	23,405	39,800
3143 Advanced Tactical Fighter	1,900	0	0	226,500	230,300
3282 C-17 Aircrew Training System	26,268	24,300	8,100	7,000	96,900
3772 C-141 Aircrew Training System	3,785	10,220	13,000	3,800	30,805
3775 Manpower, Personnel, and Training	0	400	400	Cont	TBD
FY 89 COMPLETED PROJECTS					
2997 GBU-15 Part Task Trainer					
2999 LANTIRN Part Task Trainer					
3000 KC-135 Operational Flight Trainer					
3105 F-15E Weapon System Trainer	1,484	0	0	0	0
TOTAL	64,045	58,186	41,220	Cont	TBD

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Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Training Systems Development

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is a continuing program element for development of aircrew and maintenance training techniques and devices. Objectives are to adapt simulation technology and standards developed in the laboratories and industry to satisfy training requirements, and to develop prototype training devices.

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

1. (U) Project 2325 - Simulator Development Activities: Provides the funds to conduct engineering development of new aircrew/maintenance training technologies and standards. Funds the pre-production of first article training devices to satisfy the customer's training requirements. Identifies and corrects deficiencies in current training capabilities, develops tools that improve aircraft/simulator concurrency and reduce system life cycle costs.

(U) FY 1989 Accomplishments:
- (U) Determined G-seat drive algorithms for providing more effective flight motion in the simulator.
- (U) Determined maximum tolerable simulator induced time delays.

(U) FY 1990 Planned Program:
- (U) Develop software system to support instructors.
- (U) Develop a standard format for technical and aircraft performance data for use in simulator development.
- (U) Identify maintenance training requirements.

(U) FY 1991 Planned Program:
- (U) Determine flight simulator motion requirements and develop the algorithms for the simulator drive mechanism.
- (U) Complete development of next generation motion/force cueing module.
- (U) Complete full field of view dome training effectiveness research tool development.
- (U) Complete second generation low cost, lightweight helmet coupled image generation and projection device.

(U) Work Performed By: The Training Systems SPO, ASD, Wright-Patterson AFB OH. Contractors include General Electric, Daytona Beach FL; SIMTEC, Manassas VA; CAE-Link, Binghamton NY; General Dynamics, Ft Worth TX; Logicon, San Diego CA.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Training Systems Development

(U) Related Activities: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

2. (U) Project 2769 - Simulator Update Development/Simulator Requirements Definition: Develops updates to training systems to maintain and improve their supportability and effectiveness. It includes courseware development for a C-130 aircrew training system (ATS). After the completion of the C-130 ATS in FY-90, this project will be used to:

a. (U) Define requirements for new training systems in the form of tasks to be trained (this supports a milestone 0 decision).
b. (U) Develop options to meet the requirements (this supports a milestone 1 decision).
c. (U) Build a prototype of one or more of the options to evaluate the training effectiveness of those options.

(U) FY 1989 Accomplishments:
- (U) Completed C-130 ATS course readiness reviews.

(U) FY 1990 Planned Program:
- (U) Conduct C-130 ATS summative evaluation.
- (U) Complete C-130 ATS readiness review: Aug 90.

(U) FY 1991 Planned Program:
- (U) Joint Primary Aircrew Training Systems (JPATS) training requirement analysis.
- (U) Joint Combat Training System (JCATS) training requirements analysis.
- (U) Develop and evaluate prototypes for the European low altitude training system (ELATS).

(U) Work Performed By: The Training Systems SPO, ASD, Wright-Patterson AFB OH. Prime contractor is CAE-Link, Dallas, Texas.

(U) Related Activities: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Training Systems Development

3. (U) Project 2851 - Standard DOD Simulator Data Base/Common Transformation Program: Develops a standard DOD digital data base library; enhancement and exchange standards; and a distribution system. This minimizes data base redundancy among the services and maximizes data base interoperability.

(U) FY 1989 Accomplishments:
- (U) Critical Design Review completed.
- (U) Produced prototype data base.
- (U) Completed test readiness review.

(U) FY 1990 Planned Program:
- (U) Acceptance testing of development system.
- (U) Interim production and exercise validation option.
- (U) Add rapid data base generation capability to system.

(U) FY 1991 Planned Program:
- (U) Test and accept turn-key production capability: May 91.
- (U) Complete rapid data base generation capability.

(U) Work Performed By: The Training Systems SPO, ASD, Wright-Patterson AFB OH. Contractor is Planning Research Corporation, McLean VA.

(U) Related Activities:
- (U) Project 2851 is a joint service project conducted under the Joint Logistic Commanders (JLC) through the Joint Technical Coordinating Group for Training Systems and Devices.
- (U) Rome Air Development Center (RADC) Cartographic Applications for Tactical and Strategic Systems (CATSS) Program (PE 0603227F).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

4. (U) Project 2901 - B-1B Weapon System Trainer: Develops an aircrew training device for all B-1B crew members to include mission rehearsal, takeoff and landing, navigation, air refueling, threat analysis/countermeasures, low-level penetration, weapons delivery, and emergency procedures.

(U) FY 1989 Accomplishments:
- (U) Accepted six Cockpit Procedure Trainers (CPTs).
- (U) Completed Design Test and Evaluation for Software Support Center.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Training Systems Development

(U) FY 1990 Planned Program:
- (U) Deliver updated ILS, Aero package, and Blk 3.5 on the CPT.
- (U) Complete DT&E and IOT&E of WST and MT.
- (U) Complete WST design on Block 3.5/4.5 software updates.

(U) FY 1991 Planned Program:
- (U) Complete testing on Block 3.5/4.5 updates for WST and MT.
- (U) Deliver updates for aerodynamics on WST.
- (U) Deliver Block 3.5/4.5 updates for WST and MT.
- (U) Complete system verification tests on Block 4.5 for CPT.

(U) Work Performed By: The Training Systems SPO, ASD, Wright-Patterson AFB OH. Prime contractor; Boeing Military Co., Huntsville AL.

(U) Related Activities: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

5. (U) Project 2968 - Modular Simulator Design: Develop a MIL-STD for flight simulator software modules. Standardizing the functions of each simulator module and its interfaces to all other modules (in the Ada programming language) will allow reuse of software from one simulator to the next and simplify the job of updating module software to maintain simulator concurrency with aircraft.

(U) FY 1989 Accomplishments:
- (U) Fabricate the Modular Validation testbed.
- (U) Establish Functional Baseline Requirements.
- (U) Preliminary Design Review and interfaces defined.

(U) FY 1990 Planned Program:
- (U) Conduct Critical Design Review.
- (U) Complete draft military standard for modular simulators.
- (U) Develop modular simulator software.

(U) FY 1991 Planned Program:
- (U) Demonstrate modular simulator architecture concept and validate on the testbed simulator.
- (U) Publish modular standard and incorporate in testbed simulator and future acquisitions.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Training Systems Development

(U) Work Performed By: The Training Systems SPO, ASD Wright-Patterson AFB OH. Prime contractor; Boeing Military Airplane Co., Huntsville AL.

(U) Related Activities:
- (U) Project 2968 is a joint service project conducted under the Joint Logistic Commanders (JLC) through the Joint Technical Coordinating Group for Training Systems and Devices.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

6. (U) Project 3135 - Advanced Training System (ATS): Changes to the Air Force Training environment have resulted in an increased training workload at Air Training Command (ATC) Technical Training Centers. Increasing equipment complexity, together with greater student instructional needs, combine to heavily tax ATC's instructor resources. The manual ATC system is becomming increasingly inefficient and inflexible. ATS will support all the major functions in the technical training arena, e.g. instructional development, delivery, evaluation, and resource management. Its main goals are to free instructors for individualized instruction in complex, highly technical tasks; promote efficient training methods; and provide rapid course creation and updating.

(U) FY 1989 Accomlishments:
- (U) Awarded FSED contract, May 89, to IBM Corp.,Manassas, VA.

(U) FY 1990 Planned Program:
- (U) Preliminary Design Review (PDR).
- (U) Software Specification Review.
- (U) Update life cycle cost estimate and cost/benefits analysis.

(U) FY 1991 Planned Program:
- (U) Critical Design Review.
- (U) Start Development, Test and Evaluation: (DT&E) Jun 91.

(U) Work Performed By: Advanced Training System SPO, HSD, Brooks AFB TX. Contractor is IBM, Federal Systems Division, Manassas VA.

(U) Related Activities: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Training Systems Development

7. (U) Project 3143 - Advanced Tactical Fighter (ATF) Training System: The Tactical Air Forces require an ATF Training System to meet personnel training needs to support operations and maintenance personnel assigned to the weapon system.

(U) FY 1989 Accomplishments:
- (U) Front end analysis completed.
- (U) ATF Training System defined.

(U) FY 1990 Planned Program:
- (U) Release Weapon System Request for Proposal (RFP).
- (U) Training System Acquisition Strategy Panel (ASP).

(U) FY 1991 Planned Program:
- (U) Weapon System FSD contract award.
- (U) Release Training System RFP

(U) Work performed by: The Training Systems SPO, and the Advanced Tactical Fighter SPO located at ASD, Wright-Patterson AFB OH. Contractors are Northrop Corp Aircraft Division, Hawthorne CA and Lockheed Aeronautical Sytems Co., Burbank CA.

(U) Related activities: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other appropriation funds: Not applicable.

(U) International cooperative agreements: Not applicable.

8. (U) Project 3282 - C-17 Aircrew Training System (ATS): Provides initial and continuation training for C-17 aircrew members. Training will be totally contractor administered and supported, with MAC evaluating the final product - a fully qualified aircrew member. The training system will be developed concurrently with the aircraft development and production efforts, allowing the first main operating base (MOB) to be available for training at the initial squadron.

(U) FY 1989 Accomplishments:
- (U) Downselect from three to one contractor.
- (U) Continue full scale development effort.

(U) FY 1990 Planned Program:
- (U) Conduct preliminary design review.
- (U) Conduct critical design review.
- (U) Initiate development of courseware.

(U) FY 1991 Planned Program:
- (U) Begin fabrication of training devices.
- (U) Complete courseware development.

Element: #0604227F Budget Activity: #6 - Defense-Wide
PE Title: Training Systems Development Mission Support

(U) Work Performed By: The Training Systems SPO, ASD, Wright-Patterson AFB OH. Contractor is McDonnell Douglas Training Systems Inc., Bedford, TX.

(U) Related Activities: There is no unnecessary duplication of effort within the Air Force of the Department of Defense.

(U) Other Appropriation Funds:

Aircraft Procurement (BA 3010):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	42,100	7,600	263,000	312,700

(U) International Cooperative Agreements: Not applicable.

9. (U) Project 3775 - Manpower, Personnel and Training (MPT): This project will provide for the front end analyses and studies to ensure MPT factors and constraints are developed during the early phases of the weapon system acquisition process. It will establish the needed data sources, analytical tools, and procedures which support MPT trade-off analysis in the design. These analyses will emphasize life cycle cost-effective use of critical manpower, personnel and training resources.

(U) FY 1989 Accomplishments: Not applicable.

(U) FY 1990 Planned Program:
- (U) Develop a Manpower, Personnel, and Training (MPT) Course.
- (U) Initiate MPT studies and development of MPT models.
- (U) Begin development of the MPT Computer Supported Network Analysis System (CSNAS) prototype.

(U) FY 1991 Planned Program:
- (U) Develop MPT Education Course.
- (U) Continue MPT models development.
- (U) Develop MPT, Job Aids and Measures of Effectiveness (MOE).
- (U) Continue development of (CSNAS).

(U) Work Performed By: Training Systems SPO and the Deputy for Acquisition Logistics, Wright-Patterson AFB OH. Contractor(s) to be determined.

(U) Related Activities: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604227F Project Number: 3772
PE Title: Training Systems Development Budget Activity: # 6 - Defense-Wide Mission Support

A. (U) RESOURCES: ($ in Thousands)
Project Title: C-141 Aircrew Training System (ATS)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
C-141 ATS	3,785	10,220	13,000	3,800	30,805

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The C-141 ATS will be a totally contracted effort for the ground and flight simulation aircrew training programs, including initial qualification, upgrade and continuation training, for all MAC, AFRES and ANG C-141 primary crew members. The system will also include the Basic Flight Engineer School at Altus AFB. The contractor will also provide for the logistics support of all ATS associated training equipment and operate a training management system to track student progress, update the training programs and interface with Air Force Operations Resource Management System. The ATS will be conducted on site at all C-141 operating locations, active and air reserve components.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Full scale development contract awarded with options for operation and maintenance support.
   - (U) Began training System Requirements Analysis (SRA).
   - (U) Began media design/development.

2. (U) FY 1990 Planned Program:
   - (U) Conduct Training System Review #1.
   - (U) Begin courseware development.
   - (U) Conduct Training System Review #2.

3. (U) FY 1991 Planned Program:
   - (U) Begin course readiness reviews.
   - (U) Deliver prototype training equipment.
   - (U) Conduct training validation.

4. (U) Program to Completion:
   - (U) Activate and support ATS sites.
   - (U) Program management responsibility transfer to Air Force Logistics Command Oct 1995.

D. (U) WORK PERFORMED BY: The Training Systems SPO located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manages this effort. The prime contractor for this program is Hughes Training Systems, Arlington, TX.

Program Element: #0604227F Project Number: 3772
PE Title: Training Systems Development Budget Activity: #6 - Defense-Wide Mission Support

E. (U) COMPARISON WITH AMENDED FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Reflects actual contract costs based on firm fixed price contract, awarded May 1989.

F. (U) PROGRAM DOCUMENTATION:
- (U) Military Airlift Command (MAC) Statement of Need (SON) 01-87, C-141 Aircrew Training System (ATS), 28 Oct 87.

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. (U) AIRCRAFT PROCUREMENT:	0	100	2,300	26,230	29,530
2. (U) MILITARY CONSTRUCTION:	0	0	3,600		

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

J. (U) MILESTONE SCHEDULE:

1. (U) Contract Award	May 89
2. (U) Training System Review (TSR) #1	Nov 89
3. (U) TSR #2	May 90
4. (U) Course Readiness Review (CRR)	Dec 91
5. (U) Required Assets Available (RAA) Site 1	Apr 92
6. (U) System Validation	Oct 95
7. (U) Program Management Responsibility Transfer	Oct 95

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604231F
PE Title: C-17 Program
Project: #xxx1
Budget Activity: #4-Tactical Programs

Project Title: C-17



POPULAR NAME: C-17

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	IIIA Jan 89	N/A	N/A	IIIB 4th Qtr FY93
Engineering Milestones	Mission Computer CDR Jul 89	N/A	N/A	N/A
T&E Milestones	N/A	N/A	1st Flight Jun 91	IOT&E May 93
Contract Milestones	Lot 2 4A/C Jul 89	Lot 3 4A/C Dec 90	Lot 4 6A/C Sep 91	Remaining Lots TBD
BUDGET ($000)	FY 1989	FY 1990	Prog. Total FY 1991	To Complete
Major Contract	R&D 876,700	R&D 799,600	R&D 467,400	R&D 508,200
Support Contract	N/A	N/A	N/A	N/A
In-House Support	R&D 8,700	R&D 23,800	R&D 21,400	R&D 32,800
GFE/ Other	R&D 20,100	R&D 61,800	R&D 52,300	R&D 80,500
Total	R&D 905,520	R&D 885,[illegible]7	R&D 541,081	R&D 621,500

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Program Element: #0604231F
PE Title: C-17 Program
Project: #xxx1
Budget Activity: #4-Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

Additional airlift capability is needed for rapid intertheater deployment of combat forces to support national objectives and for timely intratheater movement to meet forward area mobility requirements. Airlift is vital to meet U.S. mobility requirements and is tailored to respond to contingencies anywhere in the world. Specific tasks associated with the airlift mission area include deployment, employment (airland, airdrop, and extraction), sustaining support, retrograde, and combat redeployment. The C-17 will be capable of performing the entire spectrum of airlift missions and is specifically designed to operate effectively and efficiently in both the intertheater and intratheater environments. Therefore, it will not only increase our overall airlift capability, but will be able to replace the capability lost from retiring some C-130 and C-141 aircraft beginning in the 1990s. The C-17 will be a modern technology aircraft capable of performing the airlift mission well into the 21st century.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Assembly of the durability test article, static test article, and first two production aircraft began
   - (U) The tooling effort to support low-rate production requirement continued
   - (U) The organizational and intermediate support equipment preliminary design review was completed
   - (U) Planning for the RDT&E flight test aircraft air load calibrations continued
   - (U) Engineering design and drawing releases continued
   - (U) Development of detailed test planning concentrating on full-scale durability and static articles, and RDT&E test aircraft
   - (U) Full-scale F-117 engine testing/FAA certification completed 8 Dec 88
   - (U) Technical and logistics analyses continued
   - (U) Flight test aircraft assembly continued
   - (U) Avionics/software integration continued
   - (U) Low rate initial production (Milestone IIIA) approved 18 Jan 89

3. (U) FY 1990 Planned Program:
   - (U) Avionics/software integration continued
   - (U) Complete O&I level support equipment critical design reviews
   - (U) Complete procurement of GFE mission flight test spares
   - (U) The tooling effort to support low-rate production requirement will be completed
   - (U) Planning for the RDT&E flight test aircraft air load calibrations will be completed
   - (U) Engineering design and drawing releases will be completed

Program Element: #0604231F
PE Title: C-17 Program
Project Number: xxx1
Budget Activity: #4-Tactical Programs

- (U) Technical and logistics analyses continued
- (U) Flight test aircraft assembly continued
- (U) Avionics/software integration continued

4. (U) FY 1991 Planned Program:
   - (U) Complete assembly of durability article
   - (U) Begin durability and static testing
   - (U) Complete assembly of static article
   - (U) Complete assembly of test aircraft (T-1)
   - (U) First flight Jun 91
   - (U) Avionics/software integration continued
   - (U) Development of detailed test planning concentrating on full-scale durability and static articles, and RDT&E test aircraft will be completed
   - (U) First production aircraft (P-1) delivered to airloads calibration testing (start & complete)
   - (U) Begin static article ultimate strength testing

5. (U) Program to Completion:
   - (U) Complete static article ultimate strength testing (FY92)
   - (U) Complete O level technical order validation (FY92)
   - (U) Deliver maintenance/aircrew trainers (FY92)
   - (U) Functional Configuration Audit/Physical Configuration Audit (FY92)
   - (U) Complete one life of durability testing (FY92)
   - (U) Begin dedicated IOT&E (FY 92)
   - (U) Complete 2nd life durability test (FY93)
   - (U) Operational Readiness Evaluation Conducted (FY93)
   - (U) Flight/Weather Testing Completed (FY94)

D. (U) WORK PERFORMED BY: Douglas Aircraft Company, Long Beach, California.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: The current estimates for the maintenance, MTBMI, MTBMC, MTBR, and Mean Manhours to Repair parameters have been changed to account for the latest analyses and aircraft design. Also, the current estimate for the payload/range, landing and takeoff distance have been adjusted to account for the latest projected operating weight. The reported payload/range is 28 nautical miles short of specification requirements using the specification ground rules. However, the maximum payload/range (160,000lbs/2400nm) threshold will be met.

2. (U) SCHEDULE CHANGES: Milestones IIIB, IOC, First Flight, FOC, and Complete DT&E/IOT&E have been rescheduled to reflect the overall delay caused by problems experienced in T-1 assembly and avionics development. The schedule also reflects the impact of the Congressional reduction in FY90 procurement quantity (with subsequent production buy/delivery reschedule.) Milestone FOC reflects the same date (FY instead of month and year) as shown in the current SAR Acquisition Program Baseline.

Program Element: #0604231F Project Number: xxxi
PE Title: C-17 Program Budget Activity: #4-Tactical Programs

3. (U) COST CHANGES: RDT&E: (-20,400) This change is primarily a result of decreasing training, data, and PSE requirements. This decrease is partially offset by an increase in costs due to the reestimate of Air Vehicle, Test, and Systems Engineering/Program Management costs. PROCUREMENT: (+4,305,500) This change is a result of revised OSD economic escalation indices and the buy profile for incorporation of a slower build-up rate.

F. (U) PROGRAM DOCUMENTATION:
- (U) SON (MENS) Nov 80
- (U) SORD (SOC) Apr 88
- (U) DCP Jun 88
- (U) ADM 6 Nov 89
- (U) Acquisition Program Baseline - Revision submitted to OSD 8 Dec 89.
- (U) TEMP - Approved 4 Oct 88, revised TEMP completed OSD review 19 Dec 89.

G. (U) RELATED ACTIVITIES: None. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT (PE #0401130F):

	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Comp	Total Prog
Funds	1,104.7	1,429.4	2,146.1	30,674.4	36,092.9
Quantity	4	4	6	194	210

1. (U) MILCON (PE #0401130F):

	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Comp	Total Prog
Funds	4.2	4.7	29.6	339.6	378.1

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
None	(Engineering Development And Component Qualification Testing Only)	

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Initiate DT&E	Jun 91	None
Initiate Dedicated IOT&E	Dec 92	None
Complete DT&E/IOT&E	Jun 93	None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604233F Budget Activity: #4 - Tactical Programs
PE Title: Tanker-Transport Training System (TTTS)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Tanker-Transport Training System (TTTS)	4,081	3,602	2,401	0	10,084

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Tanker-Transport Training System (TTTS) is required to implement Specialized Undergraduate Pilot Training (SUPT) in Air Training Command. This HQ USAF approved training concept will provide higher quality graduates with skills specifically tailored to the needs of gaining commands. Additionally, it will reduce training costs and reduce the training load on the T-38 allowing the Air Force to continue using the T-38 into the next century. The acquisition of the TTTS aircraft will also substantially reduce the eventual size of the T-38 replacement fleet thereby providing additional acquisition cost savings. The TTTS program will procure commercially available jet aircraft, missionized for the training role and accomodating an instructor and two students, and compatible simulators, courseware, and ground training devices. In SUPT students will receive common primary training in the T-37 and then enter either the Tanker-Transport (TT) track (for students destined for TT type aircraft) or the Bomber-Fighter (BF) track (for students destined for BF type aircraft). The TT syllabus will include training in high and low altitude instrument approaches, crew coordination, asymmetric thrust situations, airdrop fundamentals, low-level navigation, airborne rendezvous, and cell formation.

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

1. (U) Tanker-Transport Training System (TTTS): See PE description above.

(U) FY 1989 Accomplishments:
- (U) Issued Request for Proposals 28 Aug 89

(U) FY 1990 Planned Program:
- (U) Conduct Source Selection and Award Contract
- (U) Begin courseware development
- (U) Begin simulator fidelity/compatiblity design/integration

Program Element: #0604233F Budget Activity: #4 - Tactical Programs
PE Title: Tanker-Transport Training System (TTTS)

(U) FY 1991 Planned Program:
- (U) Complete missionization of selected aircraft and simulators
- (U) Complete curriculum/courseware development

(U) Work Performed By: Contractor TBD.

(U) Related Activities:
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Aircraft Procurement (Air Vehicle and Spares) (BA 3)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	9,525	144,400	193,037	1281,720	1628,682

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604236F Budget Activity: #4-Tactical Programs
PE Title: Infrared Search and Track System (IRSTS)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3298 IRSTS	4,542	2,449	0	0	53,583
Total	4,542	2,449	0	0	53,583

B. (U) BRIEF DESCRIPTION OF ELEMENT: The IRSTS program designed, developed and demonstrated an IRSTS capable of passively detecting enemy aircraft by their IR emissions. The program is a joint USAF/USN program to provide passive detection capability to fighter aircraft. The USN will continue the program through to production while the USAF will only utilize the data from the program to support the IRSTS development for the Advanced Tactical Fighter (ATF) program.

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

1. (U) Project 3298, IRSTS: This program was to develop and flight test the mid-wave IRSTS to provide risk reduction for the INEWS IRSTS proposed program.

(U) FY 1989 Accomplishments:
- (U) Completed flight testing and provide flight test data to support ATF SPO.
- (U) USN started flight testing of both mid- and long-wave systems.
- (U) Monitored and funded USN flight testing of long-wave IRSTS.
- (U) USN started FSD.

(U) FY 1990 Planned Program:
- (U) Funds USAF share of USN flight testing to support USN production decision on mid- or long-wave IRST system. USAF to obtain flight test results for applicability to Air Force programs.

(U) FY 1991 Planned Program:
- (U) No USAF activities.
- (U) Effort completed.

Program Element: #0604236F Budget Activity: #4-Tactical Programs
PE Title: Infrared Search and Track System (IRSTS)

(U) Work Performed By: General Electric Co, Utica, NY is the prime contractor. Testing is being conducted by the 3246 Test Wing, Eglin AFB. Air Force Wright Aeronautical Laboratory (AFWAL) has also contributed with technical expertise.

(U) Related Activities:

- The impact of the atmosphere upon IRSTS performance has been extensively studied. ASD/VL contracted with Aeromet, Inc., to provide an airborne Light Detection and Ranging (LIDAR) system to qualitatively describe the test range atmosphere. MacAulay Brown, Inc., collected data from all sources involved in this flight test and compiled a data base for use by future systems in determining their electro-optical sensor requirements.

- There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604237F
Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA)
Project Number: 3308
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Variable Stability In-Flight Simulator Test Aircraft (VISTA)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
VISTA	7,731	12,348	7,316	2,100	41,613

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program modifies an F-16D to create a high-performance, flying simulator, known as VISTA, as a replacement for the NT-33A. For the past 30 years, the R&D flight test community (Air Force, Navy, NASA, and industry) has extensively employed the variable stability NT-33A for pre-first flight evaluation of advanced aircraft, to establish flying quality specification criteria, and as a flying laboratory for flight control and cockpit display research. The NT-33A has been a veritable workhorse with a full schedule of test activities. Its success is directly attributable to its relatively low cost of operation, rapid response to customer needs, and high degree of credibility in the flight test community. The NT-33A has been credited with identification of flight control deficiencies on the prototypes for the YF-17 and F-18. Gone undetected, such deficiencies could have resulted in loss of the prototype aircraft. Now, the NT-33A must be replaced. It is the oldest actively flying aircraft in the Air Force inventory and its performance is not representative of future aircraft. VISTA, a modified F-16D, will have the capability to simulate a wide range of air vehicles to identify crucial flight control and human factor design deficiencies before first flight. In addition, the Air Force and Navy Test Pilot Schools will use VISTA, as they have the NT-33A, to safely train test pilots to judge the deficiencies and characteristics for aircraft handling quality, avionics, and human factors in a realistic high performance environment. VISTA will be a national facility for flight research.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) All aircraft modification design activity was completed.
   - (U) A cockpit mockup was evaluated by pilots.
   - (U) Aircraft modification activity was initiated and 40 percent of the drawings released.
   - (U) A flight test was performed to assist in locating the sideslip sensor.

2. (U) FY 1990 Planned Program:
   - (U) Extensive aircraft modification and Variable Stability System development activities will be completed.

Program Element: #0604237F Project Number: 3308
Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA) Budget Activity: #4 - Tactical Programs

- (U) Variability Stability System components will be installed and integrated with the F-16D flight control system.
- (U) Flight control and Variability Stability System software validation and verification testing will be initiated.
- (U) Ground testing will be initiated to ensure design and safety requirements have been met.

3. (U) FY 1991 Planned Program:
   - (U) Ground testing will be completed.
   - (U) Software validation and verification will be completed.
   - (U) The flight readiness review will be conducted.
   - (U) Flight testing will be initiated to verify operational performance.

4. (U) Program to Completion:
   - (U) Flight testing will be completed.
   - (U) A physical and functional configuration audit will be conducted.
   - (U) The program will be completed and VISTA will be transitioned to flight research in the first quarter of FY 1992.

D. (U) WORK PERFORMED BY: The VISTA prime contractor is General Dynamics, Fort Worth Division, Fort Worth, Texas. The program is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB, OH.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: Due to a combination of slow contractor startup and non-availability of critical computer spares, VISTA transition to flight research will be delayed by five months.
   3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) Approval of request for RDT&E Aerospace Vehicle, HQ USAF letter dated 15 July 1985.

G. (U) RELATED ACTIVITIES:
   - (U) This program receives technology inputs from Aerospace Flight Dynamics (PE 0602201F).
   - (U) The technology product of this program will be applied to Flight Vehicle Technology (PE 0603205F) and Advanced Flight Technology Integration (PE 0603245F).
   - (U) Coordination is maintained through the VISTA Users Group comprised of members of the Air Force, Navy, NASA, and industry.
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #0604237F Project Number: 3308
Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA) Budget Activity: #4 - Tactical Programs

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1.	(U) Request for Proposal	4th Quarter FY 1987
2.	(U) Source Selection Completed	2nd Quarter FY 1988
3.	(U) Contract Award	4th Quarter FY 1988
4.	(U) System Design Completed	4th Quarter FY 1989
5.	(U) Aircraft Modification Completed	4th Quarter FY 1990
6.	(U) Ground Check-out Completed	2nd Quarter FY 1991
7.	(U) First Flight	3rd Quarter FY 1991
8.	(U) Flight Test and Certification Completed	1st Quarter FY 1992
9.	(U) Transition to Flight Research Program	1st Quarter FY 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604239F
PE Title: Advanced Tactical Fighter (ATF) FSD

Project: N/A
Budget Activity: # 4 - Tactical Programs

Project Title: ATF FSD



POPULAR NAME: ATF

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			DAB II	Milestone III A and B
Engineering Milestones				PDR CDR
T&E Milestones				
Contract Milestones			FSD contract award	
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract			265,641	9,439,641 (9,174,000)
Support Contract			500	20,000 (19,500)
In-House Support			3,300	82,400 (79,100)
GFE/ Other			14,000	752,600 (738,600)
Total			283,441	10,294,641 (10,011,200)

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Program Element: #0604239F
PE Title: Advanced Tactical Fighter FSD

Project: # N/A
Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The ATF Program will develop the next-generation air superiority fighter for introduction in the late-1990s to counter the emergence of large numbers of advanced Soviet fighters. The ATF is designed to penetrate multiple targets. The ongoing competitive 54-month Demonstration/ Validation (Dem/Val) phase is designed to reduce risk for entry into Full Scale Development (FSD) and includes design trade-off analyses, flying prototype aircraft, ground-based avionics prototypes, and other contractor-tailored hardware intensive demonstrations. An additional 2 months to sustain engineering is planned for the winning contractor. The ATF FSD effort will be based on the Weapon System Specification formulated from data developed during the Dem/Val (Prototype) phase. The FSD program will consist of design, fabrication, and development flight testing of 9 FSD test vehicles; updating of Avionics Flying Laboratory (AFL) and using it to develop and integrate the FSD avionics suite; and design, development, and evaluation of all necessary supporting equipment, information, and planning for the production and operational fielding of the ATF Weapon System.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments: Not Applicable.

2. (U) FY 1990 Planned Program: Not Applicable.

3. (U) FY 1991 Planned Program:
   - (U) Conduct FSD source selection and award contracts to winning weapon system contractor team and winning engine contractor.
   - (U) Initiate design of FSD aircraft and support elements.
   - (U) Initiate fabrication and assembly of FSD flight test engines.
   - (U) Upgrade avionics ground prototype to a system integration laboratory (SIL) to develop and test the full-up ATF integrated avionics architecture.
   - (U) Initiate validation of Common Avionics specifications.
   - (U) Use winner's Prototype Air Vehicles and completed AFL to provide initial flight environment experience and development for emerging avionics components and other subsystems until FSD aircraft are available.

4. (U) Program to Completion:
   - (U) Preliminary Design Review (PDR) will be completed in FY 1992.
   - (U) Critical Design Review (CDR) will be completed in FY 1993.
   - (U) Nine FSD aircraft will be delivered (FY 1994 to FY 1996).
   - (U) Testing will be conducted with these aircraft to include: weapon compatibility, performance, flying qualities, observables, integrated avionics, climatics, SEEK EAGLE and completion of Initial Operational Test and Evaluation (FY 1994 to FY 1996).

Program Element: #0604239F
PE Title: Advanced Tactical Fighter FSD

Project: # N/A
Budget Activity: # 4 - Tactical Programs

D. (U) WORK PERFORMED BY: The ATF FSD Program will be managed by the Aeronautical Systems Division (ASD), Wright-Patterson AFB OH. At the completion of the ongoing Dem/Val phase in FY 1991, the government will conduct an ATF FSD source selection and award contracts to a single airframe manufacturer and a single engine contractor.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: FSD Contract Award 4Q FY91 vice 2Q FY91.
3. (U) COST CHANGES: $1,266,341 increase due to additional engine airframe, ground and flight test due to extension of FSD for 1 year and the use of Dec 89 inflation indices.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-83, 9 Nov 84.
- (U) TAF 304-83-3/IIA, SORD for ATF (Revision 1), 1 Feb 89.
- (U) ATF TEMP, 3 Mar 89.

G. (U) RELATED ACTIVITIES:
- (U) PE #0603230F, ATF (Dem/Val), focuses on the ATF mission and is performing risk reduction demonstrations prior to entering FSD.
- (U) Preliminary FSD for Integrated Electronic Warfare Systems/Integrated Communications, Navigation, Identification Avionics (INEWS/ICNIA) (PE #0604250F) provides the common core set of integrated avionics module designs for integration into the overall weapon system and continue test and validation of ATF applicable avionics modules.
- (U) ATF procurement will be funded in PE #0207219F, ATF Procurement.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not applicable.

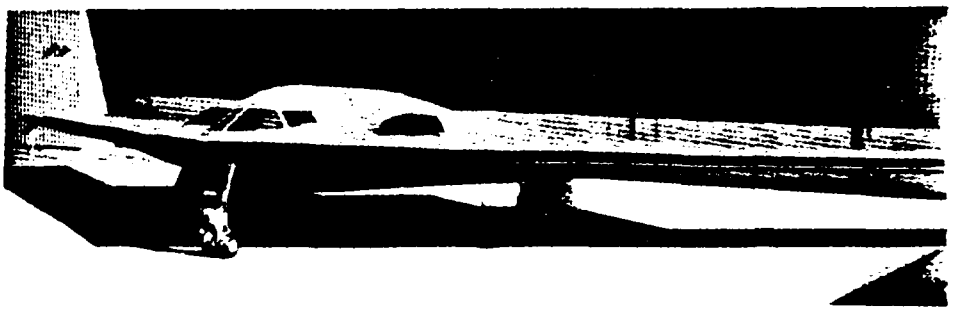
I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

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

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604240F Project: # N/A
PE Title: B-2 Advanced Technology Bomber Budget Activity: #3-Strategic Programs

Project Title: B-2 Advanced Technology Bomber



POPULAR NAME: B-2

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

SCHEDULE	FY 1989	FY 1990	FY 1991	TO COMPLETE
Program Milestones			Full Production Decision	
Engineering Milestones	First Flight			
T&E Milestones		Start L/O Testing		
Contract Milestones		Award FY89/ FY90 LRIP Contract	Award FY91 Production Contract	
BUDGET ($000)	FY 1989	FY 1990	FY 1991	PROGRAM TOTAL (To Complete)
Major Contract				
Support Contract				
In-House Support				
GFE/Other				
TOTAL	2,176,560	1,881,448	1,566,692	21.3B (2,769,312)

Program Element: #0604240F Project: # N/A
PE Title: B-2 Advanced Technology Bomber Budget Activity: #3-Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

The B-2 is a multirole strategic bomber with exceptional range and payload that is capable of performing both the conventional and nuclear delivery roles. Deployment of the B-2 will address the national requirement to increase our targeting flexibility, to redress the relative decline of our strategic capabilities, and to revitalize our strategic deterrent forces. The B-2 program will significantly enhance the manned bomber portion of the strategic TRIAD, while preserving the vitally needed flexibility for worldwide nonnuclear force projection in response to unforeseen contingencies.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued B-2 system development with emphasis on flight test activities of the Full Scale Development (FSD) aircraft.
   - (U) Continued flight testing of navigation and radar systems on C-135 flying test bed.
   - (U) Began initial testing of D&DT airframe.

2. (U) FY 1990 Planned Program:
   - (U) Continue B-2 system development with emphasis on flight test activities of the FSD aircraft.
   - (U) Continued flight testing of navigation and radar systems on C-135 flying test bed.
   - (U) Continued testing of the D&DT airframe and initial testing of static airframe.

3. (U) FY 1991 Planned Program:
   - (U) Continue B-2 system development with emphasis on flight test activities of the FSD aircraft.
   - (U) Continued flight testing of navigation and radar systems on C-135 flying test bed.
   - (U) Continued testing of D&DT and static airframe.

4. (U) Program To Completion:
   - (U) Complete flight testing of the B-2 aircraft.
   - (U) Complete testing of D&DT and static airframe.

D. (U) WORK PERFORMED BY:

Program Element: #0604240F Project: # N/A
PE Title: B-2 Advanced Technology Bomber Budget Activity: #3-Strategic Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES:
   - (U) FY89 and FY90 combined into a single LRIP contract.
   - (U) Full production decision moved from FY90 to FY91.
   - (U) Multiyear procurement start date moved from FY92 to FY93.
   - (U) RAA moved from FY94 to FY95.
   - (U) Procurement program extended by one year to FY96.
3. (U) COST CHANGES:
   - (U) Total program cost increased from $67.7B to $70.2B (May 89 DAB) as a result of stretching the procurement program and delaying the full production and multiyear decisions by one year. A revised estimate of total program cost incorporating the effects of the Boeing strike (fall FY89), the quantity reduction directed by the FY90 Appropriation Bill, and the revised OSD inflation rates as of Jan 1990, will be available later, after review by the Air Force and OSD CAIG.

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC Requirements Documents, Mar 1985, classified S/SAR
- (U) B-2 TEMP, Nov 1989, classified S/SAR
- (U) B-2 ADM, Jun 1989, classified SECRET

G. (U) RELATED ACTIVITIES:
- (U) The aircrew training devices for the B-2 are funded in the B-2 baseline. The aircrew training devices development and procurement costs are included in the total program cost. The aircrew training devices program is managed by the B-2 System Program Office and includes eight Weapon System Trainers (WST), two Weapon System Operator Mission Trainers (WSOMT), and a System Support Center (SCC).
- (U) Other Related activities. None.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604240F Project: # N/A
PE Title: B-2 Advanced Technology Bomber Budget Activity: #3-Strategic Programs

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

	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate
1. (U) PROCUREMENT:	3,036,831	2,309,422	3,827,643
QTY:	(3)	(2)	(5)
2. (U) MILITARY CONSTRUCTION:	59,000	112,000	141,000

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
(U) Acceptance of D&DT airframe	6 May 89	Delivered
(U) First flight	17 Jun 89	Successful
(U) Acceptance of static airframe	9 Jan 90	Delivered
(U) Total of 8 test flights (31.6 hrs)		Successful

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
(U) Future events classified C/SAR		

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604242F
PE Title: Advanced Tactical Aircraft (ATA)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

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

Project Title: Advanced Tactical Aircraft

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ATA				CONT	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The Advanced Tactical Aircraft (ATA) program will develop the next generation deep interdiction fighter to replace the F-111.

The ATA will face vastly improved defenses made up of a network of air and ground threats significantly improved over present forces. These forces threaten our ability to penetrate Warsaw Pact and other defended areas worldwide and pose a serious threat to the F-111.

readiness, reliability, maintainability and supportability will be improved through fault tolerant systems with on-board detection/isolation capabilities and faster flightline repair.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U)
   - (U)
   - (U)

2. (U) FY 1990 Planned Program:
   - (U)
   - (U)
   - (U)

3. (U) FY 1991 Planned Program:
   - (U)
   - (U)
   - (U)

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

D. (U) WORK PERFORMED BY:

(U) Prime Contractors:

General Dynamics	Ft. Worth, TX	Concept Definition, Dem/Val, FSD phases
McDonnell Douglas Aircraft	St. Louis, MO	Concept Definition, Dem/Val, FSD phase

Program Element: # 0604242F
PE Title: Advanced Tactical Aircraft (ATA)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

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

F. (U) PROGRAM DOCUMENTATION:
- (U) SAF/AQ ATA Acquisition Strategy Briefing to AF/CC with attached SAF/AQ Memorandum, 13 May 1988.
- (U) TAF SON 336-88, 1 Mar 1989.
- (U) TAF SORD 336-88-I-A,19 June 1989.
- (U) MOU for ATF and ATA Cross Service Utilization, 4 Mar 1986.

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0604233N (Navy A-12).
  -- (U) Programmatic relationship is established by the 4 Mar 86 MOU for Cross-Service Utilization of ATF and ATA.
  -- (U) Air Force direction is contained in the 13 May 88 SAF/AQ Acquisition Strategy Briefing to the AF/CC.
  -- (U) The Air Force has staffed the Navy Program Office with three Air Force Officers (program manager, engineer, and logistician) to provide extra space well-rounded Air Force representation in the basic Navy program.

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

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

J. (U) MILESTONE SCHEDULE:

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604243F Budget Activity: #6 - Defense Wide Mission Support
PE Title: Manpower, Personnel, and Training Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3816 Pilot Selection and Classification System (PSACS)	0	3,912	2,799	255	6,966
3817 Forcewide Training Systems	0	480	695	Cont	TBD
	0	4,392	3,494	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element provides engineering development to ensure transition of maturing manpower, personnel, and training (MPT) technologies from AF laboratories, and fielding of MPT systems which are logistically supportable by the operational forces. Historically, transition of MPT technologies to operational users has been ineffective due to a lack of a formal program. This program element will solve this problem and field technologies to improve effectiveness of AF training development/ delivery, performance assessment, personnel acquisition, job assignment, force management, and human performance in weapon systems.

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

1. (U) Project 3816, Pilot Selection and Classification System (PSACS): The Air Force needs the ability to select pilot candidates who have the best chance for completing pilot training. Small reductions in the attrition rate can save millions of dollars each year, as well as increase the number of pilots. Further, an additional capability is needed to predict the probability of success in specific types of aircraft. This capability supports Specialized Undergraduate Pilot Training (SUPT), which will provide basic pilot training in T-37 aircraft and allow immediate specialized training in T-38 aircraft for Fighter-Bomber pilots and in business jet trainers for Tanker-Transport pilots. The net result is a more efficient use of training aircraft, reduced attrition in pilot training, and greater job satisfaction. This program will design, develop, validate, and produce a specialized computerized testing device and computer-based battery of tests designed to predict which pilot candidates will be successful in training and follow-on aircraft assignment.

(U) FY 1989 Accomplishments: Not applicable.

(U) FY 1990 Planned Program:
- (U) Begin full scale development of the Pilot Selection and Classification System (PSACS) based upon technology

developed by the AF Human Resources Laboratory in PE 0602205F and PE 0603227F.
- (U) Begin software coding of the selection test battery.
- (U) Produce prototype test devices to verify that the new design is capable of producing valid predictions of success.

(U) FY 1991 Planned Program:
- (U) Complete full scale development of the PSACS.
- (U) Integrate a validated specialized pilot training predictor into the test battery.
- (U) Conduct Operational Testing and Evaluation of the PSACS.
- (U) Set up an operational support center to maintain the system and provide software support.
- (U) Begin production of the PSACS test devices (funded in PE 080478F).

(U) Work Performed by: Project is managed by Human Systems Division, Brooks AFB TX. The major contractors are to be determined.

(U) Related Activities:
- (U) PE 0602205F, Personnel, Training, and Simulation
- (U) PE 0603227F, Personnel, Training, and Simulation Technology
- (U) PE 0804748F, Flight Screening
- (U) No unnecessary duplication of effort within AF or DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 3817, Forcewide Training Systems: New and increasingly complex weapon systems and rapidly changing technology are vastly increasing AF training requirements, while training resources remain relatively fixed. Personnel programs, such as RIVET WORKFORCE, which combine related AF specialities, further increase enlisted field training requirements. Thus, the AF will have to rely more heavily upon on-the-job training and more efficient methods of training. This program will capitalize on the advances in intelligent computer-aided instruction and computer engineering and will focus on providing cost effective, efficient delivery of training to the operational forces.

(U) FY 1989 Accomplishments: Not applicable.

(U) FY 1990 Planned Program:
- (U) Begin design and analysis of system concept options and full scale development of an AF enlisted field training system based upon the results of the advanced technology development project in PE 0603227F, Personnel, Training, and Simulation Technology (Project 2557).

Program Element: #0604243F Budget Activity: #6 - Defense Wide Mission Support
PE Title: Manpower, Personnel, and Training Development

- (U) Develop and evaluate computer-based tutoring system for maintenance troubleshooting.
- (U) Begin full scale development of Maintenance Skills Tutors for Tactical Air Forces, based upon the results of the advanced technology demonstration project in PE 0603227F, Personnel, Training, and Simulation Technology (Project 2949).

(U) FY 1991 Planned Program:
- (U) Conduct pre-acquisition analysis of the enlisted field training system.
- (U) Conduct preliminary design review of Maintenance Skills Tutors.
- (U) Begin software conversion for Maintenance Skills Tutors.

(U) Work Performed By: This program will be managed by the Human Systems Division, Brooks AFB TX. The major contractors are to be determined.

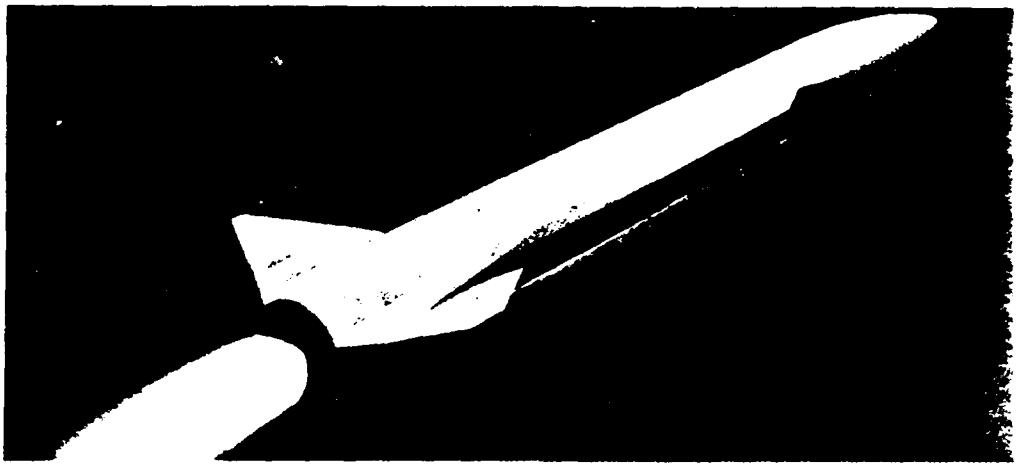
(U) Related Activities:
- (U) PE 0601102F, Defense Research Sciences
- (U) PE 0602205F, Personnel, Training, and Simulation
- (U) PE 0603227F, Personnel, Training and Simulation Technology
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area
- (U) PE 0602234N, Systems Support Technology: Human Factors Technology Area
- (U) PE 0603733N, Training Devices Technology
- (U) PE 0603720N, Education and Training
- (U) PE 0603707N, Manpower and Personnel Systems Development
- (U) PE 0603733N, Training Devices Technology
- (U) PE 0603720N, Education and Training
- (U) PE 0604703N, Training and Personnel Systems Development
- (U) PE 0602716A, Human Factors Engineering Technology Dev
- (U) PE 0602727A, Non-System Training Devices Technology
- (U) PE 0602785A, Manpower, Personnel, and Training Technology
- (U) PE 0603007A, Human Factors, Personnel, and Training Advanced Development
- (U) PE 0604722A, Education and Training Systems
- (U) No unnecessary duplication of effort within the AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604244F Project: 3182
PE Title: SRAM II - Eng Development Budget Activity: #3 - Strategic Programs
Project Title: Short Range Attack Missile II (SRAM II)



POPULAR NAME: SRAM II

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones				MS IIIA Feb 92 IOC FY94/3
Engineering Milestones			CDR Sep	
T&E Milestones			1st Flight April	25th Flight Feb 93
Contract Milestones			LRIP LL February	LRIP Feb 92 FRP FY93/3
BUDGET	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	91,500	64,100	33,500	333,900 (34,200)
Support Contract**	71,300	92,700	86,000	391,400 (77,500)
In-House Support	3,000	13,200	6,800	31,800 (7,000)
GFE/ Other	25,083	45,630	30,582	238,400 (79,300)
Total	190,883*	215,630	156,882	1,013,500

* Funds in PE #0603364F, SRAM II Advanced Development
** Funds engineering development to integrate SRAM II on the B-1B

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
Strategic Air Command requires an improved short range attack missile to improve the operational flexibility of our penetrating bombers by providing

Program Element: # 0604244F Project: 3182
PE Title: SRAM II - Eng Development Budget Activity: #3 - Strategic Programs

a single weapon to strike defended, hard and relocatable targets without having to directly overfly targets. SRAM II is a supersonic, air-to-ground nuclear weapon that severely stresses the defensive threat. The combination of supersonic speed, low observability, and variable flight profile makes SRAM II highly survivable in terminal defense zones. SRAM II significantly compounds enemy defense requirements and prevents optimization of defenses against low altitude subsonic targets. The required performance improvements relative to SRAM-A are attainable with existing technology. It is not the intent of this program to stress technology to its limits, but rather to build a state-of-the-art SRAM II using available technology.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Planned Program:
   - (U) Full scale engineering development activities continued, with all major subsystems completing CDR, except for the rocket propellant. Final CDR delayed from May 89 to Sep 90.
   - (U) Fabrication of flight test missiles began
   - (U) Flight test plans completed

2. (U) FY 1990 Planned Program:
   - (U) FSD activities will begin transition to system level testing of the fully integrated missile
   - (U) Complete the rocket motor fault tree analysis and institute procedures to correct cold soak propellant cracking
   - (U) Complete production of development rocket motors
   - (U) Continue testing SRAM II/B1-B integration

3. (U) FY 1991 Planned Program:
   - (U) Delivery of first flight test missile
   - (U) The first live test launch will be conducted, with six additional flights, including DOE test warhead integration
   - (U) Conduct eight DT&E test flights of the missile
   - (U) Rocket motor preliminary flight rating test complete
   - (U) Rocket motor qualification phase started
   - (U) First Avionics Lifetime Durability Tests complete
   - (U) B-1B aircraft and launcher FSD equipment validation and verification complete
   - (U) Continued B-2 integration and lab testing

4. (U) Program to Completion:
   - (U) Long lead low rate initial production
   - (U) Low rate initial production authorization (MS IIIA)
   - (U) Missile production transitions to automated production facility in Oak Ridge, TN
   - (U) Radar cross section testing complete

Program Element: # 0604244F Project: 3182
PE Title: SRAM II - Eng Development Budget Activity: #3 - Strategic Programs

- (U) Continue to flight test the missile, completing the scheduled 25 launch test program in FY 1992. The final five launches will be OT&E launches of production missiles that incorporate design changes identified during previous DT&E/IOT&E launches
- (U) Production approval to produce 1633 missiles

D. (U) WORK PERFORMED BY: Boeing Aerospace, Seattle, WA, and McDonnell Douglas Astronautics, St. Louis, MO, responded to our request for proposals. Boeing Military Airplane, Wichita, KS, and Rockwell International, El Segundo, CA, will integrate SRAM II on the B-1B aircraft. The SRAM II program will be directed by Air Force Systems Command's Aeronautical Systems Division, Wright-Patterson AFB, OH.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: Chosen alternate rocket propellant failed thermal cycle tests, as did the "Pathfinder" mixture. Pulse 2 cracked at extremely cold temperatures, yet Pulse 1 passed. Detailed fault tree analysis is being conducted to precisely determine the cause(s) and a fix. The investigation has centered on the propellant barrier interaction, Pulse 2 bulb geometry and propellant cure times. This delay has impacted CDR, first flight and subsequent milestones. Once the fix is implemented, there are no expected impacts to system capability.
2. (U) SCHEDULE CHANGES: Critical Design Review completion delayed from May 1989 to September 1990. First flight has been delayed from September 1990 until April 1991.
3. (U) COST CHANGES: RDT&E for FY 1991 has been reduced $55.9M from $212.8 to $156.9 and procurement has been reduced $62.0M from $83.2M to $21.2M. The FY 1992 budget estimate will incorporate the original FY 1991 LRIP production. The FY 1993 RDT&E will be increased to support the delayed flight test effort.

F. (U) PROGRAM DOCUMENTATION:

- (U) SAC SON 14-82, SECRET, 1 MAR 86
- (U) AFSC SCP, SECRET, 22 FEB 86
- (U) SRAM II DCP, 2 JUN 87
- (U) SRAM II SYSTEM SPECIFICATION, SECRET, 30 MAR 86
- (U) SRAM II TEMP w/ANNEX, SECRET, JAN 88
- (U) SAC SORD 14-82 II/III, SECRET, 16 OCT 89

G. (U) RELATED ACTIVITIES:

- (U) All missile development activities prior to FY 90 are funded through the SRAM II Advanced Development program (PE 0603364).
- (U) SRAM II will be developed for internal carriage on the B-1B (PE 0604226F) and B-2 (PE 0604240F).

Program Element: # 0604244F Project: 3182
PE Title: SRAM II - Eng Development Budget Activity: #3 - Strategic Programs

- (U) Funds are programmed in the B-1B program element to procure the hardware modifications to support SRAM II carriage. The SRAM II program element contains the RDT&E funds to develop the B-1B hardware modifications.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY1990 Actual	FY1991 Estimate	Total Program
Missile Procurement, BA 4201			
Funds (Weapon System Only)	10,791	21,210	1,277,000
Quantities			1633

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:
- (U) The United Kingdom (UK) is interested in developing/purchasing a nuclear tactical air-to-surface missile (TASM). The United States and UK have signed a Memorandum of Understanding for the exchange of SRAM II data to facilitate a UK feasibility study of this potential TASM solution (See SRAM-T Descriptive Summary, PE 0604245F).

J. (U) TEST AND EVALUATION DATA:
- (U) B-1B aircraft #9, at Edwards Air Force Base, has successfully been modified and instrumented to carry the SRAM II for the test program
- (U) Flight test began in Nov 89, carrying dummy shape missile to check the launcher modifications and instrumentation. A successful jettison of a dummy shape missile was accomplished on 20 Dec 89.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604245F
PE Title: Short Range Attack Missile - Tactical (SRAM T)
Project: XXX1
Budget Activity: #4 - Tactical Programs

Project Title: Short Range Attack Missile - Tactical (SRAM-T)



POPULAR NAME: SRAM-T

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		MS II Nov		MS III FY94/2 IOC
Engineering Milestones			PDR Oct CDR Jun	
T&E Milestones				1st Flight Jun 92 21st Flight FY94/2
Contract Milestones		FSD Feb		FRP LL FY93/4 FRP FY94/3
BUDGET	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract		26,100	70,800	197,800 (100,900)
Support * Contract		16,000	13,200	37,700 (8,500)
In-House Support		1,900	3,900	12,100 (6,300)
GFE/ Other		10,650	30,681	77,900 (36,569)
Total		54,650	118,581	325,500

* Funds engineering development for integr ting SRAM T on the F-15E.

Program Element: # 0604245F Project: XXX1
PE Title: Short Range Attack Missile - Tactical (SRAM T) Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The Short Range Attack Missile - Tactical (SRAM-T) is a first generation tactical nuclear air delivered missile capable of penetrating Soviet and Warsaw Pact air defenses to strike defended, hard and relocatable targets without having to directly overfly targets. The need for SRAM-T is based upon an operational deficiency: there are no tactical stand-off nuclear weapons for Tactical Air Force, Navy and NATO dual capable aircraft. A modified Short Range Attack Missile II (SRAM II) offers the least costly, most timely and lowest risk option for meeting the tactical nuclear stand-off weapon requirement. This modified SRAM II has been designated SRAM-T. Its extended range will enable aircraft to avoid enemy air defenses at or beyond the forward line of troops, as well as stand-off from terminal area target defenses. Its combination of supersonic speed, low observability and variable flight profiles will make the SRAM-T a highly survivable weapon, significantly compounding enemy defense requirements. The required SRAM-T performance modifications are attainable with existing technology. It is not the intent of this program to stress technology to its limits, but rather to build a state of the art missile using available technology.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments: Not applicable.

2. (U) FY 1990 Planned Program:
- (U) SRAM-T engineering change proposal award
- (U) F-15E integration engineering change proposal award
- (U) Conduct preliminary design reviews on the tactical missile variant of the basic SRAM II missile design, unique support equipment and aircraft integration effort

3. (U) FY 1991 Planned Program:
- (U) Conduct critical design reviews on the tactical missile, support equipment and aircraft integration effort
- (U) Initiate missile and aircraft computer software development
- (U) Conduct early vibration flyaround and wind tunnel testing
- (U) Begin engineering for test flight missile payloads with DOE
- (U) Conduct warhead support equipment and training development
- (U) Support Weapon Secure Storage System (WS3) vault integration and logistic support planning
- (U) Begin fabrication and qualification of SRAM-T test units and F-15E adaptor hardware

4. (U) Program to Completion:
- (U) Fabricate and qualify flight test assets
- (U) Conduct flight test program on the F-15E to include separation, captive carry and live launch missions. A total of 21 live launches are planned

Program Element: # 0604245F Project: XXX1
PE Title: Short Range Attack Missile - Tactical (SRAM T) Budget Activity: #4 - Tactical Programs

- (U) Conduct flight test program on the F-111. Conduct separation, captive carry and live launch test missions to include two live launches per carrier (four total live launches planned)
- (U) Begin SRAM-T long lead production based upon successful completion of developmental test launches on the F-15E
- (U) Begin SRAM-T full production based upon successful completion of developmental and operational test launches from the F-15E
- (U) Conduct flight test qualification program on other tactical aircraft as required (F-111, EPG F-16, Tornado)

D. (U) WORK PERFORMED BY: Boeing Aerospace, Seattle, WA, will modify the SRAM II for the tactical mission and McDonnell Douglas Astronautics, Saint Louis, MO, will integrate the SRAM-T on the F-15E.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Increased due to new inflation indices and a F-15E integration contract that is greater than the original estimate.

F. (U) PROGRAM DOCUMENTATION:
- (U) NWRS-85, SECRET, MAY 85
- (U) TAC SON 306-86, SECRET, JUN 87
- (U) MNS, SECRET, APR 88
- (U) AFSC SCP, SECRET, SEP 88
- (U) TAF SORD 306-86-I-A, SECRET, 8 Aug 89
- (U) SRAM-T DCP, SECRET, 20 Sep 89
- (U) SRAM-T TEMP, SECRET, 16 Nov 89

G. (U) RELATED ACTIVITIES:
- (U) The parent SRAM II design is being developed under the SRAM II Engineering Development program, PE #060244F
- (U) The SRAM-T/F-15E integration funding is justified under this descriptive summary and is contained in PE #0207134F
- (U) NATO nuclear weapon storage facilities are funded in the Weapons Storage and Security System (WS3) program, PE #0305155F.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS ($ in Thousands):
- (U) F-15E modification production funding (3010), PE #0207134F, will be included in the SRAM-T program in the to complete data.
- (U) Engineering to built an adapter to hang the missile in the WS3 (3080), PE #0208030, is contained within the SRAM-T program in the to complete data.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

- ( ) The United Kingdom (UK) is interested in developing/purchasing a nuclear tactical air-to-surface missile (TASM) to [redacted] The United States and UK have signed a Memorandum of Understanding for the exchange of (1) SRAM II and Supersonic Low Altitude Target (SLAT) data to facilitate a UK feasibility study of these alternative TASM systems and (2) Tornado aircraft data for SRAM-T integration requirements on NATO dual capable aircraft.

J. (U) TEST AND EVALUATION DATA: None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604247F Budget Activity: #4 - Tactical Programs
PE Title: Modular Automatic Test Equipment

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2503 Modular Automatic Test Equipment (MATE)	11,423	11,000	11,025	Cont.	TBD
3080 Generic Integrated Maintenance Diagnostics (GIMADS)	0*	2,926	2,022	Cont.	TBD
Total	11,423	13,926	13,047	Cont.	TBD

*FY 1989 previously funded under PE 0604708F - Other Operational Equipment

B. (U) BRIEF DESCRIPTION OF ELEMENT: Previous and current methods used to specify, design, build and support automatic test systems (ATS) have resulted in a proliferation of equipment, low operational reliability and supportability, and increased life cycle costs. A major reason why aircraft availability (force readiness) is often below desired levels is because of malfunctioning and unsupportable ATS at all levels of maintenance. The MATE program has developed a set of guides which delineates a standard modular architecture and a management system for ATS and established a framework for the acquisition and support of future Air Force ATS. In addition, an Air Force owned MATE Operations Center has been developed to manage the MATE hardware and software standards, perform verification testing on proposed MATE modules and provide a center of MATE expertise for government and industry. The GIMADS program develops systems engineering methods to integrate maintenance diagnostics considerations into weapon system design, development and deployment. Special needs of various theaters of operation, including those peculiar to the rapid deployment forces, are addressed. The overall goal of GIMADS, in concert with the MATE program, is to provide methods that can achieve 100% fault detection/fault isolation capabilities in any weapon system.

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

1. (U) Project 3080, GIMADS: Provides generic, expandable, integrated maintenance diagnostics methods with early demonstration of GIMADS application on fielded weapon system upgrades.

(U) FY 1989 Accomplishments:
- (U) Redefined and integrated techniques and methodologies for non-electronics fault isolation with continuing application to weapon system acquisitions
- (U) Continued technical investigation tasks

(U) FY 1990 Planned Program:
- (U) Update GIMADS Air Force Guide Specification (AFGS) and Mil-Standard (Mil-Std) Specification with requirements derived from technology tasks
- (U) AFGS 85% complete
- (U) Mil-Std 90% complete

(U) FY 1991 Planned Program:
- (U) Complete technology tasks of avionics prognostics and software diagnostics
- (U) GIMADS AFGS and Mil-Std 95% complete
- (U) Issue interim AFGS and Mil-Std

(U) Work Performed By: The GIMADS Program is managed by the GIMADS Program Office of the Aeronautical Systems Division at Wright-Patterson AFB, Ohio. The primary contractor for GIMADS is General Dynamics, Ft Worth Division, Ft Worth, Texas. Other contractors on the GIMADS contractor team are General Dynamics (Electronics Division), Hughes Aircraft Company, Marcon Industries, Inc., Rockwell International, Giordano Associates, General Electric Company, TRW, and Bell Helicopter.

(U) Related Activities:
- (U) Close cooperation is maintained with other services via the DOD/Industry Forum held annually. GIMADS is supported with recommendations by the DOD/Industry Forum consisting of approximately 150 companies formed as a subgroup of the Integrated Diagnostics Working Group of the National Security Industrial Association.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604247F
PE Title: Modular Automatic Test Equipment
Project Number: 2503
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MATE	11,423	11,000	11,025	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
Previous Air Force methods used in acquiring automatic test systems (ATS) have caused a proliferation of unique equipment (over 500 different systems) resulting in specialized training, technical manuals and spares, as well as low operational reliability, supportability, weapon system interoperability and large life cycle costs. A major reason why aircraft availability (force readiness) is often below desired levels is because of malfunctioning and unsupportable ATS at all levels of maintenance. The MATE program has developed a methodology which delineates a standard modular architecture and a management system for acquisition and support of all future Air Force ATS. In addition, an Air Force owned MATE Operations Center has been developed to manage the MATE hardware and software standards, perform verification testing on proposed MATE modules and provide a center of MATE expertise for government and industry.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Developed and released downsized tester guide
   - (U) Completed FCA/PCA of MATE Control & Support Software (MCSS) 5.1
   - (U) Completed CDR for MATE Test Executive and ATLAS Complier
   - (U) Released new MATE standard for digital Simulation Data Format
   - (U) Released compact version of MATE guides
   - (U) Provided Instrumentation-on-a-Card (IAC) verification procedures to the MATE Operations Center
   - (U) Completed support to the A-7 CAST and B-52 MIDATS programs
   - (U) Released MCSS version 6.0 for initial site testing

2. (U) FY 1990 Planned Program:
   - (U) Release MCSS version 5.1, 5.2 & 6.0
   - (U) Develop automated MATE guides with application of Artificial Intelligence
   - (U) Complete development of digital bus testing capability
   - (U) Develop RF and Electro-optical interface standards
   - (U) Begin development of Ada for MCSS

3. (U) FY 1991 Planned Program:
   - (U) Continue to develop and implement new technologies into the MATE architecture and standards (i.e. 18 gigahertz, integrated diagnostics)
   - (U) Continue development of an Ada capability in support of next generation test environments
   - (U) Develop an automated statement of work (SOW) tool
   - (U) Initiate Test Program Set (TPS) development environment

4. (U) Program to Completion:
   - (U) Complete and release MATE Ada software in support of next generation test environments
   - (U) Establish VHSIC test standards
   - (U) Complete and release advanced Test Program Set (TPS) development environment
   - (U) Issue revised MATE Master Plan
   - (U) Apply MATE system to new weapon system development and major modifications
   - (U) Apply downsized tester standards to mobile test requirements

D. (U) WORK PERFORMED BY: The MATE Program is managed by the Support Equipment Systems Program Office of the Aeronautical Systems Division at Wright-Patterson AFB, Ohio. The MATE Operations Center is manned and controlled by the Automated Test Systems Division at the San Antonio Air Logistics Center, Kelly AFB, Texas. The MATE integrating contractor for new technology insertion is SOFTECH, Alexandria, Virginia. MATE is also supported with recommendations by the MATE Users Group (MUG) composed of approximately 100 companies formed as a subgroup of the Automatic Testing Committee of the National Security Industrial Association.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: None.
   3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) Mission Element Need Statement - USAITRADOC ACN 22358 - 13 Aug 1979
   - (U) MATE PMD 7098 (10)/64247F - 19 Mar 1987
   - (U) MATE TEMP - May 1981
   - (U) AFSC/AFLC Regulation 800-23, MATE, 25 Jan 1984
   - (U) SAF/RL MATE Air Force Policy Letter for Commanders - 1 Jul 1987

G. (U) RELATED ACTIVITIES:
   - (U) Joint Logistics Commanders (JLC) Panel on Automatic Testing
   - (U) Navy Consolidated Automated Support System (CASS) Program
   - (U) Army Intermediate Forward Test Equipment (IFTE) Program
   - (U) Industry MATE Users Group (MUG), subgroup of the Automatic Testing Committee of the National Security Industrial Association
   - (U) A-10 Intermediate Automatic Test Station (IATS), Program Element #0207131F (A-10 Squadrons)
   - (U) B-1B Depot Automatic Test System for Avionics (DATSA), Program Element #0101126F (B-1B Squadrons)
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not applicable.
2. (U) MILITARY CONSTRUCTION: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1.	(U)	MATE Full Scale Development Phase I Completed	Sep 1985
2.	(U)	MATE Operations Center Full Operational Capability	Dec 1987
3.	(U)	Release of Instrument on a Card Standard	Jun 1988
4.	(U)	Unit Under Test (UUT) Simulator Completed	Nov 1988
5.	(U)	Program Management Transfer of MATE 5.0 software	Dec 1988
6.	(U)	Simulation Data Format Standard Completed	May 1989
7.	(U)	Downsized Tester Guidance Completed	Jun 1989
8.	(U)	Restructure MATE Guides Completed	Jul 1989
9.	(U)	Ada Design Activity Begins	Aug 1989
10.	(U)	Release MATE Software Versions 5.1 & 6.0	FY 1990
11.	(U)	Begin Development of Automated MATE Guides	FY 1990
12.	(U)	Complete Development of Digital Bus Testing	FY 1990
13.	(U)	Complete Development of Radio Frequency (RF) Std	FY 1990
14.	(U)	Initiate Development of Test Program Set (TPS) Development Environment	FY 1991
15.	(U)	Establish VHSIC Test Interface Standard	FY 1992
16.	(U)	Issue Revised MATE Master Plan	FY 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604249F
PE Title: Night/Precision Attack

Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2693 LANTIRN	4,504	3,514	1,692	-0-	528,300
3920 Night Attack Program		8,000	6,000	CONT	TBD
A/OA-10 Technology Demonstrator Program (TDP)	1,849	-0-	-0-	-0-	-0-
Total	6,353	11,514	7,692	CONT	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: PE contains two separate efforts which contribute to Air Force capabilities to conduct successful interdiction and Close Air Support/Battlefield Air Interdiction (CAS/BAI) missions at night. Funding under Project No. 2693 completes the development and testing of the ongoing Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system on production F-15E and F-16 Block 40 aircraft. The Night Attack Program (NAP) Project No. 3920, is an FY 1990 new start which will develop, test, and evaluate Forward Looking InfraRed (FLIR) based systems to enhance night capabilities for follow-on CAS/BAI aircraft. $1,849 thousand was added to this PE in FY 1989 to initiate the A/OA-10 Technology Demonstrator Program (TDP). This effort is discussed in the FY 1991 RDT&E Descriptive Summary for A-10 Squadrons, PE 0207131F.

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

1. (U) Project 3920, Night Attack Program: The need for enhanced night attack capabilities is documented in TAF SON 312-88, Follow-on Close Air Support (CAS) aircraft, dated 10 May 89. The Night Attack Program (NAP) will develop, test, evaluate, and demonstrate night vision technologies for potential application to F-16 and A-10 aircraft. The program will investigate fixed and head-steered FLIRs, night vision goggle (NVG) systems, helmet-mounted displays (HMD), and current/future weapons integration. Results will be used by the Tactical Air Command to establish the requirements for F-16 and A-10 modifications and for a follow-on CAS/BAI aircraft.

(U) FY 1989 Accomplishments: Not Applicable.

(U) FY 1990 Planned Program:
- (U) Identify trade-offs between head-steered and fixed FLIR systems.
- (U) Investigate improvements to existing FLIR technology.
- (U) Investigate helmet-mounted displays/sights (HMD/S) and head position sensing systems.
- (U) Evaluate advantages of an automatic Maverick missile handoff technique in the CAS/BAI mission.
- (U) Evaluate NVG technology and its performance as a situation awareness aid.
- (U) Provide recommendation for FLIR/HMD system for follow-on development and integration.

Program Element: #0604249F
PE Title: Night/Precision Attack

Budget Activity: #4 - Tactical Programs

(U) FY 1991 Planned Program:
- (U) Continue evaluation/assessment of most promising night attack technologies.
- (U) Conduct source selection.
- (U) Begin FSD for preferred FLIR-based system.

(U) Work Performed By: General Dynamics, Ft Worth TX, under contract to the F-16 program office, Aeronautical Systems Division, Wright-Patterson AFB OH.

(U) Related Activities:
- (U) Program Element #0207133F, F-16 Squadrons.
- (U) Program Element #0207131F, A-10 Squadrons.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

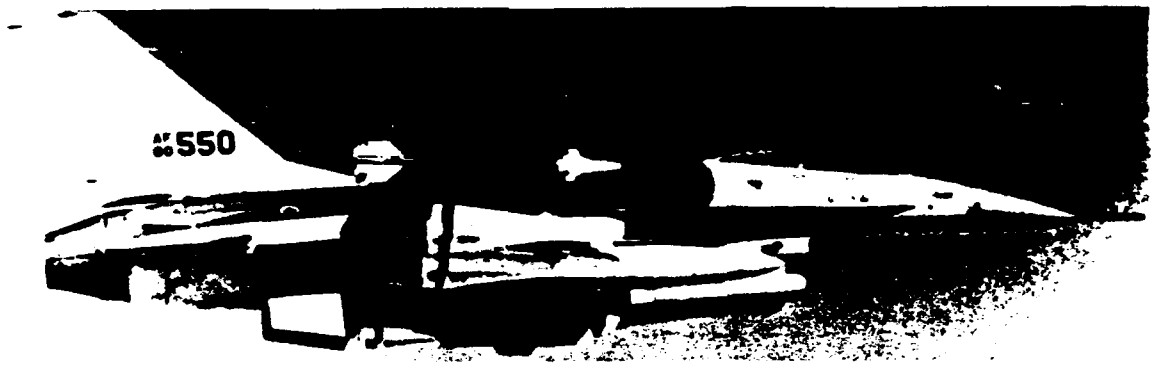
(U) Other Appropriation Funds: Not Applicaable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604249F
PE Title: Night/Precision Attack
Project Number: 2693
Budget Activity: #4 - Tactical Programs

Project Title: Low Altitude Navigation and Targeting Infrared System for Night



POPULAR NAME: LANTIRN

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Tgt Pod IIIB Dec 88 Nav Pod IOC	Tgt Pod IOC	N/A	N/A
Enginerng Milestones	N/A	N/A	N/A	N/A
T&E Milestones	N/A	N/A	N/A	N/A
Contract Milestones	N/A	N/A	N/A	N/A
BUDGET	**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract	1,538	0	0	346,152 (0)
Support Contract	0	0	0	63,094 (0)
In-House Support	1,967	2,514	1,192	37,578 (0)
GFE/ Other	999	1,000	500	81,476 (0)
Total	4,504	3,514	1,692	528,300 (0)

Program Element: #0604249F
PE Title: Night/Precision Attack
Project Number: 2693
Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The threat posed by the enemy's formidable armored and air forces has increased in the past few years and is projected to become stronger in both quantitative and qualitative terms. Enemy armor, equipped with night vision and accurate laser ranging systems, has been combined with new hardware, training and operational doctrine to assure a continued thrust during night and adverse weather conditions. Successful interdiction and close air support missions against this threat require low altitude navigation, standoff target acquisition and accurate weapons delivery against small mobile targets as well as fixed targets. The need for LANTIRN is documented in Tactical Air Forces' Statement of Operational Need 302-81, Night Attack Capabilities. LANTIRN responds to that need by providing the capability to conduct close air support and interdiction missions at night and under-the-weather for F-15E and F-16C/D fighter aircraft. LANTIRN provides the capability not only to attack at night, but also to attack with precision laser guided weapons day or night and in conditions of limited visibility. The LANTIRN program includes development and testing of a wide angle raster head-up display, a navigation pod, and a targeting pod. The navigation pod contains a terrain following radar and a fixed forward looking infrared (FLIR) sensor; the targeting pod contains a gimballed FLIR, a laser designator, an automatic tracker, a missile boresight correlator, and growth provisions for an automatic target recognizer.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued integration and development flight testing of LANTIRN/ F-15E and the F-16 Block 40 production aircraft.
   - (U) Continued production of both navigation and targeting pods.

2. (U) FY 1990 Planned Program:
   - (U) Complete integration and development flight testing of LANTIRN/ F-15E and the F-16 Block 40 production aircraft.
   - (U) Complete production of navigation pods and continue production of targeting pods.

3. (U) FY 1991 Planned Program:
   - (U) Develop and flight test software changes resulting from initial operational use of the targeting pod. FY 1991 will be the final year of the LANTIRN program.

4. (U) Program to Completion: Not Applicable.

Program Element: #0604249F
PE Title: Night/Precision Attack
Project Number: 2693
Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY: The LANTIRN program office is located at Aeronautical Systems Division, Wright-Patterson AFB OH. The LANTIRN prime contractor is Martin Marietta, Orlando FL. Major subcontractors include Texas Instruments, Dallas TX, for terrain following radar; Delco Electronics, Milwaukee WI, for Military Standard 1750 pod control computers; Sperry Systems Management, Great Neck NY, for pod automatic test support equipment; and Grumman Aerospace Corp., Long Island NY for portions of the radar support equipment. The head-up display prime contractor is GEC Avionics, Rochester, England. F-16/LANTIRN integration work is being performed by the General Dynamics Corp., Ft. Worth TX. F-15E/LANTIRN integration work is being performed by the McDonnell Douglas Corp., St. Louis MO.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: $1.7 million increase to fund development and testing of software changes resulting from initial operational use of the targeting pod.

F. (U) PROGRAM DOCUMENTATION:
- (U) SON 302-81, Dec 86
- (U) TEMP, Mar 88
- (U) SORD, Oct 89
- (U) APB, Jan 90

G. (U) RELATED ACTIVITIES:
- (U) Aircraft production changes to support LANTIRN/F-16 integration are funded under PE 0207133F, F-16 Squadrons. Aircraft production changes to support LANTIRN/F-15E integration are funded under PE 0207134F, F-15E Squadrons.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, PE #0207249F					
Funds	709,700	250,100	192,500	0	3,273,000
Quantity					
Navigation Pods	240	0	0	0	561
Targeting Pods	231	120	65	0	506

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: #0604249F
PE Title: Night/Precision Attack

Project Number: 2693
Budget Activity: #4 - Tactical Programs

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
LANTIRN DT&E/IOT&E	Completed Jun 87	Supported first nav pod production decision; delayed tgt pod by 1 year
LANTIRN FOT&E	Completed Sep 87	Supported tgt pod IIIB decision
LANTIRN DT&E	Completed Dec 88	Supported tgt pod production decision and cleared OSD(DOT&E) concerns
F-15E/LANTIRN Phase II DT&E	Completed Aug 88	Supported tgt pod production decision
F-15E OT&E	Completed Sep 89	Successful
F-15E/LANTIRN Phase IV DT&E	Completed Nov 89	Successful

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Results
F-15E/LANTIRN Phase VII DT&E	Nov 89 - Nov 91	In process

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604250F Budget Activity: #4 - Tactical Programs
PE Title: Integrated Electronic Warfare/Communications Navigation Identification (EW/CNI) Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3389 Integrated Electronic Warfare System (INEWS) Pre-FSD	76,988	59,800	1,000	0	145,470
3393 Integrated Communications, Navigation, Identification Avionics (ICNIA) Pre-FSD	33,534	20,980	3,528	0	58,042
3786 Integrated Communication Security (COMSEC)	8,662	17,414	6,340	0	32,416
3858 SEEK SPARTAN	384	5,000	5,740	Cont	TBD
Total	119,568	103,194	16,608	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: An advanced avionics development program with specific application to the Advanced Tactical Fighter (ATF), the Army Lightweight Helicopter (LHX), Advanced Tactical Aircraft (ATA), and other low observable platforms. The INEWS/ICNIA program supports a modular architecture made up of advanced semi-conductor technologies including insertion of Very High Speed Integrated Circuits (VHSIC). Avionics suites based on these programs will combine high information processing power, built-in diagnostics, modular packaging techniques, and fault tolerant design. Program goals include very high mission reliability, reduction in support costs and reduction in aircrew workload in a dense threat environment. Further, by integrating INEWS/ICNIA technologies with the offensive avionics package, the pilot's situation awareness and combat effectiveness will be increased. The INEWS/ICNIA pre-FSD and COMSEC tasks directly support the ATF program by developing and delivering clusters of Advanced Development Model(ADM) modules which will be incorporated into prototype ATF integrated avionics suites. During ATF FSD these modules will be developed into JIAWG compliant modules for use in the Common Avionics Baseline (CAB) architecture. The SEEK SPARTAN task is designed to apply INEWS technology to meet functional requirements of existing operational aircraft.

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

1. (U) Project 3389 INEWS Pre-FSD: Develops modular, integrated threat warning and countermeasures functions as part of advanced integrated avionics suites. Provides self-protection capabilities that include: 1) advanced receivers and signal processors; 2) VHSIC based data processing and management system; 3) RF and IR warning receivers and processors; 4) advanced expendables and 5) low observable apertures.

(U) FY 1989 Accomplishments:
- (U) Continued development of advanced development models based on ATF and evolving JIAWG requirements.

Program Element: #0604250F Budget Activity: #4 - Tactical Programs
PE Title: Integrated EW/CNI Development

- (U) Continued pre-FSD risk reduction and system concept demonstration.
- (U) Began flight demonstrations of threat warning sensors.
- (U) Conducted integrated ground prototype demonstrations.
- (U) Completed software algorithm design and validated software techniques and tools for integrated EC.

(U) FY 1990 Planned Program:
- (U) Complete Pre-FSD tasks and transition results to weapon system programs.
- (U) Support EC demonstrations as part of ATF integrated avionics ground prototypes.
- (U) Complete flight demonstrations of multi-spectral warning functions.
- (U) Conduct system design and test readiness reviews.
- (U) Complete expanded analysis of NATF integrated EC functional requirements.

(U) FY 1991 Planned Program:
- (U) Complete data analysis and reporting.
- (U) Close out project.

(U) Work Performed By: Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio, is responsible for the INEWS/ICNIA program. Two contractor Joint Venture Teams (TRW/Westinghouse and Sanders/GE) have been selected to conduct the Phase 1B, Pre-Full Scale Development program for INEWS.

(U) Related Activities:
- (U) Program Element #0603109F, INEWS/ICNIA.
- (U) Program Element #0603109N, Navy unique application of INEWS/ICNIA.
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0603270F, Electronic Warfare Technology.
- (U) Program Element #0603230F, ATF.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 3393 - ICNIA Pre-FSD: Transitions tri-service ICNIA development program results funded under PE 0603109F to FSD. The Common Module Program builds on ICNIA technology to define a set of modules which can efficiently implement diverse CNI requirements for multiple aircraft and which are compatible with the overall integrated architecture. Functions include secure, anti-jam, and clear voice radio such as HAVE QUICK and SINCGARS; data links such as Link 16; radio navigation aids such as TACAN and ILS; and cooperative identification functions such as MARK XII.

Program Element: #0604250F Budget Activity: #4 - Tactical Programs
PE Title: Integrated EW/CNI Development

(U) FY 1989 Accomplishments:
- (U) Initiated Common Module Program based on ATF/LHX/A-12 requirements.
- (U) Continued key JIAWG risk reduction initiatives.
- (U) Initiated computer aided modeling of modular encryption devices for secure CNI functions.
- (U) Funded Navy analysis of JIAWG compliant modular integrated avionics requirements for A-12 and Air Force variant.

(U) FY 1990 Planned Program:
- (U) Continue Common Module Program with delivery of initial module specifications.
- (U) Continue JIAWG risk reduction and computer modeling efforts in such areas as software tool evaluation suites, high fidelity simulation, and critical component manufacturing technology.

(U) FY 1991 Planned Program:
- (U) Complete FY90 efforts.
- (U) Close out project.

(U) Work Performed By: In-house work by the ATF SPO and WRDC/AAA, Wright-Patterson AFB, OH. Major contractors are TRW Corp., San Diego, CA and Rockwell-Collins, Cedar Rapids IA.

(U) Related Activities:
- (U) Program Element #0603109F, INEWS/ICNIA.
- (U) Program Element #0603109N, Navy Unique Application of INEWS/ICNIA.
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0603270F, Electronic Warfare Technology.
- (U) Program Element #0603230F, Advanced Tactical Fighter.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 3786 - Integrated Communications Security: A lead-Service funded, NSA managed effort to develop and demonstrate an Advanced Avionics COMSEC Unit (AACU). The AACU will be a VHSIC based, JIAWG compliant module implementing the information security (INFOSEC) encryption/decryption algorithms for secure transmission, reception, storage, and processing of classified information and signals.

(U) FY 1989 Accomplishments:
- (U) Supported NSA assessment of weapon system security design strategies.

Program Element: #0604250F Budget Activity: #4 - Tactical Programs
PE Title: Integrated EW/CNI Development

- (U) Continued AACU development with definition of design requirements based on JIAWG architecture standards and weapon system functional requirements.
- (U) Conducted security analysis risk assessment.
- (U) Prototyped custom microcircuits for AACU.

(U) FY 1990 Planned Program:
- (U) Continue AACU development.
- (U) Deliver breadboard units for initial integration experiments in weapon system integrated avionics prototypes.
- (U) Incorporate AACU design in JIAWG gate-level system simulation program to develop tools for interfacing the AACU with multiple aircraft avionics suites.

(U) FY 1991 Planned Program:
- (U) Complete initial AACU development.
- (U) Complete JIAWG definition of common COMSEC interfaces and AACU standard.
- (U) Finalize security risk assessments and NSA review of weapon system INFOSEC designs.

(U) Work Performed By: NSA will conduct in-house work. Major contractors are Motorola, Scottsdale, AZ and TRW, San Diego, CA.

(U) Related Activities:
- (U) Program Element #0603109F, INEWS/ICNIA.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

4. (U) Project 3858 - SEEK SPARTAN: The SEEK SPARTAN objective is to spin-off Joint Integrated Avionics Working Group (JIAWG) compliant INEWS technologies to meet requirements such as missile and laser warning on existing operational aircraft. Systems providing these capabilities must provide both functional and physical modularity so as to facilitate avionics commonality and reconfigurability for multi-aircraft/mission applications. SEEK SPARTAN developed systems will utilize architectures that meet JIAWG standards and be integrated with existing aircraft systems. This is to achieve greater system capability, improve reliability and maintainability, and reduce the proliferation of EC devices. A benefit of modular design and production should be greater economies of scale in production, which complement a prime objective of affordability without compromising mission effectiveness.

(U) FY 1989 Accomplishments:
- (U) Initiated feasibility studies on missile warning and laser warning for operational TAF aircraft.

Program Element: #0604250F Budget Activity: #4 - Tactical Programs
PE Title: Integrated EW/CNI Development

- (U) Initiated INEWS components of the Air Force Electronic Combat Office (AFECO) Cost and Operational Effectiveness Analysis (COEA) for TAF missile and laser warning.
- (U) Monitored ATF EW development and participated in JIAWG.
- (U) Began planning FSD methodology of specified functions and platforms.

(U) FY 1990 Planned Program:
- (U) Complete feasibility studies including preliminary installation concepts and associated life cycle costs and risks for candidate tactical aircraft.
- (U) Monitor ATF EW development and participate in JIAWG ECSG.
- (U) Prepare FSD system procurement strategy.
- (U) Refine system requirements identified in TAF SONs through modeling and analysis of threat and aircraft mission.

(U) FY 1991 Planned Program:
- (U) Conduct JVT missile warning sensor probability of detection and false alarm rate measurements.
- (U) Develop methods to adapt INEWS liquid cooled modules to use air cooled environments of existing aircraft.
- (U) Define specific Seek Spartan requirements for an Integrated System Facility/System Integration Lab to expedite integration with the various aircraft systems that Seek Spartan must interface.
- (U) Define and develop pilot/vehicle interface requirements for interfacing Seek Spartan systems onto existing data buses of user identified aircraft.
- (U) Perform pre-FSD integration analyses for first platform.
- (U) Prepare FSD system procurement for FY92 FSD start.

(U) Work Performed By: In-house work will be conducted by ASD/RWW1 and AFECO, Wright-Patterson AFB, OH. Major contractors are Sanders/General Electric Joint Venture Team, Nashua NH.and TRW/Westinghouse Joint Venture Team, San Diego CA and Baltimore MD.

(U) Related Activities:
- (U) Program Element #0603109F, INEWS/ICNIA.
- (U) Program Element #0603109N, Navy Unique Application of INEWS/ICNIA.
- (U) Program Element #0604270F, Electronic Warfare Technology.
- (U) Program Element #0603230F, Advanced Tactical Fighter.
- (U) Joint Integrated Avionics Working Group (JIAWG).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604268F
PE Title: Aircaft Engine Component Improvement Program (CIP)
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Engine CIP	93,380	75,900	93,561	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: CIP provides critical sustaining engineering support (only source) to ensure in-service Air Force engines continue to safely support current missions of host aircraft, reduce cost of ownership, improve system operational readiness (OR), and keep older engines operational. Historically, aircraft systems change missions, tactics, and environments to meet changing threats throughout their lives. Numerous new problems can arise through actual use during deployment, production, and service. The highest priority of CIP is to address all safety of flight issues. Another CIP objective is to ensure engines maintain satisfactory performance under new conditions. History also shows an active CIP is an effective way to reduce the cost of engine ownership and improve system OR by improving durability, operability, reliability and maintainability (R&M), repairability, and suitability as service time accumulates and operational conditions change. CIP starts after engine development with the acceptance of the first production engine. CIP continues over the engine's life, gradually decreasing to a minimum level sufficient to keep older inventory engines operational. Typically, this low level CIP effort develops depot repair procedures. CIP addresses usage and life not covered by engine warranty and enables the Air Force to obtain improved warranties when manufacturers incorporate CIP improvements into production engines. Since changes continue throughout a system's operational life, CIP must be maintained at a level to provide the engineering support to make changes which are essential for satisfactory system performance at costs affordable to the Air Force. CIP ensures continued improvements in engine R&M factors which reduces the size of outyear support costs. Typically, CIP efforts reduce outyear operations and maintenance (O&M) and spares costs by a ratio greater than 21 to 1. O&M and spares costs are budgeted on the basis that a viable CIP effort is in place, therefore CIP savings are outyear cost avoidance. Without CIP, outyear support costs would have to be increased drastically. CIP funding is driven by field events and types/maturity of engines and not by total engine quantity.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Documented life cycle cost (LCC) avoidance, a measure of R&M improvement, exceeded $2.6 billion, with the majority of the savings from F100, F101, F110, TF30, T56, TF39, TF34, and TF41 engines.
   - (U) TF39 (C-5): Initiated an effort to remove the life limits from the engine bearings, which currently have a 10,000 cycle life, to achieve a $7.4M LCC savings.

Program Element: #0604268F
PE Title: Aircraft Engine Component Improvement Program (CIP)
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

- (U) F100 (F-15/F-16): Completed design of a logic change to incorporate Control Mode Optimization (CMO) in the digital engine control which will increase engine inspection interval with a resultant LCC savings of $248.3M.
- (U) TF30 (F-111): Redesigned the 1st stage turbine blade to eliminate a high failure and scrappage rate due to high cycle fatigue resulting in a 15% reduction in Unscheduled Engine Removals (UERs), 30% reduction in aborts, and a LCC savings of $165M.
- (U) F110 Engine (F-16):
  a. (U) Initiated a redesign of the 1st stage compressor blade to eliminate a cracking problem requiring blade replacement every 550 hours and return the blades to an on-condition maintenance concept which will result in a $146.5M LCC savings.
  b. (U) Initiated the development effort (6 tasks) for the FALCON 110 Safety Upgrade Program which will correct an unacceptable Non-Recoverable Inflight Shutdown Rate (NRIFSD) and save 34 F-16 aircraft by the year 2000.

2. (U) FY 1990 Planned Program:
   - (U) Continue effort on each engine to reduce air aborts, aircraft safety incidents, not-mission-capable rates, scheduled and unscheduled engine removals, maintenance man-hours, and overall costs.
   - (U) Effort will include 5,500 hours of ground test (4,850 hours of sea level test and 650 hours of altitude test) and 100 hours of flight tests to analyze, verify, and approve 218 CIP tasks (146 redesign tasks and 72 repair tasks) which will generate an estimated LCC savings of $1.3B.
   - (U) F100 (F-15/F-16): Redesign the high pressure turbine second vane to improve durability (improved erosion and cracking resistance), which will reduce scrap rate and spares costs resulting in a LCC savings of $19.5M.
   - (U) TF30 (F-111): Redesign the retention method for the inner transition duct liner to eliminate liner/turbine nozzle distress caused by worn retention feet resulting in a $6.0M LCC savings.
   - (U) F110 (F-16): Redesign the combustor dome to eliminate a cracking problem, which can lead to combustor burn through into the engine bay and a NRIFSD (safety hazard), reducing the NRIFSD rate by 1.09/M EFH and generating a LCC savings of $120.35M.
   - (U) Effort will begin on the F100-PW-229 and the F110-GE-129 Increased Performance Engines (IPEs).

3. (U) FY 1991 Planned Program:
   - (U) Continue effort on each engine to reduce air aborts, aircraft safety incidents, not-mission-capable rates, scheduled and unscheduled engine removals, maintenance man-hours, and overall costs.
   - (U) Effort will include 3,030 hours of ground test (1,848 hours of sea level test and 1,182 hours of altitude test) and 100 hours of flight tests to analyze, verify, and approve 154 CIP tasks (100 redesign tasks and 54 repair tasks) which will generate an estimated LCC savings of $1.8B.
   - (U) Address IPE service revealed deficiencies as they are identified through operational use.

Program Element: #0604268F
PE Title: Aircraft Engine Component Improvement Program (CIP)
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

4. (U) Program to Completion:
   - (U) Continue effort on each engine to reduce air aborts, aircraft safety incidents, not-mission-capable rates, scheduled and unscheduled engine removals, maintenance man-hours, and overall costs.
   - (U) A continuing program is conducted for each in-service engine from completion of qualification until inventory phase out.

D. (U) WORK PERFORMED BY: The Deputy for Propulsion at Aeronautical Systems Division (ASD), Wright-Patterson AFB OH manages the overall program. Engine CIPs are managed at ASD, and at San Antonio and Oklahoma City Air Logistics Centers. Arnold Engineering Development Center, Tullahoma TN and the Air Force Flight Test Center, Edwards AFB CA conduct in-house test and evaluation efforts. Contractors (and engines) include Allison Gas Turbine, Indianapolis IN (T56, TF41); General Electric Company, Evendale OH (J79, TF39, F101, F110) and Lynn MA (J85, TF34, T64, T58); Air Research (Garrett), Torrance CA and Phoenix AZ (T76, gas turbine engines); Pratt and Whitney Aircraft of Canada, Ltd (T400) and West Palm Beach FL (F100, J57, TF30, TF33); Solar Turbine Inc, CA (gas turbine engines); Teledyne, Toledo OH (J69); and Williams International, Walled Lake MI (F107, F112).

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: Funding reductions have reduced the number of engine types being fully supported by CIP sustaining engineering from 24 to 12. Of the 12 engines not receiving full support, 6 will receive funding to accomplish only tasks begun prior to FY90, and the other 6 engines will receive no funding.
2. (U) SCHEDULE CHANGES: Funding reductions have delayed tasks on all engines creating delays in retrofit and increased outyear support costs.
3. (U) COST CHANGES: Program funding reductions in FY90 and FY91 were due to fiscal constraints.

F. (U) PROGRAM DOCUMENTATION: Not Applicable.

G. (U) RELATED ACTIVITIES:
   - (U) PE #0603202F (Aircraft Propulsion Subsystem Integration) provides fan and low pressure turbine technology.
   - (U) PE #0603216F (Advanced Turbine Engine Gas Generator) provides compressor, combustor, and high pressure turbine technology.
   - (U) PE #0604218F (Engine Model Derivative Program) provides additional component and engine test data.
   - (U) PE #0708011F (Industrial Preparedness Program) provides materials processing and component fabrication demonstration.
   - (U) The Army and the Navy have Aircraft Engine CIPs, PE #0604268A and PE #0604268N, respectively.
   - (U) There is no duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

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

J. (U) MILESTONE SCHEDULE: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604270F
PE Title: EW Development

Budget Activity: # 4 - Tactical Program

A. (U) RDT&E RESOURCES ($ In Thousands)

Project Number & Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1627	Sim, Analysis, and Eval.**	29900	500	600	Cont.	N/A
2066	EF-111A SIP	2000	6700	25080	Cont.	N/A
2114	Antenna Test Range**	2100	-	-	Cont.	N/A
2272	F-16 Protective Systems	9000	8350	14200	Cont.	N/A
2274	Special Ops Acft Prot Syst	100	1500	1000	Cont.	N/A
2462	COMPASS CALL	8800	5000	7450	Cont.	N/A
2712	ASPJ Common Development	4800	2900	0	Cont.	N/A
2719	F-16/ASPJ Devel/Integration	4000	2900	0	Cont.	N/A
2827	F/FB/EF-111 RWR**	4300	-	500	Cont.	N/A
2879	EWIR	3000	5200	2450	Cont.	N/A
2907	EC Intell Support**	1500	-	-	Cont.	N/A
3108	Airlift Defense Systems	2000	4100	14000	Cont.	N/A
3158	EC Digital Eval System**	1560	-	-	Cont.	N/A
3630	Joint Elect Warfare Center**	2000	-	-	Cont.	N/A
3660	AFECO	900	1000	1000	Cont.	N/A
3894	JSTARS (Self-Def Suite)	-	11500	27700	Cont.	N/A
3895	B-1B RWR	0	0	45471	Cont.	N/A
3896	Adv Strat/Tac IR Exp	-	0	6000	Cont.	N/A
5618	F-15 Protective Systems	20200	20606	13900	Cont.	N/A
TOTAL		96161	70256	159351	Cont.	N/A

** Funded in various PE's commencing in FY 90.

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element consolidates engineering development efforts related to Air Force electronic warfare (EW) requirements. The objectives of the Air Force EW Development Program are to (1) transition advanced development technologies to installed operational capabilities via full scale development (FSD) programs, and (2) maintain and advance the intelligence data base necessary to support these FSD and planned production programs. Technology base/advanced development efforts are funded in a separate program element, PE 0603270F, Electronic Warfare Technology. Multiple electronic warfare program elements (6.3 and 6.4) were consolidated by the FY 1988 Authorization and Appropriation Bills. The FY 1988 consolidation was continued in the FY 1989 Additional Budget Submission with the inclusion of additional program elements while 6.3 projects are excluded for FY 1989. In order to preserve continuity and clarity, the original project numbers within the former (FY 1987) Program Elements (PEs) have been retained.

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

1. (U) Project: 1627, Simulation, Analysis, and Evaluation: This project manages the Armstrong Aerospace Medical Research Lab (AAMRL)/Human Engineering Development (AAMRL/HED) that provides cockpit simulations of strategic aircraft defensive suites. These simulations are used in making human factors decisions during modification programs and in workload studies of associated EW tasks. The AAMRL task will remain within PE 0604270F through FY 91 when the funding support will transfer to the organizations the lab supports. This project previously funded Air Force Electronic Warfare Evaluation Simulator (AFEWES) and Real-Time Electromagnetic Digitally-Controlled Analyzer and Processor (REDCAP) facilities. These tasks were transferred to PE 0604735F in FY 90.

(U) FY 1989 Accomplishments:
- (U) AAMRL B-1B crew station simulator operational
- (U) Continued operation of AAMRL simulations

(U) FY 1990 Planned Program:
- (U) Cont maintenance and operation of AAMRL/HED facility

(U) FY 1991 Planned Program:
- (U) Cont maintenance and operation of AAMRL/HED facility.

Program Element: # 0604270F
PE Title: EW Development

Budget Activity: # 4 - Tactical Program

(U) WORK PERFORMED BY: AAMRL/HED is located at Wright Patterson AFB, OH.

(U) RELATED ACTIVITIES: None
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands): None

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

2. (U) Project: 2274, Special Operations Aircraft Protection Systems:
This project will evaluate a pylon mounted implementation of the Technique 101 [ ] on tactical aircraft. [ ] was developed to counter the [ ] threat. The ORC 85-04 program will test the [ ] concept on an [ ] and [ ] aircraft and conduct live-fire test using the [ ]

(U) FY 1989 Accomplishments:
- (U) [ ] Flight Test Evaluation/Documentation - Completed
- (U) Began Class II Mod investigation for [ ] and [ ] integration

(U) FY 1990 Planned Program:
- (U) Begin Class II modification of [ ] and obtain flight approval
- (U) [ ] Flight Test/Documentation System Integration analysis

(U) FY 1991 Planned Program:
- (U) Begin Class II modification of [ ] and obtain flight approval
- (U) [ ] Flight Test/Demonstration
- (U) [ ] Flight Test/Demonstration

(U) WORK PERFORMED BY: Raytheon Corporation, Goleta, CA. Testing accomplished at Eglin AFB, FL.

(U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands): None

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

3. (U) Project: 2462, Compass Call.
This project provides engineering development of jammers to [ ] The EC-130H stand-off jamming platform complements both present and future ground-based and sea-based systems to provide theater commanders with a coordinated jamming capability. This project makes major improvements to the initial EC-130H installed equipment and system architecture to [ ]

(U) FY 1989 Accomplishments:
- (U) Developed low-band transmit antenna upgrade kits.
- (U) Completed preliminary design of new generation transmit antenna and RF distribution suite.
- (U) Initiated a program for software reprogrammable [

(U) FY 1990 Planned Program:
- (U) Review results of the jamming system antenna preliminary design effort. Select a source for FSD program.
- (U) Continue with hardware/software changes to fielded [
- (U) Upgrade mission simulator to match aircraft upgrades.

(U) FY 1991 Planned Program:
- (U) Conclude incorporation of the DF subsystem changes.
- (U) Begin FSD of [ ] upgrade program.
- (U) Investigate methods for upgrading [ ]
- (U) Upgrade mission simulator to match aircraft upgrades.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright Patterson AFB, OH, manages the program to develop improvements to the EC-130H COMPASS CALL; Air Force Logistics Command, Wright Patterson AFB, OH, manages the EC-130H modification program. The primary COMPASS CALL contractors working this program include: Lockheed Aircraft Services, Ontario, CA; Sanders Associates, Nashua, NH; and Magnavox, Ft Wayne, IN.

(U) RELATED ACTIVITIES:
- (U) PE 0603743F, Electronic Combat Technology provides technology development. COMPASS CALL, PE 0207253F, procures the system hardware.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands): None

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

4. (U) Project: 2712, ASPJ Common Development.
This project funded the Air Force share of the joint Navy/Air Force common development of the ASPJ (ALQ-165).

(U) FY 1989 Accomplishments:
- (U) AFOTEC/OPTEVFOR operational testing
- (U) Milestone IIIA limited production decision
- (U) Award of Lot 1, Low-Rate Production option (50 Air Force and 50 Navy System)

(U) Program to Termination:
- (U) The Air Force suggested termination of the Airborne Self-Protection Jammer as a FY 91 program adjustment. Secretary of Defense Program Budget Decision 807 approved termination. Termination actions are progressing.

(U) WORK PERFORMED BY: ASPJ development was managed by a Navy/Air Force Joint Program Office (JPO) at the Naval Air Systems Command, Washington, DC. The Navy is the lead service. The Air Force unique portion of this program, integration of the ASPJ into the F-16, was managed by the Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH. The ASPJ contractor team was ITT, Nutley, NJ, and Westinghouse Corporation, Baltimore, MD. The ITT/Westinghouse Joint Venture (JV) team was selected during FY 1981 to proceed into ASPJ Phase II Full-Scale Development (FSD) of engineering development models and production system.

(U) RELATED ACTIVITIES:
- (U) The ASPJ ECM efforts were directly related to PE 0207133F, Multi-Mission Fighter.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands): None

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

5. (U) Project: 2719, F-16 ASPJ Development/Integration. This project supported unique engineering required to integrate the ASPJ into the F-16 aircraft.

(U) FY 1989 Accomplishments:
- (U) AFOTEC F-16A testing
- (U) Milestone IIIA Limited Production Decision

(U) Program to Termination:
- (U) The Air Force suggested termination of the Airborne Self-Protection Jammer as a FY 91 program adjustment. Secretary of Defense Program Budget Decision 807 approved termination. Termination actions are progressing.

(U) WORK PERFORMED BY: Integration of ASPJ into the F-16 was being accomplished by General Dynamics, Ft Worth, TX.

(U) RELATED ACTIVITIES:
- (U) The ASPJ ECM efforts were directly related to PE 0207133F, F-16 Multi-Mission Fighters.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ In Thousands): None

Program Element: # 0604270F Budget Activity: # 4 - Tactical Programs
PE Title: EW Development

6. (U) Project: 2827, F/FB/EF-111 RWR: This project funds the development, integration, and test of updated electronic countermeasures and radar warning systems allowing the F/FB/EF-111 to remain operationally viable in the presence of the latest Soviet ground and airborne radar systems. The radar warning receiver (RWR) (ALR-62I) is in full-production for the F/FB-111. Additional development is required to adapt it to the EF-111A, and for support equipment and Test Program Set (TPS) development.

(U) FY 1989 Accomplishments:
- (U) Began to define EF-111 RWR system configuration
- (U) Started antenna isolation and pattern tests
- (U) Began effort to study alternative antenna placement/configuration to accomodate the ALR-62I

(U) FY 1990 Planned Program:
- (U) Complete antenna testing
- (U) Begin TPS and peculiar support equipment development to support depot testing of Shop Replaceable Units
- (U) Complete integration study for EF-111A

(U) FY 1991 Planned Program:
- (U) Continue TPS and peculiar support equipment development.
- (U) Develop system requirements for EF-111A integration.
- (U) Develop system specifications for EF-111A integration.

(U) WORK PERFORMED BY: Dalmo Victor Corporation of Belmont, California, is the primary contractor for the ALR-62I. Air Force Systems Command is responsible for development, test, and integration on the EF-111A. Warner Robins Air Logistics Center is responsible for procuring production systems and support equipment.

(U) RELATED ACTIVITIES:
- (U) PE 0207168F, F-111 Self-Protection Systems
- (U) PE 0207252F, EF-111A Squadrons
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

(U) OTHER APPROPRIATION FUNDS: PE 0207168F ($ IN THOUSANDS)

	FY 1989 Actual	FY 1990 Estimated	FY 1991 Estimated	To Complete	Total Program
Acft Procurement BA 7*	59,400	66,400	38,700	Cont	TBD

*ALR-62I production for F/FB-111

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

00589

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

7. (U) Project: 2879, Electronic Warfare Integrated Reprogramming (EWIR). Develop a "common" USAF reprogramming architecture to provide timely reprogramming of TAC, SAC and MAC Electronic Combat systems in response to unknown enemy threats or operating modes.

(U) FY 1989 Accomplishments:
- (U) AF/XOOTE became responsible for residual FY 90/91 ARC monies residing in PE 0604270F in Feb 89.
- (U) Multi-command EWIR SON 522-88 dated 23 Oct 89 and PMD published Nov 89.
- (U) ALR-46/69 Intelligent Editor (INTED) on contract Jun 89.

(U) FY 1990 Planned Program:
- (U) ALR-62I, ALR-56C/M, ALQ-172 Selectively Improved Flagging Task (SIFT) software models and MAJCOM computers hardware upgrades complete in FY 90.

(U) FY 1991 Planned Program:
- (U) ALQ-131 R/P, ALQ-135 (Band 3), ALQ-155, ALQ-196 SIFT and Computer Aided Electronic Combat Information System (CAEWIS) procured in FY 91.

(U) WORK PERFORMED BY: ALR-46/69 INTED contractor is TRW. FY90/91 contractor TBD.

(U) RELATED ACTIVITIES:
- (U) AF/XOOTE and SAF/AQRE Nov 89 memorandum consolidating funds from project 2879 in PDP E060 (EWIR) to E951 Electronic Warfare Avionics Integration Support Facility (EWAISF).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: None.

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

8. (U) Project: 3660, Air Force Electronic Combat Office (AFECO). Purpose is to focus USAF electronic Combat acquisition and upgrade programs; integrate the planning, development, production, life cycle support and modification of USAF EC systems and ensure the EC programs are technically and fiscally executable to meet the user's needs. This is a joint AFSC/AFLC organization.

(U) FY 1989 Accomplishments:
- (U) Continued EW data base expansion
- (U) Initiated ECM Pod capabilities growth study

(U) FY 1990 Planned Program:
- (U) Continue to support program offices
- (U) Author a program manager's Test Guide
- (U) Support users SON/SORD development
- (U) As tasked by HQ AFSC/AFLC

(U) FY 1991 Planned Program:
- (U) Test resource planning and development
- (U) Author test handbooks for five specific EC disciplines
- (U) As tasked by HQ AFSC/AFLC

(U) WORK PERFORMED BY: Project is Jointly managed by Air Force Systems Command and Air Force Logistics Command with an office at Aeronautical Systems Division, Wright Patterson AFB, OH.

(U) RELATED ACTIVITIES:
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: None

Program Element: # 0604270F Budget Activity: # 4 - Tactical Program
PE Title: EW Development

9. (U) Project: 3896, Advance Strategic and Tactical Expendables: The project develops advanced infrared (IR) expendables for airlift, strategic and tactical aircraft. [ ] indicates that improvements to the [ ] Flight test and threat assessment analysis also show that the [ ] has been significantly [ ] This program will develop and demonstrate an [ ]

(U) FY 1989 Accomplishments:
- (U) Issued program direction.
- (U) Developed program options for the advanced expendable.
- (U) Continued

(U) FY 1990 Planned Program:
- (U) Funding for the program was zeroed in FY 90.

(U) FY 1991 Planned Program:
- (U) Convene a threat assessment working group.
- (U) Initiate threat modeling and analysis.
- (U) Complete IR signature data collection on selected airlift, strategic and tactical platforms.
- (U) Initiate Concept Exploration.

(U) WORK PERFORMED BY: The Air Force Electronic Combat Office completed a study that identified the need for an in-depth concept exploration program prior to starting an FSD program.

(U) RELATED ACTIVITIES:
- (U) Program Element 0603270F, Electronic Combat Technology.
- (U) Program Element 0603270N, Electronic Combat Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

(U) OTHER APPROPRIATED FUNDS: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604270F
PE Title: EW Development
Project Number: 2066
Budget Activity: # 4 - Tactical Programs

A. (U) RESOURCES ($ In Thousands)
Project Title: EF-111 Upgrade

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
EF-111A SIP	2,000	6,700	25,080	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The EF-111A System Improvement Program (SIP) project updates the EF-111A Tactical Jamming System (TJS). The update is required to keep the system current against the evolving threat. Since the [ ] cut-off point for the original jamming suite, Soviet radars have increased in both quantity and sophistication. Most Soviet radars use state-of-the-art Electronic Counter-Countermeasure (ECCM) techniques which [ ] to counter these radars. The SIP will incorporate a new processor, encoder, a MIL-STD 1750 computer, MIL-STD 1553-B data bus, study the integration of narrow-beam antennas, an improved Band 4 transmitter, integration of Band 9 transmitters and antennas, and software changes. These improvements will allow the system to defeat the threat by placing concentrated jamming with an improved power management system on specific radars of interest.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed development program restructure update TJS.
   - (U) Completed operational assessments/studies to verify the system's requirements against an updated threat base.

2. (U) FY 1990 Planned Program:
   - (U) Initiate TJS full scale development (FSD) phase
   - (U) Complete Band 4 modification kit design specification

3. (U) FY 1991 Planned Program:
   - (U) Continue full scale development
   - (U) Accomplish Preliminary Design Review
   - (U) Begin modification kit design to update the Band 4 transmitter

Program Element: # 0604270F
PE Title: EW Development
Project Number: 2066
Budget Activity: # 4 - Tactical Programs

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

D. (U) WORK PERFORMED BY: Air Force Systems Command, Aeronautical Systems Division will manage the development contract. Class V modification of the EF-111 aircraft will be managed by Sacramento Air Logistics Center. Prime contractor is to be determined. The Band 4 upgrade and the Band 9 integration will be managed by Warner-Robins Air Logistics Center.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) TAC SON 319-88, (S) dated 23 Oct 89
- (U) TAC SON 337-88, (S) dated 15 Sep 89

G. (U) RELATED ACTIVITIES:
- (U) PE 0207168F, F-111 Self Protection Systems.
- (U) PE 0207252F, EF-111A Squadrons.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

AIRCRAFT PROCUREMENT (3010) FUNDS PE 0207252F ($ In Thousands)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	0	7,275	Cont.	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

1. (U) Begin full scale development phase — Sep 1990
2. (U) Production deliveries — Late 1990s

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604270F Project Number: 2272
PE Title: EW Development Budget Activity: # 4 - Tactical Programs

A. (U) RDT&E RESOURCES ($ In Thousands)
Project Title: F-16 Protective Systems (U)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OBEWS & ALE-47 CMDS	9,000	8,350	14,200	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project develops EW equipment which form the F-16 self-protection suite. Two major tasks include the ALE-47 Countermeasures Dispenser System (CMDS) and OBEWS, the onboard EW system. The ALE-47 CMDS is a Joint AF (lead), Navy, Army program to develop an interactive/smart expendables dispenser for the F-16 and numerous Navy aircraft. The OBEWS is a pod-mounted digital trainer that provides EW training for F-16 pilots by supplementing the outside environment with digital signals. This system will provide a significant cost savings vs funding ranges and threat systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) OBEWS - DT&E Flight test began in Jan 89 - successful
   - (U) OBEWS - IOT&E Flight test at Nellis AFB, NV began Jul 89 awaiting user production decision.
   - (U) ALE-47 - Design complete, continued fabrication
   - (U) ALE-47 - Engineering and Fabrication tests begin

2. (U) FY 1990 Planned Program:
   - (U) ALE-47 - Completion of Engineering and Fabrication testing
   - (U) ALE-47 - Delivery of 20 FSD testing support systems
   - (U) ALE-47 - DT&E/IOT&E Jan 90 - Sep 91
   - (U) ALE-47 - PRR - Feb 90

3. (U) FY 1991 Planned Program:
   - (U) ALE-47 - Complete DT&E/IOT&E Sep 91
   - (U) ALE-47 - Low-Rate Production decision FY 2/91

4. (U) Program to Completion:
   - (U) ALE-47 Production lots 1-4 begin mid 1992

Program Element: # 0604270F Project Number: 2272
PE Title: EW Development Budget Activity: # 4 - Tactical Programs

D. (U) WORK PERFORMED BY: ALE-47 Source Selection completed, Tracor awarded a FFP contract for FSD and four production lots. The program is managed by ASD/RW at WPAFB OH. OBEWS prime contractor is AAI, Baltimore, MD. The program is managed by MSD/YI at Eglin AFB, FL.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF ROC 303-76, F-16 Air Combat Fighter, Dec 76
- (U) TAF SON 312-80, Optical Threat Acquisition and Cueing Systems
- (U) TAF SON 304-80, Tactical Self-Protection EW Systems, May 80

G. (U) RELATED ACTIVITIES:
- (U) PE 0207133F, F-16 Squadrons
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

Acft Procurement PE 0207133F	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	6,700	18,300	105,500	130,500
Quantity	0	463	1,303	1,766

I. (U) INTERNATIONAL COOPERATIVE AGREEMENT: None.

J. (U) MILESTONE SCHEDULE:

- (U)	ALE-47 Preliminary FSD Contract Award	Sep 1983
- (U)	ALE-47 FSD and Prod Contract Award	Jul 1988
- (U)	OBEWS DT&E Test Report - Complete	Aug 1989
- (U)	OBEWS IOT&E Test Report - Complete	Dec 1989
- (U)	ALE-47 DT&E/IOT&E	Feb 1990
- (U)	ALE-47 LRIP Decision	Feb 1991
- (U)	ALE-47 Production Decision	Sep 1991
- (U)	ALE-47 LRIP Deliveries	Jan-Jul 1992
- (U)	ALE-47 Production Deliveries	Jul 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604270F
PE Title: EW Development
Project Number: 3108
Budget Activity: # 4 - Tactical Programs

A. (U) RDT&E RESOURCES ($ In Thousands)
Project Title: Airlift Defensive Systems

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ADS	2000	4100	14000	Cont	TBD

B. ( ) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project provides for the development of a common, defensive architecture on tactical and strategic airlift aircraft, specifically the C-17, C-130, C-141, and C-5. This is a design-to-cost effort, utilizing C-17 requirements, with schedule as the primary driver for development.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) C-17 Defensive Systems Study, Phase I completed FY 4/89
   - (U) Group B hardware for the C-130 Class IV MOD ordered for the FY 91 integration and FY 93 flight testing

2. (U) FY 1990 Planned Program:
   - (U) Request for Proposal (RFP) to industry late FY 90 with projected contract award FY 2/91
   - (U) C-130 will be lead aircraft for installation
   - (U) System architecture will be common

3. (U) FY 1991 Planned Program:
   - (U) Proposals will be evaluated in early FY 91
   - (U) Contract award for selected team
   - (U) Initial efforts for C-130 flight test will commence
   - (U) This will lead to start of installations and C-130 DT&E flight test beginning in FY 92

4. (U) Program to Completion:
   - (U) FY 92 will find C-130 installation effort ongoing
   - (U) Installations will begin for the C-5s and C-141s in FY 92
   - (U) Upon completion of C-130 DT&E flight test, QOT&E will begin
   - (U) Installations on the C-17 will begin in FY 93

Program Element: #0604270F
PE Title: EW Development
Project Number: 3108
Budget Activity: # 4 - Tactical Programs

D. (U) WORK PERFORMED BY: The ADS Air Force program manager is Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson Air Base, OH.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) Technical CHANGES: None.
2. (U) SCHEDULE CHANGES: Schedule slips due to FY 90 funding reductions (PBD 262). Impact of reduction is a one year slip to the program.
3. (U) COST CHANGES: Consolidation of parallel efforts into single, common, aircraft fleet defensive suite integration.

F. (U) PROGRAM DOCUMENTATION:
- (U) MAC SON 7-81, Defensive Systems for Airlift Aircraft (S)
- (U) C-17 Acquisition Decision Memorandum

G. (U) RELATED ACTIVITIES:
- (U) PE 0401330F, C-17 Program
- (U) PE 0401115F, C-130 Airlift Squadrons
- (U) PE 0401118F, C-141 Airlift Squadrons
- (U) PE 0401119F, C-5 Airlift Squadrons
- (U) PE 0404011F, Special Operations Forces
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

ACFT Procurement PEs 41115F,41130F 41118F,41119F 72207F	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	0	0	0	53,000	53,000

J. (U) MILESTONE SCHEDULE:

1. (U) RFP Preparation	FY 3/90
2. (U) Contract Award	FY 2/91
3. (U) C-130 Production Decision	FY 2/92
4. (U) C-17 Production Decision	FY 2/93

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604270F
PE Title: EW Development
Project Number: 3894
Budget Activity: # 4 - Tactical Systems

A. (U) RESOURCES ($ in Thousands)
Project Title: JSTARS Self-Defense Suite

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	0.0	11,500	33,700	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project, as directed by the DAB at milestone IIB, will develop and integrate a suite of avionics to provide [ ] for the E-8B Joint Surveillance Target Attack Radar System (JSTARS) aircraft. Such avionics will enhance the survivability and mission effectiveness of the Boeing 707 derivative aircraft in the face of an increasingly sophisticated and complex integrated air defense system in Central Europe and third-world countries. Emphasis will be on use of off-the-shelf components or those which require absolute minimum development. Other aircraft self-defense suite development programs will be analyzed to capitalize on potential use of those avionics for JSTARS application. In order to meet the planned aircraft [ ] and the long-lead production milestones associated with that [ ] only those components available mid-FY 91 with delivery one year later will be considered. The full scale development and integration of the SDS will occur in the #3 JSTARS test aircraft and one of the E-8A prototypes.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLAN:

1. (U) FY 1989 Accomplishments:
   - (U) In PE 0604770F, JSTARS R&D, a study was begun to appraise inclusion of various Electronic Combat self-defense avionics components in the SDS.

2. (U) FY 1990 Planned Program:
   - (U) The suite configuration study will be completed
   - (U) Grumman will recommend a suite configuration to ESD and TAC
   - (U) Draft specifications and interface control documents will be accomplished for the chosen suite
   - (U) DEM/VAL will begin for the suite and the situational awareness display at the Navigator/Electronic Warfare Officer (EWO) station
   - (U) Updated threat information will be analyzed for its impact on the SDS design as result of lessons learned in the DEM/VAL phase

Program Element: # 0604270F Project Number: 3894
PE Title: EW Development Budget Activity: # 4 - Tactical Systems

3. (U) FY 1991 Planned Program:
   - (U) Conclude the DEM/VAL phase
   - (U) Integrate the prototype SDS into the #3 test aircraft
   - (U) Begin full scale development (FSD)
   - (U) Accomplish a Preliminary Design Review
   - (U) Start long-lead component procurement

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

D. (U) WORK PERFORMED BY: The component suite study is being performed by the JSTARS integrating contractor Grumman Aerospace, Melbourne, FL. Operational effectiveness studies are being performed by CALSPAN Corp. The suite component contractors will be selected when the configuration is determined

E. (U) COMPARISON WITH AMENDED FY 1990/91 DESCRIPTIVE SUMMARY: None

F. (U) PROGRAM DOCUMENTATION:
   - (U) Joint STARS System Threat Assessment Report (STAR),(U), 2 Jan 89, (S/NF/WN)
   - (U) Joint STARS Joint system operational concept (JSOC),(U), 27 JUN 86, (S/NF/WN)

G. (U) RELATED ACTIVITIES:
   - (U) 0604770F, Joint STARS
   - (U) 0207581F, Joint Surveillance Target Attack Radar System
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS ($ In Thousands):
   1. (U) PROCUREMENT:
   2. (U) MILITARY CONSTRUCTION: Not applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: NONE

J. (U) MILESTONE SCHEDULE:

- (U) Complete component study	MAR 90
- (U) ESD and TAC select SDS configuration	APR 90
- (U) Complete draft specification/ICD	SEP 90
- (U) Begin DEM/VAL	OCT 90
- (U) DAB III/Begin FSD	JAN 91
- (U) Preliminary Design Review (PDR)	AUG 92
- (U) Critical Design Review (CDR)	AUG 93
- (U) Start Flight Test	JUN 95
- (U) End Flight Test	OCT 96
- (U) DAB IV/Start Production	JAN 97

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604270F Project Number: 3895
PE Title: EW Development Budget Activity: # 4 - Tactical Programs

A. (U) RD&T RESOURCES ($ In Thousands)
Project Title: B-1B Advanced Radar Warning Receiver (ARWR)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
B-1B ARWR	0	0	46,000	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The B-1B is a strategic, long-range, multirole weapon system able to perform the missions of conventional bomber, cruise missile launch platform, and nuclear weapons delivery system in both the tactical and strategic roles. Production of the B-1B addresses the national requirements to increase targeting flexibility, to redress the relative decline of our strategic capabilities, and to revitalize our strategic deterrent forces. The B-1B significantly enhances the manned bomber portion of the strategic TRIAD while preserving the vitally needed flexibility for worldwide nonnuclear force projection in response to unforeseen contingencies. The program was mandated by Congress under Public Law 96-342 and fulfills Strategic Air Command Required Operational Capability 3-66 (Revised), New Strategic Manned Bomber, dated 22 November 1978, and the Long Range Combat Aircraft Mission Element Need Statement, dated 8 June 1981.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued development, as well as lab and flight evaluations, of the ALQ-161A core configuration (Mature the Central Integrated Test System, Improve system reliability, verify installed system performance).
   - (U) Conducted risk reduction efforts in preparation for full scale development and integration of the Air Force common radar warning receiver (RWR) on the B-1B.

2. (U) FY 1990 Planned Program:
   - (U) Congressional Language in appropriation bill prohibits any development and integration of the B-1B ARWR in FY 1990.

3. (U) FY 1991 Planned Program:
   - (U) Conclude ARWR studies and risk reduction efforts
   - (U) Begin full scale development to integrate the Air Force Common ARWR into the B-1B.

Program Element: # 0604270F
PE Title: EW Development
Project Number: 3895
Budget Activity: # 4 - Tactical Programs

4. (U) Program to Completion:
   - (U) Complete developmental evaluations of the Air Force common ARWR installed on the B-1B.
   - (U) Continue operational evaluations of the Air Force common ARWR installed on the B-1B

D. (U) WORK PERFORMED BY: The B-1B program is in concurrent, full scale development and production. It is managed by the B-1B System Program Office (SPO), Aeronautical Systems Division, Wright-Patterson AFB, OH. The B-1B SPO has overall integration responsibility for the development of the B-1B bomber. Rockwell International, North American Aircraft Operations, Los Angeles, CA, is the B-1B airframe manufacturer. General Electric, Evendale, OH is the propulsion plant contractor. Several government agencies provide specialized assistance. For example: The facilities at Holloman AFB, NM, are used to measure radar cross-section characteristics; the wind tunnels at the Arnold Engineering Development Center, TN, are used for comparative analyses; and the Air Force Materials Laboratory and Air Force Avionics Laboratory at Wright-Patterson AFB, OH, are used in the development effort. The majority of the flight test will be done at the Air Force Flight Test Center, Edwards AFB, CA, but several other Department of Defense test ranges will also be used: White Sands Missile Range, NM; Eglin AFB, FL; Point Mugu Naval Air Station, CA; Utah Test and Training Range, UT; China Lake Naval Weapons Center, CA; Nellis Range Complex, NV; and others.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: Recent flight test of the ALQ-161 confirmed that the most operationally significant ECM techniques worked, but the tests also identified a design deficiency which precludes achieving the full performance specification without further modifications. The Air Force believes integrating the common ARWR, ALR-56M, into the B-1B is the most prudent, reduced risk approach to providing the B-1B aircrew with the needed situational awareness capability.
2. (U) SCHEDULE IMPACT: Congressional restrictions on B-1B RWR development in FY 90 caused a one year delay to the program.
3. (U) COST CHANGES: Financial changes are due to restriction of FY 90 B-1B funding.

Program Element: # 0604270F
PE Title: EW Development
Project Number: 3895
Budget Activity: # 4 - Tactical Programs

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC-SON 3-66, 10 Nov 78
- (U) SAC-MENS, 8 Jun 81
- (U) DEPSECDEF B-1B Program (Baseline Nov 81)
- (U) President's Cost Certification, 18 Jan 82
- (U) B-1B TEMP, 7 Nov 88
- (U) B-1B PMD, 4 Jan 88

G. (U) RELATED ACTIVITIES:
- (U) The aircrew training devices and military construction for the B-1B are funded outside the B-1B baseline. These devices (five B-1B weapon system trainers, two mission trainers, six cockpit procedures trainers, and support equipment) will be developed in PE 0604227F, Flight Simulator Development. The program is managed by the Simulator Program Office at Wright-Patterson AFB, OH.
- (U) Long range enhancements to the B-1B electronic countermeasures system are being developed in PE 0604427F.
- (U) The SRAM II is being developed to replace the aging SRAM missiles under PE 064244F (SRAM II Engineering Development).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not Applicable.

2. (U) MILITARY CONSTRUCTION: Not Applicable.

I. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
ALQ-161A Tests	Jun 88	Key techniques confirmed Design deficiency identified

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Core ECM System Test	Jan 90	
Radar Warning Receiver Test	Mar 92	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604270F
PE Title: EW Development
Project Number: 5618
Budget Activity: # 4 - Tactical Programs

A. (U) RDT&E RESOURCES ($ In Thousands)
Project Title: F-15 Protective Systems

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
TEWS	20,200	20,606	13,900	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project develops the Tactical Electronic Warfare System (TEWS) improvements and upgrades to the F-15 self-protection suite. The F-15 TEWS consists of the ALR-56 Radar Warning Receiver (RWR), the ALQ-135 Internal Countermeasures System, the ALQ-128 Electronic Warfare Warning System and the ALE-45 Countermeasures Dispenser (CMD). Upgrades of the ALR-56A to the ALR-56C configuration is completed, of the ALQ-135 to include Band 3/1.5 capabilities and a CMD interfaced with the RWR are required to provide effective aircrew warning and countermeasures against the] airborne threat and sophisticated] threats.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) IOT&E flight testing of ALR-56C began in Nov 89
   - (U) ALQ-135 Band 3 P^{3}I systems began delivery
     ALQ-135 was restructured into a 2 Phase program primarily due to significant software problems
   - (U) ALR-56C testing at DEES Mar/May - Complete. HQ TAC approved installation into the F-15E.

2. (U) FY 1990 Planned Program:
   - (U) ALQ-135 Band 3 and 1.5 software development continues
   - (U) ALQ-135 Band 3, Phase 1 begins DT&E flight test - Feb 90
     OT&E flight test - May 90
   - (U)] based on ALQ-135 Band 3 delivery
   - (U) TEWS integration testing continues

3. (U) FY 1991 Planned Program:
   - (U) Integration testing continues
   - (U) ALQ-135 Band 1.5 system deliveries begin

Program Element: # 0604270F
PE Title: EW Development
Project Number: 5618
Budget Activity: # 4 - Tactical Programs

4. (U) Program to Completion:
   - (U) Improve integration of TEWS with aircraft avionics and fire control radar.
   - (U) Annual upgrades to defeat the evolving threat.
   - (U) This is a continuing program.

D. (U) WORK PERFORMED BY:
   - (U) ASD/VF - WPAFB, OH, is the system integrator
   - (U) ALR-56C - Loral, Yonkers, NY
   - (U) ALQ-135 - Northrop, Rolling Meadows, IL
   - (U) ALE-45 - TRACOR, Austin, TX

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: Schedule impact assures R&M testing is adequate
   3. (U) COST CHANGES: Increased emphasis and testing on R&M and software development and test.

F. (U) PROGRAM DOCUMENTATION:
   - (U) TAC ROC 9-68, Feb 1968.
   - (U) DCP #19, Rev C, May 77, amended Feb 80.
   - (U) TAF SON 321-82, Nov 84.
   - (U) F-15E TEMP, Nov 87 (TEWS Annex complete).
   - (U) TAF SON 304-80
   - (U) ALQ-135 SORD (Draft), Oct 89

G. (U) RELATED ACTIVITIES:
   - (U) VHSIC technology developed in PE 0603452F. F-15E aircraft is developed and produced in PE 0207134F.
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

ACFT Procurement PE 0207134F,	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
BA 01 Funds	1,470,050	1,443,414	1,750,735	406,234	26,708,100
Quantity	36	36	36	78	1152

Program Element: # 0604270F
PE Title: EW Development
Project Number: 5618
Budget Activity: # 4 - Tactical Programs

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

-	(U)	ALQ-135 ICS P3I Development Contract Award	Mar 1985
-	(U)	ALR-56C DT&E/IOT&E Flight Test (concurrent)	Oct 1985
-	(U)	ALQ-135 ICS QRC Band 3 Deliveries	Feb 1986
-	(U)	ALR-56C Deliveries	May 1986
-	(U)	ALQ-135 ICS QRC Band 3 DT&E/IOT&E Flight Test	May 1986
-	(U)	ALE-45 CMD Production Deliveries	Jul 1986
-	(U)	ALQ-135 ICS P3I Critical Design Review	Nov 1986
-	(U)	Integrated F-15 TEWS Flight Test	Jul 1987
-	(U)	ALQ-135 P3I Production Contract Award	Dec 1986
-	(U)	ALQ-135 P3I Band 3 Production Deliveries start	Feb 1989
-	(U)	ALQ-135 Lot IV & V J&A with FAAA	Feb 1989

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604312F Budget Activity: #3 - Strategic Programs
PE Title: ICBM Modernization

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Peacekeeper in Minuteman Silo	40,000	14,766	7,463	18,931	6,431,600
Peacekeeper Rail Garrison	458,669	774,244	548,049	278,509	2,505,900
Small ICBM	346.001	100.000	202.159	3.381.000	6.919.100
Total	844,670	889,010	757,671	3,697,371	15,856,600

B. (U) BRIEF DESCRIPTION OF ELEMENT: The military need for ICBM modernization stems from the requirement to respond to Soviet ICBM developments which are causing a major imbalance between the United States and Soviet strategic capabilities. The overall mission of the ICBM modernization program is to support the U.S. strategic deterrent policy while responding to changes in the projected Soviet threat and target base. The modernization program is built on the recognition that all ICBM tasks cannot be served by a single missile or a single basing mode. The near-term response --deploying 50 Peacekeeper in Minuteman silos--will reduce the Soviet advantage in ICBM capability and help deter a broad spectrum of potential threats including massive conventional or limited nuclear attack on the United States or our allies. The long-term response includes deploying both Peacekeeper missiles in Rail Garrison and Small ICBM in Hard Mobile Launchers. The two mobile missile program proposed by the Administration possesses complimentary capabilities which will greatly reduce the likelihood of a successful Soviet attack. Further, the sequential deployment is affordable, and will greatly strengthen our START negotiating position and the quality of post-START forces.

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

1. (U) Peacekeeper in Minuteman Silo:
Continues the Simulated Electronic Launch - Peacekeeper (SELP) and Operational Testing (OT) programs and the effort to improve Specific Force Integrating Receiver (SFIR) reliability.

(U) FY 1989 Accomplishments:
- (U) FOC declared in December 1988.
- (U) RDT&E for nuclear hardness testing and engineering support.
- (U) Flight Test 18 - March 19, 1989.
- (U) Operational Testing (OT) Program began September 1989.
- (U) Completed Program Management Responsibility Transfer (PMRT) for Operational Ground Equipment (OGE).

(U) FY 1990 Planned Program:
- (U) Continue SELP and OT programs.
- (U) Continue SFIR improvement effort.

(U) FY 1991 Planned Program:
- (U) Continue SELP and OT programs.
- (U) Continue SFIR improvement effort.

(U) Program to Completion:
- (U) Complete PMRT for aeronautical vehicle equipment (AVE).
- (U) Missile production is projected to continue through FY 1996 (173 missiles). *
- (U) Continue SFIR improvement effort.

(U) WORK PERFORMED BY: The program managed by Ballistic Systems Division, Norton Air Force Base, CA. Facilities at Arnold Engineering Development Center, Tullahoma, TN, are used for motor testing and facilities at the Central Inertial Guidance Test Facility at Holloman AFB, NM, are used for guidance testing. Flight testing is conducted at Vandenberg AFB, CA. The top five ICBM Modernization Program contractors are Martin Marietta Aerospace, Denver, CO (Assembly, Test and Systems Support; Peacekeeper Support Equipment); Boeing Aerospace, Seattle, WA (Basing Operational Support); Rockwell, Anaheim, CA (Guidance and Control); Northrop Electronics Division, Hawthorne, CA (Inertial Measurement Unit); and Textron, Wilmington, MA (Reentry Vehicle/Reentry System).

(U) RELATED ACTIVITIES:
- (U) Program Element # 0101215F, Peacekeeper Squadrons, for Airborne Launch Control Center Modifications.
- (U) Program Element # 0101215F, Peacekeeper Squadrons, for Flight/Ground Test Support.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Missile Procurement (BA 4; P-1 Line 001):					
(Weapon System only)	792,510	729,860	671,988	3,237,561	12,508,300
Quantity	12	12	12	59	173*

* The Air Force is reviewing the total Peacekeeper missile buy given life cycle and testing requirements associated with Rail Garrison rebasing.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: #3 - Strategic Programs
Project Title: Peacekeeper Rail Garrison



POPULAR NAME: Rail Garrison

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		IIIA-04/90 ROD-11/89	IIIB-04/93	FAD-12/92 FOC-12/94
Engineering Milestones	PDR-02/89-05/90	CDR-1/90-1/91		
T&E Milestones	1st CALTP-07/89	2nd CALTP - 07/90	1ST BVM - 3Q/92	
Contract Milestones				
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	307,689	531,983	324,366	146,883 (94,127)
Support Contract	39,521	31,412	35,776	196,700 (22,638)
In-House Support	32,847	70,000	60,000	261,529 (45,000)
GFE/ Other	78,612	140,849	127,907	550,239 (116,744)
Total	458,669	774,244	548,049	2,472,351 (278,509)

Program Element: # 0604312F
PE Title: ICBM Modernization

Project Number: N/A
Budget Activity: 3 - Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The military need for ICBM modernization stems from the requirement to respond to Soviet ICBM developments which are causing a major imbalance between the United States and Soviet strategic capabilities. The overall mission of the ICBM modernization program is to support the U.S. strategic deterrent policy while responding to changes in the projected Soviet threat and target base. The modernization program is built on the recognition that all ICBM tasks cannot be served by a single missile or a single basing mode. The response includes deploying Peacekeeper missiles in Rail Garrison.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed phase I land navigation testing, phase I of the canisterized launch test program, and shock tube/SREMP testing.
   - (U) Conducted Preliminary Design Reviews of all subsystems and support equipment.
   - (U) Filed and released final EIS.
   - (U) Constructed facilities to test Rail Garrison concept at Vandenberg AFB.
   - (U) Began the Logistics Support Analysis Record (LSAR).
   - (U) Conducted the Launch Control System (LCS) Software Specification Review (SSR).
   - (U) Design authorization granted for construction of garrison and Missile Assembly Building (MAB) at F.E. Warren AFB (FEWAFB).

2. (U) FY 1990 Planned Program:
   - (U) Begin Chapter 11 rail car tests.
   - (U) Start Mechanical Development Test (MDT) at Vandenberg AFB (VAFB).
   - (U) Make Record of Decision (ROD) announcement for remaining six bases.
   - (U) Complete Phase III of the Habitability Test Program.
   - (U) Begin conducting Critical Design Reviews (CDRs).
   - (U) Complete Preliminary Design Reviews (PDRs).
   - (U) Initiate system integration at Vandenburg AFB (VAFB).
   - (U) Complete Phase II Canister Assembly Launch Test Program (CALTP).
   - (U) Complete Phase IIA and IIB land navigation testing.
   - (U) Construct facilities at F.E. Warren AFB.
   - (U) Delivery of first Launch Control Car (LCC) Engineering Model (EM), EMS-2.
   - (U) Start MAB construction at FEWAFB.
   - (U) Obtain design authorization for garrisons at bases 2-4.
   - (U) Source of Repair Decision will be made.
   - (U) Operational equipment spares contract will be awarded.
   - (U) Complete prime item development specification.
   - (U) Canister/Missile/MLC integration tests.
   - (U) Conduct command and status and EM demonstratons at the Development Integration Lab (DIL).
   - (U) Delivery of the first MLC EM (EM-1) for development testing.

Program Element: #0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

3. (U) FY 1991 Planned Program:
   - (U) Milestone IIIA review.
   - (U) Perform Launch Control Car (LCC)/MLC system integration tests.
   - (U) Award rail car production contracts.
   - (U) Complete CDRs.
   - (U) Complete Chapter 11 rail car testing.
   - (U) Start provisioning item orders.
   - (U) Complete interface control drawings.
   - (U) First Basing Verification Missile (BVM) and Aerospace Vehicle Equipment (AVE) hardware delivered.
   - (U) Complete Guidance & Control (G&C) Software Test Readiness Review.
   - (U) First MLC Operational Model (OM) delivered (Pathfinder OM-4).
   - (U) Begin functional configuration audits (FCAs).
   - (U) Conduct the security car and train physical security system (TPSS) qualification.
   - (U) Start construction of garrisons at bases 2-4.
   - (U) Conduct mobility testing.
   - (U) Conduct the LCC/operational support equipment (OSE) bay qualification.
   - (U) Complete construction of VAFB facilities.
   - (U) Baseline the logistics support analysis (LSA)/LASR.
   - (U) Conduct the OM demonstration at the DIL.

4. (U) Program to Completion:
   - (U) Conduct BVM launches.
   - (U) First Assets Delivered (FAD) in December 1992.
   - (U) Achieve Full Operational Capability (FOC) in December 1994.

D. (U) WORK PERFORMED BY: The program is managed by the Ballistic Systems Division, Norton Air Force Base, CA. Facilities at the Rail Transportation Test Center and Vandenberg AFB are used for development, integration, and system level tests. The major Peacekeeper Rail Garrison contractors are: Boeing Aerospace, Seattle, WA (Basing, Test, and System Support (BT&SS)); Westinghouse Electric, Sunnyvale, CA for the MLC; Rockwell Autonetices, San Bernadino, CA for the LCS; and the Peacekeeper aeronautical vehicle equipment contractors will provide missile components.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: None.
   2. (U) SCHEDULE CHANGES: None.
   3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
   - (U) SAC ROC 16-71 (Revised), 1 Feb 79 (S)
   - (U) SAC SORD 018-87-II, Jun 88 (S)
   - (U) BCD, Oct 87 (U)
   - (U) WSS, Jun 88 (U)
   - (U) DCP, Mar 88 (S)
   - (U) STAR, Mar 88 (S)
   - (U) ILSP, Mar 88 (U)
   - (U) TEMP, Jun 89 (S)

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

G. (U) RELATED ACTIVITIES:

- (U) Program Element # 0101215F, Peacekeeper Squadrons, for Airborne Launch Control Center Modifications.
- (U) Program Element # 0101215F, Peacekeeper Squadrons, for Flight/Ground Test Support.
- (U) Program Element # 0101215F, Peacekeeper Squadrons, for Peacekeeper missile production (shared).
- (U) Program Element # 0604312F, ICBM Modernization, for Peacekeeper in Minuteman Silo missile development (shared).
- (U) Program Element # 0303131F, Minimum Essential Emergency Communications Network contains FY 89 development funding for dual frequency MEECN receiver.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. (U) Missile Procurement (BA 4; P-1 Line 001):					
Funds	0	102,607	1,346,043	2,568,500	4,017,100
2. (U) Military Construction (BA _):					
Funds	0	104,850	249,220	232,900	587,020
3. (U) Military Construction (BA _):					
Funds	0	0	5,100	0	5,100
4. (U) Military Construction (BA _):					
Funds	13,200	10,800	14,230	5,000	43,230

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

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Static Load	06/88 - 09/88	Launch load reaction is well within program requirements
Stationary Vibration	10/88 - 11/88	Results did not exceed program requirements
CALTP Launch I	07/89	First launch indicated MLC and track launch reaction loads are within requirements
Land Navigation Phase I	08/87	Inertial instruments stable
Land Navigation Phase II	12/88 - 03/89	Initial conditions for Phase IIA sled tests generated; demonstrated and evaluated a number of land navigation techniques
Land Navigation Phase IIA	06/89 - 10/89	G&C performance during sled tests consistently within accuracy requirements and associated timelines

Program Element: # 0604312F
PE Title: ICBM Modernization

Project Number: N/A
Budget Activity: 3 - Strategic Programs

T&E ACTIVITY (PAST 36 MONTHS) (Cont'd)

Event	Date	Results
NH&S Blast and SREMP	02/88 - 08/88; 06/89	Results within program requirements

T&E ACTIVITY (TO COMPLETION)

Event	Date	Results
CALTP Phase II	07/90, TBD	
SYSTEM INTEGRATION		
Rail car/Train Dynamics	01/90 - 02/91	TBD
Canister/Missile/MLC Integration	07/90	TBD
Train Integration	12/90	TBD
MLC/LCC Integration	01/91	
WEAPON SYSTEM		
NH&S SREMP	08/88 - 03/89	
Ground Tests	01/90 - 06/90	TBD
Pathfinder	02/92 - 04/92	TBD
NH&S HEMP	06/92	
BVM Launches	07/92 - 06/93	TBD
Dedicated IOT&E	09/92 - 11/92	TBD

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs
Project Title: Small ICBM

POPULAR NAME: Small ICBM

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Program Restart 07/89			Basing PSD Restart; IIIA; IIIB; FAD 12/97
Engineering Milestones				Msl CDR/FCA/PCA; HML CDR/FCA/PCA; WCS PDR/CDR/FCA/PCA
T&E Milestones	Mob Test 3/89; FTM-1 05/89		FTM-2	FTM 3-16 HML Cold Launches
Contract Milestones	Restart Change Orders	Missile Restart Support Agreements	HML/WCS Restart Support Agreements	
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract		TBD	TBD	TBD (TBD)
Support Contract		TBD	TBD	TBD (TBD)
In-House Support		TBD	TBD	TBD (TBD)
GFE/ Other		TBD	TBD	TBD (TBD)
Total	346,001	100,000	202,159	6,919,100 (3,381,000)

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The military need for ICBM modernization stems from the requirement to respond to Soviet mobile ICBM developments which are causing a major imbalance between the United States and Soviet strategic capabilities. The overall mission of the ICBM modernization program is to support the U.S. strategic deterrent policy while responding to changes in the projected Soviet threat and target base. The modernization program is built on a recognition that all ICBM tasks cannot be served by a single missile or a single basing mode. ICBM Modernization provides mobile, flexible, highly survivable ICBMs, which enhance strategic stability, deterrence, and arms control. The FY 89 President's Budget contained funds intended to keep the options open for the new Administration to decide whether or not to continue the Small ICBM program. In June 1989, the President decided to continue development of both the Peacekeeper Rail Garrison and the Small ICBM programs. The FY 91 Amended President's Budget contains funds to continue Small ICBM missile development and basing risk mitigation tasks with restart of full-scale development of the entire system in FY 1992 leading to an FAD in Dec 1997.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Maintained reduced contractor force in place and continued minimum missile and basing development efforts to allow the new Administration the option to continue the program if desired.
   - (U) Completed missile Canister Assembly Launch Test Program (CALTP) (cold launches).
   - (U) Launched the first flight test missile, FTM-1.
   - (U) Built a full scale HML engineering test unit (ETU) which contained an instrumented ground test missile (GTM).
   - (U) Completed critical weapon control system (WCS) operational requirements analysis (OAR).
   - (U) Conducted northern tier HML mobility and hardness transition testing at Malmstrom AFB, MT.
   - (U) Presidential decision to continue program in FY90/91 with restart of FSD of entire weapon system in FY92 leading to FAD in Dec 97.
   - (U) Contractually implemented restart program (bridge change orders).
   - (U) Started FTM-1 anomaly investigation.

2. (U) FY 1990 Planned Program:
   The following plans are based on receiving the FY 90 appropriation ($100M).
   - (U) Complete FTM-1 anomaly investigation and identify corrective actions.
   - (U) Continue missile development and begin fabrication of flight test hardware and spares to continue flight test program.
   - (U) Issue supplemental agreements for the remainder of the FSD program.
   - (U) Continue basing risk mitigation development efforts.

3. (U) FY 1991 Planned Program:
   - (U) Define basing location and reentry vehicle configuration.
   - (U) Continue missile development and fabrication of flight test hardware and spares.
   - (U) Conduct FTM-2 flight test.
   - (U) Continue basing risk mitigation development efforts.

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

4. (U) Program to Completion:
   - (U) Restart full-scale development of the entire weapon system in FY 92, perform FSD tasks leading to FAD in 1997.
   - (U) Continue the flight test program.
   - (U) Advanced procurement in FY 94.

D. (U) WORK PERFORMED BY: The program is managed by the Ballistic Systems Division, Norton Air Force Base, CA. Facilities at Arnold Engineering Development Center, Tullahoma, TN, are used for motor testing and facilities at the Central Inertial Guidance Test Facility at Holloman AFB, NM, are used for guidance testing. The Small ICBM program also utilizes 22 labs and agencies throughout the U.S. to conduct testing and analyses. Flight testing is conducted at Vandenberg AFB, CA. The associate contractors (ASCONs) are Martin Marietta Aerospace, Denver, CO (Assembly, Test and System Support); Boeing Aerospace and Electronics, Seattle, WA (Hard Mobile Launcher and Weapon Control System); Rockwell International Rocketdyne Division, Canoga Park, CA (Guidance and Control); Northrop Electronics Division, Hawthorne, CA (Inertial Measurement Unit); General Electric, Pittsfield, MA (Reentry Vehicle/Reentry System); Morton Thiokol, Brigham City, UT (Stage I and FTOS); Aerojet, Sacramento, CA (Stage II); Hercules, Magna, UT (Stage III).

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.

2. (U) SCHEDULE CHANGES: Due to Congressional budget constraints in FY 88/89, program was restructured in Apr 88 to terminate on 30 Sep 89. Presidential decision (Jun 89) to fund program in FY 90/91 Amended President's Budget to conduct missile development and basing risk mitigation efforts with restart of full-scale development of entire system in FY 92 leading to an FAD in Dec 97.

3. (U) COST CHANGES: FY 90 ($100M) and FY 91 ($202M) funding was added in the Amended Presidents Budget. OSD added $947M, FY 92-94, for missile and basing full-scale development and advanced buy (FY 94, $145M).

F. (U) PROGRAM DOCUMENTATION:
   - (U) BCD, 14 Feb 86 (S)
   - (U) SAC SON 01-83 (Change 1), 5 May 86 (S)
   - (U) SAC SOC, 15 Sep 86 (Updated Apr 88) (S)
   - (U) DCP, 1 Nov 86 (S)
   - (U) STAR, Jan 87 (S)
   - (U) NSD 14, ICBM Modernization and Strategic Defense Initiative (SDI), 14 Jun 89 (S)

G. (U) RELATED ACTIVITIES:
   - (U) Program Element # 0604312F, ICBM Modernization, for Peacekeeper Rail Garrison.
   - (U) Program Element # 0101215F, Peacekeeper Squadrons, for Airborne Launch Control Center Modifications.
   - (U) Program Element # 0101213F, Minuteman Squadrons, for Rapid Execution and Combat Targeting (REACT).
   - (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. (U) Missile Procurement (BA 4; P-1 Line 001):					
Funds	0	0	0	TBD (FY94: $145.0M)	TBD

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

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Land Navigation Tests	Dec 86-Jul 87	Tested the ability of the Inertial Measurement Unit (IMU) to maintain accurate alignment and calibration and to perform its land navigation function
Guidance Sled Testing at Holloman AFB, NM	Jan-Jul 87	Evaluated the ring laser gyro alternate inertial navigation systems
AINS Instruments Tests	Jan-Jul 87	Characterization testing of inertial instruments
Stage Static Firings	Jan-Sep 87	Four full scale stages firings at ground and simulated altitude conditions
Northern Tier Mobility Test	Feb-Apr 87	HML Mobility Test Bed (MTB) mobility evaluation at Malmstrom AFB under conditions representative of Minuteman Base siting
Simulated Breech Assembly Test Series	Jul-Sep 87	First full scale tests of complete missile launch eject system. This series of tests was a precursor to the canister assembly and launcher test program (CALTIP)
PBV/Shroud Model Survey	May-Jun 87	Verified the coupled vibration performance of the PBV/Shroud containing high fidelity mock-ups of the guidance, ordnance, RV, and instrumentation systems
Misty Picture	May 87	Above ground high explosive blast with ideal and precursor simulation testing of Hard Mobile Launcher nuclear hardness and survivability

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

T&E ACTIVITY (PAST 36 MONTHS) (Cont'd)

Event	Date	Results
Minuteman III #1 Guidance Flight Tests	Apr 87	Flight tests of Alternate Inertial Navigation Systems (AINS) guidance systems to evaluate realtive performance in a flight environment
Minuteman III #2 Guidance Flight Tests	Sep 87	Flight tests of Alternate Inertial Navigation Systems (AINS) guidance systems to evaluate relative performance in a flight environment
Canister Assembly and Launcher Test Program (CALTP)	Oct 87, Dec 87, Apr 88	Tests to confirm the test launcher-to-missile interfacing subsystems and launch eject performance
Norther Tier Mobility Test	Dec 87-Mar 88	HML Mobility Test Bed (MTB) mobility evaluation at Malmstrom AFB under conditions representative of Minuteman base siting.
Land Navigation Tests	Jun-Aug 88	Demonstrate the ability of the Inertial Measurement Unit (IMU) to maintain accurate alignment and calibration and perform its land navigation function
Stage Firings-Stage III	Feb-Jul 88	Evaluate stage performance at contractor facility and at AEDC
Stage Firings-Stage I	Feb-Oct 88	Evaluate stage performance at contractor facility and at NWC
Stage Firings-Stage II	Jun-Nov 88	Evaluate stage performance at contractor facility and at AEDC
Post-Boost Vehicle (PBV) Firing	Jul-Oct 88	Evaluate PBV performance at AEDC
Command Destruct Test at Naval Weapons Center	Nov 87	Demonstrate capability of the flight termination system to safely destroy the missile if required
Above Ground Nuclear Hardened Parts Testing	Continuous	Characterization of nuclear hardened parts. Data used to support system design
PBV/Shroud/RV Assembly (PSRA)/Stage III Model Survey Test	May 88	Characterize undamped natural test frequencies, and damping of the Small ICBM PSRA/Stage III

Program Element: #0604312F
PE Title: ICBM Modernization

Project Number: N/A
Budget Activity: 3 - Strategic Programs

T&E ACTIVITY (PAST 36 MONTHS) (Cont'd)

Event	Date	Results
Instrumentation and Range Safety System (IRSS) Qualification Testing	Feb-Oct 88	Evaluate performance adequacy of the IRSS for flight test program
Shroud Separation Test	Jun-Jul 88	Evaluate shock induced by shroud separation and verify shroud separation clearances from the PBV, Shroud, Reentry Vehicle (PSRA)
HML Engineering Test Unit Unit (ETU) Mobility and Hardness Transition Testing	Dec 88-Mar 89	HML Engineering Test Unit (ETU) performance evaluation at Malmstrom AFB under conditions representative of Minuteman Base siting
Meteror Burst Field Test Phase II	Jul-Sep 88	Determine the effect of antenna polarization, range, and power on waiting time
Meteror Burst Field Test Phase III	Nov 88-Apr 89	Confirm performance of meteor burst long range communication system
Flight Test Missile (FTM-1)	May 89	First flight test from a test launcher from the pad at Vandenberg AFB, CA

T&E ACTIVITY (TO COMPLETION)

Event	Date	Results
FTM-3 thru FTM-16	TBD	
HML Cold Launches	TBD	

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FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604321F Budget Activity: 4 - Tactical Programs
PE Title: Joint Tactical Fusion Program (JTFP)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1 Joint Tactical Fusion Program (JTFP)	7,947	4,796	[redacted]		

B. (U) BRIEF DESCRIPTION OF ELEMENT: JTFP is a joint Army/Air Force effort to develop a near-real-time (NRT), all-source, tactical intelligence fusion and processing/dissemination system. The Enemy Situation Correlation Element (ENSCE) system within the JTFP is the Air Force portion of a joint Army/Air Force project to automate the correlation and analysis of high volume, time-sensitive intelligence data. Other JTFP efforts supporting the Air Force include the Intelligence Correlation Element (ICE) software capability, which is dlesigned for IBM-based intelligence host computers at United States Air Forces, Europe (USAFE) and Pacific Air Forces (PACAF); and intelligence fusion processing systems which includes Linked Intelligence/Operations Centers Europe (LOCE) supporting EUCOM and Limited ENSCE (LENSCE) supporting 9th and 12th Air Forces in garrison and deployed operations.

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

1. (U) PROJECT XXX1, Joint Tactical Fusion Program:

(U) FY 1989 Accomplishments:
- (U) Continued ASAS/ENSCE development.
- (U) ICE cadre trained at Goodfellow AFB.
- (U) LOCE/LENSCE version 2.0 software documentation delivered.
- (U) ICE delivered and integrated at USAFE.
- (U) LENSCE participation in Blue Flag 89-2 and 89-3 exercises.
- (U) LOCE/LENSCE version 2.2 software delivered.
- (U) Began LENSCE functional test interface design/development with Contingency TACS Automated Planning System (CTAPS).
- (U) LOCE-ASARS II automated interface completed.
- (U) LOCE participated in Warrior Ace 89 and WINTEX 89.
- (U) LOCE/LENSCE software ported to portable ASAS workstation.
- (U) LOCE supported US Battlefield Information Collection and Exploitation System (BICES)/NATO Intelligence Support Steering Committee (NIISC) initiative.

(U) FY 1990 Planned Program:
- (U) Continue ASAS/ENSCE development.
- (U) LOCE/LENSCE software development, version 3.0.
- (U) ICE Operational Assessment (USAFE), and delivery to PACAF.
- (U) Begin ICE Configuration Management/Maintenance at Rome Air Development Center.
- (U) Partial LOCE/LENSCE interim database development.

Program Element: #0604321F Budget Activity: 4 - Tactical Programs
PE Title: Joint Tactical Fusion Program (JTFP)

- (U) Conduct ICE Functional and Physical Configuration Audits.
- (U) Conduct feasibility study to incorporate LOCE/LENSCE into Contingency TACS Automated Planning System (CTAPS).
- (U) Study alternatives and provide USAFE/PACAF a system-high correlation capability.

(U) FY 1991 Planned Program:
- (U) Continue ASAS/ENSCE participation.
- (U) LOCE/LENSCE version 4.0 and 5.0 software deliveries.
- (U) LOCE processing center deliveries to FRG/UK.
- (U) LOCE/LENSCE improved workstation development.
- (U) LOCE support of US BICES/NIISC initiatives.
- (U) Provide LOCE/LENSCE capability on CTAPS.
- (U) Continue USAFE/PACAF system-high correlation effort.

(U) Work Performed By: The Jet Propulsion Laboratory (JPL), California Institute of Technology, Pasadena, CA is the prime integration contractor for ASAS/ENSCE. Subcontractors include: TRW, McLean, VA; McDonnell Douglas, Huntington Beach, CA; Ford Aerospace Corp, San Jose, CA; Martin Marietta, Denver, CO; MITRE Corp, Bedford, MA.; Eagle Technology, Fairfax, VA; and Sterling Federal Systems Inc., Bellevue, NE. AFSC/Electronic Systems Division is the Air Force in-house developing organization responsible for the Air Force segment of JTFP. For LOCE/LENSCE, the contractors are: Digital Fantasies Limited, Dunn Loring, VA; Contel (Eaton), West Lake Village, CA; and Contel (DSSD) Marina del Rey,CA

(U) Related Activities: The Army is the Executive Agent for this Joint Program. The program is conducted in accordance with the following documents: US Army, Letter of Instruction (LOI) for JTFP Special Task Force (STF), 5 July 1984; Chiefs of Staff Army and Air Force Memorandum Subject: Airland Battle Programs, 30 June 1983; and Air Force Program Management Directive 9087(8)/64321F/ 27431F, 15 mar 1989. Relationships between the Air Staff; Air Force Systems Command (AFSC), the implementing command; Tactical Air Command, the operating command; and the Joint Program Management Office are continuous. Related Program Elements include: #0603260F, Intelligence Advanced Development, #0207431F, Tactical Air Intelligence Systems, #0604321A, Joint Tactical Fusion Program. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: There are no specific cooperative agreements regarding the JTFP. No signed documents exist and no foreign funds are provided to the program office. However, the JTFP is an integral part of the US BICES effort. The JTFP supports BICES through the Defense Intelligence Agency. LOCE terminals are currently on loan to the 1st British Corps and the 1st German Corps in support of BICES CADS. In addition, the Canadians have displayed an interest in using LOCE terminals.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604327F Budget Activity: #4 - Tactical Programs
PE Title: Hardened Target Munitions

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3273 I-2000 P^3I	6,122	6,408	- 0 -	- 0 -	12,630
Total	6,122	6,408	- 0 -	- 0 -	12,630

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program develops standoff munitions capable of attacking hardened targets that cannot be defeated with current inventory munitions. Recent Soviet efforts have produced a growing hardened target set, which includes command and control bunkers, hardened aircraft shelters, underground weapons and fuel storage facilities. The MK-84 bomb suffers from case failure, low order detonation and ricochet when used against hard targets. The Improved 2000-lb bomb has demonstrated the capability to defeat a large portion of the hardened target set. Coupling the Improved 2000-lb bomb with GBU-15 TV/IR guidance provides the TAF with a precision guided hard target attack capability.

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

1. (U) Project 3273 - I-2000 Pre-Planned Product Improvement: Integrates the I-2000 (BLU-109/B) hard target warhead with the existing GBU-15 guidance system to produce a standoff munition for attacking hard targets.

(U) FY 1989 Accomplishments:
- (U) Awarded FSD contract for GBU-15/I-2000 integration kits.
- (U) Conducted Preliminary Design Review.
- (U) Conducted Critical Design Review.
- (U) Modified AN/GJM-55 Test Set to include GBU-15/I-2000.

(U) FY 1990 Planned Program:
- (U) Procure flight test hardware.
- (U) Conduct Development Test and Evaluation/Initial Operational Test and Evaluation.
- (U) Begin production of GBU-15/I-2000 integration kits.

(U) FY 1991 Planned Program:
- (U) Not applicable. Program completes in FY 90.

(U) Work Performed by: Air Force Arnold Engineering Development Center, TN; Rockwell International, Duluth GA; FSD contractor, Teledyne Brown Engineering, Huntsville AL; Munitions Systems Division at Eglin AFB FL manages the development effort.

Program Element: #0604327F Budget Activity: #4 - Tactical Programs
PE Title: Hardened Target Munitions

(U) Related Activities:
- (U) Program Element 0604733F, Surface Defense Suppression.
- (U) Program Element 0604602F, Armament/Ordnance Development.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds ($ in Thousands): Procurement funding for the GBU-15/I-2000 integration kits will be under Program Element 0208030F.

Other Procurement, (Budget Activity 1, P-1 Line Item 22)

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	- 0 -	400	2,531	-0-	2,931
Quantity	- 0 -	50	1,570	-0-	1,620

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604361F
PE Title: Air-Launched Cruise Missile
Project Number: xxxl
Budget Activity: #3-Strategic

A. (U) RESOURCES ($ In Thousands)

Project Name	Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ALCM		835	1,347	0	0	2182

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Air-Launched Cruise Missile (ALCM) greatly enhances the air-breathing leg of the Triad by stressing and diluting Soviet defenses, thus improving the overall penetration prospects of the mixed air-breathing force; compelling the Soviets to devote substantial resources to their national air defenses to counter this threat; increasing the number of weapons in our strategic forces in the near term and convincing the Soviets that their massive air defense efforts will not substantially blunt U.S. air-breathing strike capabilities.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:

- (U) Completed ALCM/B-1B R&D acoustic integration testing
- (U) Completed mission planning improvements
- (U) Completed missile software changes

2. (U) FY 1990 Planned Program:

- (U) De-Modify 8 missiles that are in test configuration
- (U) Complete PMRT residual tasks

3. (U) FY 1991 Planned Program:

- (U) Terminate RDT&E

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Program Element: #0604361F
PE Title: Air-Launched Cruise Missile
Project Number: xxxl
Budget Activity: #3-Strategic

D. (U) WORK PERFORMED BY: The major contractors are Boeing Aerospace, Seattle, WA (air vehicle); Williams International Corporation, Walled Lake, MI; Teledyne CAE, Toledo, OH (engine); Litton Industries, Woodland Hills, CA; Litton of Canada Limited, Toronto, ONT; and Minneapolis Honeywell, Minneapolis, MN (navigation guidance). In-house developing organizations are Defense Mapping Agency and the Joint Cruise Missiles Project Office. The AGM-86B Air-Launched Missile program is managed by Air Force Systems Command's Aeronautical Systems Division, Wright-Patterson AFB, OH.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC ROC 1-68, 19 Jan 68, Improved Decoy for Manned Aircraft, and SAC ROC 20-69, 4 Sep 69, B-52 Decoy (inactive).

G. (U) RELATED ACTIVITIES:
- (U) The ALCM, the land attack Sea-Launched Cruise Missile (SLCM), and the Ground-Launched Cruise Missile (GLCM) programs are structured to have maximum commonalty in engine and navigation/guidance subsystems. The ALCM and SLCM share the common W-80 nuclear warhead developed by the Department of Energy.

- (U) The engine and navigation/guidance projects are jointly managed through the Joint Cruise Missiles Project Office. The B-52 Squadrons, PE 11113f, is also related to the ALCM.

- (U) There is no unnecessary duplication of effort within the Air Force or DOD.

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

1. PROCUREMENT:

	FY89	FY90	FY91	To Complete	Total Program
Mods/Updates	2205	1169	3733	Cont	TBD
Replen Spares	6466	2828	0	Cont	TBD

2. MILITARY CONSTRUCTION: FY 89 4.8M; FY 90 and out $0 dollars

Program Element: #0604361F Project Number: xxxl
PE Title: Air-Launched Cruise Missile Budget Activity: #3-Strategic

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: There is an agreement for test flight of missiles over Canadian territory. There are no international production agreements.

J. (U) MILESTONE SCHEDULE:

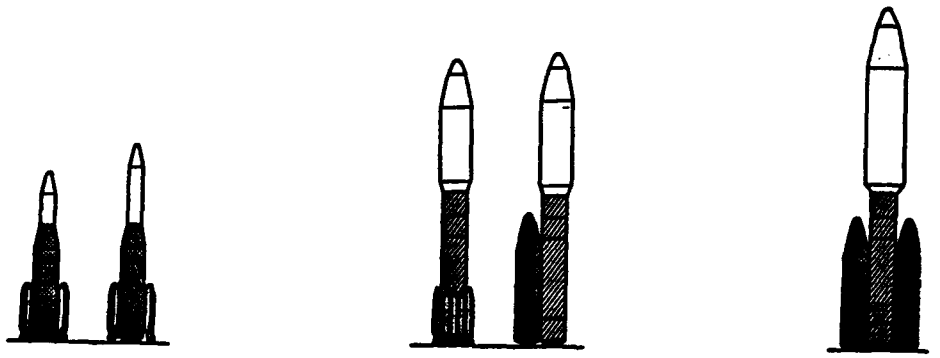
1. (U) Production deliveries have terminated

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604408F
PE Title: Advanced Launch System (ALS)

Project Number: XXX1
Budget Activity: #6 Defense Wide Mission Support

Project Title: Advanced Launch System (ALS)/ Advanced Launch Development Program (ALDP)



POPULAR NAME: ALS

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Program Restructure		
Engineering Milestones		Delta SDR		
T&E Milestones	TEMP	Begin technology demo's		
Contract Milestones	Phase Two Award			
BUDGET ($000)	FY 1989	FY 1990	FY 1991	To Complete
Major Contract		17,896	3,000	
Technology & Support Contracts		55,722	48,090	
In-House Support		12,604	9,214	
GFE/ Other				
Total	SDIO funds only	86,222 plus SDIO	60,314 pls SDIO/NASA	Cont

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Program Element:#0604408F
PE Title:Advanced Launch System (ALS)
Project Number:XXX1
Budget Activity:# 6 Defense Wide Mission Support

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The ALS program forms the technical basis for a new family of space launch vehicles that can provide secure, responsive, reliable, flexible, low cost access to space across a broad range of expected payload sizes, orbits and launch rates. The program objectives are to develop and mature the propulsion and other critical technologies necessary to support new launch concepts; to make these technologies available for improving existing systems; and to define concepts to lower the cost of assured space operations. The program began with SDIO funding from the FY 87 urgent supplemental appropriation. Starting in FY 1990, both SDIO and the Air Force share funding responsibility for ALS. The program need was acknowledged by the validation of the Air Force Space Command's and National Aeronautics Space Administration's (NASA) Mission Need Statements and the successfull completion of a Defense Acquisition Board Milestone review in September 1988.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Initiated preliminary design efforts
   - (U) Initiated Advanced Development Program (ADP) Demonstrations
   - (U) Delta System Requirements Review
   - (U) Engine Demonstration/Validation (Phase B) Contracts Awarded
   - (U) Rev "C" ADP program plan released
   - (U) Solid Rocket Motor Concept Exploration Contracts Awarded

2. (U) FY 1990 Planned Program:
   - (U) Engine Requirements Review
   - (U) Program Restructure Initiated
   - (U) Delta System Design Review
   - (U) Rev "D" ADP program plan release

3. (U) FY 1991 Planned Program:
   - (U) Engine Design Implementation Review
   - (U) Rev "E" ADP release

4. (U) Program to Completion:
   - (U) Engine Final Design Review
   - (U) End Concept Exploration/Study Contracts (FY 93)
   - (U) End Vehicle Contractor ADP tasks (FY 93)
   - (U) Engine Prototype Source Selection (FY 93)
   - (U) This is a continuing program.

D. (U) WORK PERFORMED BY: This is a joint Air Force/NASA program. Prime contractors for Phase II of the program are Boeing Aerospace Corporation, Seattle, Washington; General Dynamics Space Systems Division, San Diego, California; and Martin Marietta Astronautics Group, Denver, Colorado. The Phase B Engine Development work being contracted by NASA is performed by Pratt & Whitney, Rocketdyne, and Aereojet. The

Program Element:#0604408F
PE Title:Advanced Launch System (ALS)
Project Number:XXX1
Budget Activity:# 6 Defense Wide Mission Support

solid motor Phase A work is being performed by Hercules, Aerojet, Morton Thiokol, Atlantic Research, and United Technologies/Chemical Systems Division. The major Air Force developing organizations include Air Force Space Division, Air Force Astronautics Laboratory and Air Force Wright Aeronautical Laboratories. The major NASA developing activities include Marshall Space Flight Center, Langley Research Center, Kennedy Space Flight Center, Ames Research Center, Johnson Space Center, Lewis Research Center, and the Stennis Space Center.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: The scope of the program has changed from developing a family of launch vehicles with a projected Initial Operating Capability (IOC) in the year 1998 to exploring concepts and prototying the necessary technical elements to protect the development of a new launch vehicle system.

2. (U) SCHEDULE CHANGES: The 1998 IOC and Milestone I DAB have been deferred indefinitely until Full Scale Development funds are available. The Phase II launch vehicle design contracts, originally scheduled for completion in Jan 91, will continue until Dec 92 to support the liquid engine development program.

3. (U) COST CHANGES: NONE

F. (U) PROGRAM DOCUMENTATION:

- (U) AFSPACECOM Mission Need Statement 30 Jun 88
- (U) NASA Mission Need Statement 11 Aug 88
- (U) AFSPACECOM SON 005-88 12 Aug 88
- (U) Milestone 0 Acquisition Decision Memorandum 4 Nov 88

G. (U) RELATED ACTIVITIES:

- (U) All funding through FY 1989 provided by SDIO, Program Element #603224C, (Survivability/lethality Execution Program) Project 004, funding shared beginning in FY 1990 under Program Management Agreement (PMA) #F1505.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

- (U) Additional funding provided by NASA starting in FY 91.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

Program Element:#0604408F
PE Title:Advanced Launch System (ALS)

Project Number:XXX1
Budget Activity:# 6 Defense Wide Mission Support

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
ADP Tests Start	Oct 89	Subsystem and component demonstrations by prime vehicle and engine contractors and government lab and center sponsored technology activities.

T&E ACTIVITY (TO COMPLETION)

Event	Date	Remarks
ADP Vehicle Contractors Complete	Dec 1992	Subsystem and component demonstrations by prime vehicle contractors
ADP Test Complete	1998	Subystem and component demonstrations by prime engine contractors and government lab and center sponsored technology activities.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604601F Budget Activity: #4 - Tactical Programs
PE Title: Chemical/Biological Defense Equipment

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3321 Chemical and Biological Agent Detection and Warning	3,224	0	2,685	Cont	TBD
3337 Individual Protection	9,520	7,941	5,665	Cont	TBD
3762 Collective Protection	2,375	0	0	Cont	TBD
3764 Decontamination	2,191	0	0	Cont	TBD
Total	17,620	7,941	8,350	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program develops systems to detect, warn against, and protect personnel and equipment from chemical/biological agents. These systems will allow the Air Force to continue its mission in a chemical/biological environment and, with a credible offensive capability, deter enemy use of chemical/biological weapons. Without these protective systems, sortie generation on a sustained basis will be degraded unacceptably.

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

1. (U) Project 3321, Chemical/Biological Agent Detection and Warning: Develops detectors to warn personnel of chemical attacks.

(U) FY 1989 Accomplishments:
- (U) Continued to monitor Army efforts to develop their Advanced Chemical Agent Detector/Alarm and the Remote Sensing Chemical Agent Alarm.
- (U) Continued procurement of the Automatic Liquid Agent Detector (ALAD).
- (U) Funded efforts to provide threat scenarios and technical/analytical assistance in support of the Fixed Site Detection and Warning System (FSDWS) program.

(U) FY 1990 Planned Program:
- (U) Start full scale development of FSDWS.
- (U) Complete first article test of ALAD.

(U) FY 1991 Planned Program:
- (U) Continue development of FSDWS.
- (U) Deliver ALAD to using community.

Program Element: #0604601F Budget Activity: #4 - Tactical Programs
PE Title: Chemical/Biological Defense Equipment

(U) Work Performed By: Work has been performed by Calspan, Buffalo NY; and by task order contract with JAYCOR, Dayton OH, through the Armstrong Aerospace Medical Research Laboratory, Dayton OH. The Air Force developing organization is the Life Support System Program Office at Wright-Patterson AFB, Dayton OH.

(U) Related Activities:
- (U) Program Element #0207593F, Chemical Biological Defense Program.
- (U) Program Element #0602202F, Aerospace Biotechnology.
- (U) Program Element #0603231F, Crew Systems Technology.
- (U) Program Element #0604703F, Aeromedical Chemical Defense System Development.
- (U) Program Element #0604806A, Chemical/Biological Defense Equipment Development.
- (U) Program Element #0603514N, Ship Survivability.
- (U) Program Element #0603635M, Marine Corps Ground Combat/Support Arms.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (BA 4, P-1 Line Item 185):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	4,093	0	Continuing	TBD

(U) International Cooperative Agreements: None.

2. (U) Project 3337, Individual Protection: Develops clothing and equipment to protect personnel from chemical agent effects.

(U) FY 1989 Accomplishments:
- (U) Completed Development Test and Evaluation Flight Testing of Aircrew Eye/Respiratory Protection (AERP) systems for the C-130 and KC-135 aircraft.
- (U) Started Initial Operational Test and Evaluation (IOT&E) of AERP for the KC-135.
- (U) Initiated evaluation and development of AERP systems for the C-9 and B-1B aircraft.
- (U) NATO selected the Protective Integrated Hood Mask (PIHM) system for E-3A aircraft.
- (U) Completed Development Test and Evaluation/IOT&E for the Improved Aircrew Coverall (CWU-66/F).

(U) FY 1990 Planned Program:
- (U) Initiate IOT&E of AERP for the C-130 and F-15 aircraft.

Program Element: #0604601F Budget Activity: #4 - Tactical Programs
PE Title: Chemical/Biological Defense Equipment

- (U) Complete Initial Operational Test and Evaluation (IOT&E) of the Aircrew Eye/Respiratory Protection (AERP) system for the KC-135.
- (U) Initiate Development Test and Evaluation (DT&E)/IOT&E of AERP for the MH-53, OV-10, C-9, AC-130, and B-1B.
- (U) Conduct Functional Configurational Audits for the Tactical Aircrew Eye/Respiratory System (TAERS), Protective integrated Hood Mask (PIHM), Blower, Communication Unit, and all aircraft modification kits.
- (U) Exercise limited production of PIHM systems for C-130 and KC-135 aircraft.
- (U) Initiate development of a passive anti-drown system for AERP.
- (U) Complete reprocurement package on the Improved Aircrew Coverall (CWU-66/P).

(U) FY 1991 Planned Program:
- (U) Continue DT&E/IOT&E of AERP for the AC-130, OV-10, MH-53, C-9, B-1B, and B-52.
- (U) Make a limited production decision on AERP for the F-15, AC-130, MH-53, and OV-10.
- (U) Initiate DT&E of AERP for the B-52.

(U) Work Performed By: Work is performed by Boeing Advanced Systems Company, Seattle WA and Celanese Corp, Charlotte NC. The Air Force developing organization is the Life Support System Program Office at Wright-Patterson AFB, Dayton OH.

(U) Related Activities:
- (U) Program Element #0207593F, Chemical Biological Defense Program.
- (U) Program Element #0602202F, Aerospace Biotechnology.
- (U) Program Element #0603231F, Crew Systems Technology.
- (U) Program Element #0604703F Aeromedical Chemical Defense System Development.
- (U) Program Element #0604806A, Chemical/Biological Defense Equipment Development.
- (U) Program Element #0603514N, Ship Survivability.
- (U) Program Element #0603635M, Marine Corps Ground Combat/Support Arms.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (BA 4, P-1 Line Item 185):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	11,196	7,868	9,581	Continuing	TBD

(U) International Cooperative Agreements: None.

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Program Element: #0604601F Budget Activity: #4 - Tactical Programs
PE Title: Chemical/Biological Defense Equipment

3. (U) Project 3762, Collective Protection: Develops collective protection systems to allow personnel to perform duties requiring a shirtsleeve environment, and to seek rest and relief in an uncontaminated environment.

(U) FY 1989 Accomplishments:
- (U) Completed Development Test and Evaluation of a Transportable Collective Protection System.
- (U) Started Initial Operational Test and Evaluation (IOT&E) of TCPS.

(U) FY 1990 Planned Program:
- (U) Complete IOT&E of TCPS.
- (u) Make production decision on TCPS.

(U) FY 1991 Planned Program: Not Applicable.

(U) Work Performed By: Work has been performed by ILC Dover, Frederica DL. The Air Force developing organization is the Life Support System Program Office, Wright-Patterson AFB, Dayton OH.

(U) Related Activities:
- (U) Program Element #0207593F, Chemical Biological Defense Program.
- (U) Program Element #0602202F, Aerospace Biotechnology.
- (U) Program Element #0603231F, Crew Systems Technology.
- (U) Program Element #0604703F Aeromedical Chemical Defense System Development.
- (U) Program Element #0604806A, Chemical/Biological Defense Equipment Development.
- (U) Program Element #0603514N, Ship Survivability.
- (U) Program Element #0603635M, Marine Corps Ground Combat/Support Arms.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (BA 4, P-1 Line Item 185):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	0	11,410	Continuing	TBD

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604602F Budget Activity: #4 - Tactical Programs
PE Title: Armament/Ordnance Development

A. (U) RESOURCES ($ in thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2586 DAACM	10,698	1,000	10,274	Cont	TBD
2784 Armament Standardization/Control	1,168	600	100	Cont	TBD
3133 Bombs and Fuzes	1,259	700	300	Cont	TBD
3664 Have Stamp	275	900	0	0	3,669
5613 Munitions Material Handling Equipment/Containers	1,446	1,036	163	Cont	TBD
Total	14,846	4,236	10,837	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program modernizes and develops unguided air-to-surface conventional munitions and associated equipment. The program supports numerous Strategic Air Command and Tactical Air Forces Statements of Need. Two categories of efforts are those to provide new capabilities by modernizing existing munitions and equipment and those to develop munitions to fill operational voids. Formal organizations (focal points) are maintained to help standardize munitions and associated equipment among the services.

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

1. (U) Project 2784, Armament Standardization/Control. This continuing project supports the Armament Control Focal Point (ACFP) which conducts activities to increase standardization and commonality in armament subsystems in order to reduce proliferation and take maximum advantage of prior investments.

(U) FY 1989 Accomplishments:
- (U) Continued missile modular software program development.
- (U) Continued Mil-Std-1760 development.
- (U) Continued standardization activities.
- (U) Began AMRAAM retrofit with blind mate connectors.

(U) FY 1990 Planned Program:
- (U) Continue missile modular software development (CAMP 3).
- (U) Continue MIL-STD-1760 development.
- (U) Continue standardization activities.

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Program Element: #0604602F Budget Activity: #4 - Tactical Programs
PE Title: Armament/Ordnance Development

(U) FY 1991 Planned Program:
- (U) Continue missile modular software development (CAMP 3).
- (U) Continue MIL-STD-1760 development.
- (U) Continue standardization activities.

(U) Work Performed by: This project is managed by the Munitions Systems Division at Eglin AFB, FL. The major contractor is Sverdrup Technology, Inc., Fort Walton Beach, FL.

(U) Related Activities:
- (U) Program Element 0603601F, Conventional Weapons.
- (U) Liaison is maintained between the services through the Joint Technical Coordinating Group for Munitions Development and through coordination with the Department of Defense Armaments/Munitions Requirements and Development committee.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 3133, Bombs and Fuzes: This project develops and improves conventional bombs and fuzes. Current efforts include the M117/BSU-85/B integration effort to allow high drag delivery of the M117 bomb from strategic aircraft.

(U) FY 1989 Accomplishments:
- (U) Fabricated M117/BSU-85/B flight test articles and conducted DT&E.

(U) FY 1990 Planned Program:
- (U) Conduct BSU-85/B IOT&E.

(U) FY 1991 Planned Program:
- (U) Conduct BSU-85/B production activities.

(U) Work Performed by: This project is managed by the Munitions Systems Division at Eglin AFB, FL.

(U) Related Activities:
- (U) Program Element 0603601F, Conventional Weapons.
- (U) Liaison is maintained between the services through the Joint Technical Coordinating Group for Munitions Development and through coordination with the Department of Defense Armaments/Munitions Requirements and Development committee.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604602F Budget Activity: #4 - Tactical Programs
PE Title: Armament/Ordnance Development

(U) Other Appropriation Funds:

Other Procurement, PE 0208030F Project 3133, FMU-139/B Fuze

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	30,127	25,148	32,183	Cont	TBD
Quantity	46,753	36,213	33,066	Cont	TBD

(U) International Cooperative Agreements: None.

3. (U) Project 5613, Munitions Material Handling Equipment/Containers: This project develops more capable bomb racks, ejectors and associated handling/release equipment, and develops or improves munitions material handling equipment and containers. It supports two continuing efforts, the Container Design Retrieval System (CDRS) which was established to ensure maximum use of existing or easily modified containers by all services, and the Munitions Material Handling Equipment (MMHE) Focal Point data retrieval system which was established to ensure maximum use of existing munitions handling equipment and reduce proliferation. The CDRS and MMHE Focal Point tasks were moved from Project 2784 in FY 1988.

(U) FY 1989 Accomplishments:
- (U) Continued CDRS activities.
- (U) Continued MMHE focal point activities.

(U) FY 1990 Planned Program:
- (U) Continue CDRS activities.
- (U) Continue MMHE focal point activities.

(U) FY 1991 Planned Program:
- (U) Continue CDRS activities.
- (U) Continue MMHE focal point activities.

(U) Work Performed by: This project is managed by the Munitions Systems Division at Eglin AFB FL. There is no major contractor involved in this project. It is a combination of multiple contractors managed by the Munitions Systems Division.

(U) Related Activities:
- (U) Program Element 0603601F, Conventional Weapons.
- (U) Liaison is maintained between the services through the Joint Technical Coordinating Group for Munitions Development and through coordination with the Department of Defense Armaments/Munitions Requirements and Development committee.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

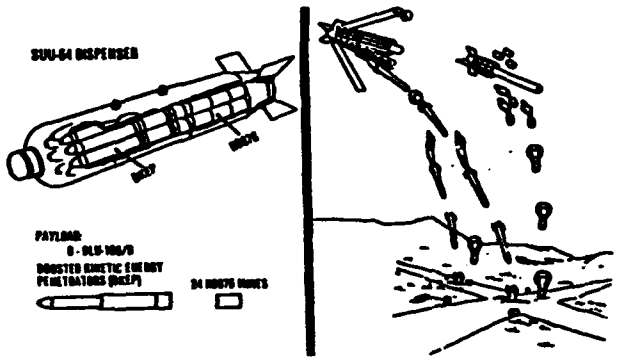
(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements. None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604602F Project Number: 2586
PE Title: Armament/Ordnance Development Budget Activity: #4 - Tactical Programs

Project Title: Direct Airfield Attack Combined Munition



POPULAR NAME: DAACM

A. (U) SCHEDULE/BUDGET INFORMATION ($ in thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	FSD Decision	FSD Start 3 Qtr/91	Complete FSD & DT/IOT&E LRIP Decision
Engineering Milestones	N/A	N/A	PDR	CDR FCA/PCA
T&E Milestones	BKEP 600 kt Test Complete	Conduct Tests vs Impr Threat	Contractor Development Test Start	DT/IOT&E TBD
Contract Milestones	N/A	N/A	FSD Awd 3 Qtr/91	LRIP Award TBD
Budget ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	5,198	-0-	7,819	TBD
Support Contract	811	-0-	1,526	TBD
In-House Support	3,634	-0-	-0-	TBD
GFE/ Other	121	-0-	929	TBD
Total	9,764 *	-0-	10,274	TBD

* $3.999M (FY 89) sourced by USAF.

Program Element: #0604602F Project Number: 2586
PE Title: Armament/Ordnance Development Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The primary requirement for the Direct Airfield Attack Combined Munition (DAACM), in accordance with TAF SON 306-79, dated 8 March 1979, is to reduce enemy sortie generation capabilities by closing down airfields through damage to the operating surfaces with the BLU-106/B Bomb, Kinetic Energy Penetrator (BKEP) cratering submunition. The employment of HB-876 Lateral Ejection (HB876LE) area denial mines, in conjunction with the BLU-106/B, will enhance the effectiveness of the cratering munitions by delaying and disrupting repair operations. The DAACM system is a 1000 pound class dispenser weapon consisting of eight BLU-106/B submunitions, twenty-four HB876LE area denial mines, an ejection/dispensing system and a control unit integrated into a SUU-64/B Tactical Munition Dispenser (TMD). DAACM is compatible with the F-16A/B/C/D, F-15E, F-111, A-7D/K, and B-52.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Conduct Airfield Attack Review.
   - (U) Begin target construction and hardware procurement/ modifications.

2. (U) FY 1990 Planned Program:
   - (U) Continue target construction and hardware procurement/modifications.
   - (U) Conduct tests of current BKEP/Durandal, improved BKEP/Durandal, alternative concepts.
   - (U) Develop Airfield Attack Roadmap.
   - (U) FSD decision.

3. (U) FY 1991 Planned Program:
   - (U) FSD contract award.
   - (U) Complete Preliminary Design Review.

4. (U) Program to Completion:
   - (U) Initial Operational Test and Evaluation Complete - FY 94.
   - (U) FSD Complete - FY 94.
   - (U) LRIP Decision - FY 94.
   - (U) LRIP Start - FY 94.

D. (U) WORK PERFORMED BY: This project is managed by the Munitions Systems Division at Eglin AFB FL. DAACM FSD source selection was cancelled in Jun 89 and FSD program deferred to Apr 90 due to threat change. BKEP development/risk reduction by Textron Defense Systems, Wilmington MA; HB876LE mine by Hunting Engineering, United Kingdom; Parachute-Only BKEP development (Training Round), Ver-Val Enterprises, Fort Walton Beach FL.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.

Program Element: #0604602F Project Number: 2586
PE Title: Armament/Ordnance Development Budget Activity: #4 - Tactical Programs

2. (U) SCHEDULE CHANGES: FSD contract award deferred to FY 91 as a result of testing required to verify submunition performance versus improved threat.

3. (U) COST CHANGES: FY 90 Appropriation deleted FY 90 budget request due to revised information regarding threat. FY 91 budget request subsequently updated to reflect delayed FSD decision.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 306-79, Mar 79.
- (U) TEMP, Jul 87 (Draft).
- (U) Tactical Air Command Concept for DAACM (U), 29 Jan 87.
- (U) SORD for DAACM, Mar 89 (Draft).

G. (U) RELATED ACTIVITIES:
- (U) BLU-106/B Bomb, Kinetic Energy Penetrator, developed under PE 0604604F, Submunitions Development, was selected for integration in DAACM.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not Applicable.

2. (U) MILITARY CONSTRUCTION: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
BKEP Risk Reduction	1985 - 1988	Improved Fuze, cratering performance adequate for DAACM.

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Airfield Attack Weapons Testing	2Q FY 90	Testing current and improved BKEP/Durandal and alternate concepts versus improved airfield threat.

Program Element: #0604602F Project Number: 2586
PE Title: Armament/Ordnance Development Budget Activity: #4 - Tactical Programs

Event	Planned Date	Remarks
Pre-CDR Contractor Demo	TBD	Each contractor to demonstrate integration and ejection of six DAACMs.
DAACM DT&E	TBD	Evaluation of 14 DAACMs from each contractor for pattern and dispensing through 600 KCAS.
DAACM IOT&E	TBD	Initial operational testing of 30 DAACMs by the winning DAACM development contractor.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604604F Budget Activity: # 4 - Tactical Programs
PE Title: Submunitions

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3166 Terminally Guided Sub-missle (TGSM)/Sense and Destroy Armor (SADARM)/Skeet Evaluation and Submunition Development	7,162	6,349	7,596	Cont	TBD
Total	7,162	6,349	7,596	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Project 3166 commonly known as "Chicken Little" is a joint project with the US Army which evaluates various developmental munitions with a high potential for use against fixed/mobile ground vehicle targets and determines antiarmor/counter-battery munition performance against actual foreign targets. This project institutionalizes the Chicken Little approach, which is the evaluation of "top attack" munitions, which includes detailed assessment of seeker/sensor and warhead performance and analysis of results. The "top attack" has been removed with emphasis toward smart munitions. Of primary importance is the use of this project by Air Force and Army program offices to gather data used to meet developmental decision points (possibly major milestone decisions). Armor and other mobile tactical targets required to conduct development tests, to evaluate operational munitions, and to provide the target set for the Chicken Little approach have been acquired under Project 3166. Vehicle signature data is collected and validated for use in simulator and seeker/sensor development.

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

1. (U) Project 3166, Joint Munitions Test and Evaluation Program: Evaluate munition performance against fixed/mobile ground targets.

(U) FY 1989 Accomplishments:
- (U) Continued Chicken Little testing against newer targets with potential countermeasures.
- (U) Continued warhead/simulated firings against advanced and add-on armor targets to determine penetration and behind armor effects for improved vulnerability analysis techniques, including ballistic countermeasures.
- (U) Continued to support Joint Tactical Coordinating Group (JTCG) in interdiction-kill (I-Kill) and standard damage assessment lists (SDAL) efforts.
- (U) Initiated Live Fire Test and Evaluation for Sensor Fuzed Weapon (SFW).
- (U) Procured armored targets and obtained characteristics for munition effectiveness modeling.
- (U) Initiated evaluation of advanced sensors/seekers for possible future application in a planned series of Captive Flight Test (CFT) events.

Program Element: # 0604604F Budget Activity: # 4 - Tactical Programs
PE Title: Submunitions

(U) FY 1990 Planned Program:
- (U) Continue evaluation of seeker/sensors against targets with potential countermeasures.
- (U) Continue warhead/simulated firings against armored targets, including the use of countermeasures, to determine penetration and behind armor effects for improved vulnerability analysis techniques.
- (U) Continue to support JTCG in I-Kill and SDAL, and warhead characterization efforts.
- (U) Conduct Live Fire Test and Evaluation for SFW.
- (U) Procure armored targets and develop high fidelity simulators.
- (U) Obtain target characteristics for munition effectiveness modelling.
- (U) Continue evaluation of advanced sensors/seekers for future applications in CFT test event series.
- (U) Analyze effectiveness of seeker/sensor combinations against targets to the one-on-one level to support weapon system development.
- (U) Gather data to support decision points for SFW and MMW seekers, Army SADARM, and others (these may or may not support major decision milestones).
- (U) Conduct Lightly Armored Fighting Vehicles (LAFV) vulnerability tests in conjunction with US Army.

(U) FY 1991 Planned Program:
- (U) Continuation of efforts described in FY 1990 planned program.

(U) Work Performed By: Program management is provided by the Munitions Systems Division, Eglin Air Force Base FL. Program office is jointly manned by Army and Air Force personnel. Advanced seekers/sensors are provided by Textron Defense Systems and Lear Astronics Corp. Advanced warheads are provided by Aerojet Precision Weapons, Textron Defense Systems, and Martin Marietta Missile Systems.

(U) Related Activities:
- (U) PE 0604607F, Wide Area Antiarmor Munitions (Sensor Fuzed Weapon (SFW)).
- (U) Army PE 0603628A, Field Artillery Ammunition Dev.
- (U) Army PE 0604631A, Field Artillery Ammunition.
- (U) Army PE 0605807A, Munitions Standardization, Effectiveness and Safety.
- (U) Memorandum of Agreement between USAF MSD and USA MICOM, TACOM, ARDC, MSAA, SMO, BRL, and TRADOC for Chicken Little II.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

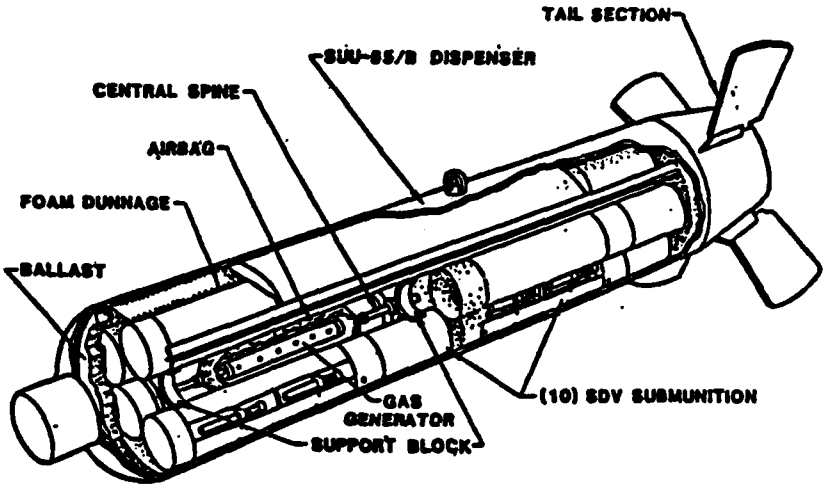
(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604607F
PE Title: Wide Area Antiarmor Munitions
Project Number: 2961
Budget Activity: # 4 - Tactical Programs

Project Title: Sensor Fuzed Weapon



POPULAR NAME: SFW

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			IIIA-Sep	IIIB-4Qtr94 LRIP1-1Qtr92
Engineering Milestones	Complete CDR Aug		FCA-Dec	
T&E Milestones	Start DT&E-Dec 88	Start IOT&E-Jul		Complete IOT&E-2Qtr92
Contract Milestones	Complete CDR Aug		FCA-Dec	LRIP1-1Qtr92
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	17,122	10,150	16,500	148,364 (0)
Support Contract	3,184	4,744	4,810	18,822 (0)
In-House Support	836	638	436	4,222 (0)
GFE/ Other	4,800	9,593	2,133	29,541 (0)
Total	25,942	25,125	23,879	200,949 (0)

Program Element: # 0604607F
PE Title: Wide Area Antiarmor Munitions
Project Number: 2961
Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Tactical Air Forces require a capability to destroy multiple enemy tanks and other armored vehicles during a single aircraft pass to overcome the existing large numerical imbalance of armor. This need is documented in the Mission Element Need Statement for an Improved Wide Area Antiarmor Capability. The Sensor Fuzed Weapon (SFW) program is an outgrowth of the Wide Area Antiarmor Munition umbrella program. This program element will accomplish full scale development of SFW.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed critical design review (CDR) and began DT&E.
   - (U) Began qualification & fabrication of test hardware for Initial Operational Test and Evaluation (IOT&E).
   - (U) Continued FSD throughout the year and corrected problems found during DT&E.
   - (U) Procured 36 SFW test stores for SEEK EAGLE accuracy verification testing of F-16.
   - (U) Conducted initial production readiness review.

2. (U) FY 1990 Planned Program:
   - (U) Begin IOT&E and Live Fire Testing.
   - (U) Begin Production Transition Program (PTP).
   - (U) Conduct additional contractor testing.
   - (U) Begin SEEK EAGLE ballistics testing of SFW on tactical aircraft.

3. (U) FY 1991 Planned Program:
   - (U) Complete Live Fire Testing, AF DT&E, and F-16 SEEK EAGLE testing.
   - (U) Continue PTP.
   - (U) Complete additional contractor testing.
   - (U) Continue IOT&E.
   - (U) Conduct final production readiness review.
   - (U) Conduct FCA.
   - (U) Conduct milestone IIIA.

4. (U) Program to Completion:
   - (U) Complete IOT&E testing.
   - (U) Plan and budget for a Multi-Staged Improvement Program (MSIP): Improvements in subsystems, e.g., warhead, sensor, and altimeter; and system reliability, survivability, and operational effectiveness against updated threats and countermeasures.

Program Element: # 0604607F Project Number: 2961
PE Title: Wide Area Antiarmor Munitions Budget Activity: # 4 - Tactical Programs

D. (U) WORK PERFORMED BY: Program management is provided by the Munitions Systems Division, Eglin Air Force Base FL. Prime contractor for the Sensor Fuzed Weapon (SFW) is Textron Defense Systems, Wilmington MA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Due to problems in pre-DT&E testing, the Critical Design Review (CDR) completion was delayed. This caused the DT&E completion, IOT&E completion and the production start to slip by 1 year.
3. (U) COST CHANGES: An additional $23.9M was added in FY 91 to perform a Production Transition Program (PTP) and accomplish additional testing.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF GOR 302-78, Wide Area Antiarmor Munitions (WAAM) (U), 28 Jan 78 (S).
- (U) TAF Operational Concept for WAAM (U), 20 Jul 79 (S).
- (U) USAF MENS 2-79 Improved Wide Area Antiarmor Capability (U), 14 Sep 79 (S).
- (U) Decision Coordinating Paper (DCP) for the Wide Area Antiarmor Munitions (WAAM) Program (U), 15 Oct 79 (S).
- (U) System Operational Concept (SOC) for SFW (U), 17 Jan 86 through Change 1, 2 Jun 86 (S).
- (U) TAF System Operational Requirements Document (SORD) 302-78-III-A for SFW (U), 11 May 1989 (S).
- (U) System Threat Assessment Report (STAR) for SFW, 21 Apr 89 (S).
- (U) Acquisition Program Baseline (APB), SAE approved 27 Nov 89 (C).

G. (U) RELATED ACTIVITIES:
- (U) SFW demonstration/validation was accomplished in PE 0603609F.
- (U) Some early portions of SFW FSD were accomplished in PE 0604604F (these funds are included in Paragraph A, BUDGET INFORMATION).
- (U) The Live Fire Tests will be done by the Chicken Little Project of PE 0604604F. Funding will be from SFW PE (PE 0604607F).
- (U) PE 0605712F, AF Operational Test & Evaluation will fund IOT&E beginning in FY91.
- (U) PE 0207590F, SEEK EAGLE will certify SFW on all aircraft after the initial F-16 certification.
- (U) Procurement of Ammunition, Army will fund a portion of the PTP program in FY91.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: # 0604607F Project Number: 2961
PE Title: Wide Area Antiarmor Munitions Budget Activity: # 4 - Tactical Programs

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. OTHER PROCUREMENT:					
Procurement of Ammunition, Army			10.0	0	10.0
PE 0208030F (SFW) Not Applicable. Procurement begins in FY92.					
2. MILITARY CONSTRUCTION: Not Applicable.					

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

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Prototype Demonstrations & Engineering Development	Oct 86 - Sep 87	Demonstrated component designs and supported design trade-offs
Contractor Demonstrations, Engineering Development	Nov 87 - Current	Demonstrate system level design

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
USAF Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E)	Dec 88 - Oct 91	IOT&E report - 2Qtr92
Live Fire Testing	Mar 90 - Mar 91	

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604609F
PE Title: Reliability & Maintainability Technology Insertion Program (RAMTIP)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title RAMTIP

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
RAMTIP	22,388	19,166	19,532	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Air Force implemented an action plan called "Reliability and Maintainability 2000" (R&M) 2000. A key element in this multi-faceted effort to institutionalize R&M is to consolidate various Air Force R&M essential improvements in management, control, and coordination of the Air Force's R&M program. RAMTIP represents one aspect of this effort. Its purpose is to accelerate the transition of emerging R&M technologies into fielded, in-production, and future systems. The leverage/payoffs to be gained from this effort are; greater combat capability; decreased vulnerability of the combat support structure, more efficient use of mobility and manpower assets, and lower operations and support costs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed On-Board Inert Gas Generating System (OBIGGS) which inerts the C-17 fuel tanks against fire and explosion. It culminates the current liquid nitrogen system; reduces vulnerability of ground-based support facilities, equipment and personnel; and reduces operation and support costs by $ 38 million over the current liquid nitrogen system.
   - (U) Completed Advanced Rocket Nozzle Inspection System (ARNIS), a nondestructive evaluation technique using low energy x-ray computed tomography for testing carbon-carbon rocket nozzles. Reduces costs by a factor of five and enhances production quality (100% reliable inspection).
   - (U) B-1B Central Integrated Test System Expert Parameter System applied artificial intelligence to analyze in-flight recorded system status data and improved aircraft readiness. Reduced test time 60%, "cannot duplicate" conditions by 30% and "retest ok" conditions by 30%.
   - (U) Completed development of boron/epoxy and graphite/epoxy repair patches for metal structural repair. Applications will improve the structural fatigue rates for the C-141 and C-130 while reducing depot repair time five-fold.

Program Element: #0604609F
PE Title: Reliability & Maintainability Technology Insertion Program (RAMTIP)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

- (U) Completed field and intermediate level repair techniques for bladed disks, called BLISKs, used in the Advanced Tactical Fighter engine. Techniques will reduce engine turnaround time, decrease spare inventory requirements, and increase sortie generation capability.

2. (U) FY 1990 Planned Program:
   - (U) C-130 Electronic Cockpit project started. Will replace 60 analog cockpit instruments in the C-130 with five thin plate, liquid crystal display panels. As a result, availability of the C-130 fleet is expected to increase 2%, thereby increasing intratheatre airlift capability by 230 tons per day.
   - (U) Begin development of advanced coatings for canopies and the test methods and criteria to validate service life increase for the F-16 and other fighter aircraft. LCC savings of $ 230M.
   - (U) Develop power-by-wire and fly-by-wire primary flight controls for the C-141 aircraft using electromechanical actuators and flight control electronics. Expected savings of $ 352M.
   - (U) Molecular Sieve Oxygen technology will provide breathing gas to the aircrew by separating preconditioned engine bleed air into its gaseous components. This system will replace the current F-16 liquid oxygen system and increase the combat capability of the aircraft.
   - (U) This project develops and demonstrates retrofit capabilities of the VHSIC technology into the F-16 Fire Control Radar. This concept inserts VHSIC modules and high reliability power supplies which improve the reliability, reduces repair time from 3 hours to 30 minutes, and increase processing capability by a factor of 20.
   - (U) Microminiature Time Stress Measurement Device (MTSMD) to measure and record selected environmental conditions on an electronic circuit board in order to identify environmental condition at the time of failure. This information can be used to reduce false removals, facilitate warranty claims, and improve preventive maintenance planning for any electronic equipment. Initial applications will be in the A-10 electronics suite.
   - (U) Incorporation of VHSIC technology into Alaskan minimally attended radars (SEEK IGLOO). The SEEK IGLOO signal processor, which currently fails every 12.5 days on average, would be upgraded to improve reliability, as well as radar coverage, for detection of low-level air attack. Increases averages time between failure from 3.5 days to 7 months and will reduce on-site manpower 50%.

3. (U) FY 1991 Planned Program:
   - (U) Development of Frameless Canopy for the F-16 aircraft. These frameless canopies will reduce replacement time/aircraft downtime, have superior bird strike capability and greatly reduce canopy cost for superior transparency.
   - (U) Remote Software Diagnostics (RSD) for the North Warning System (NWS); a project to develop the capability to remotely detect, diagnose, and eliminate software failures in the NWS unattended short wave radar.

Program Element: #0604609F
PE Title: Reliability & Maintainability Technology Insertion Program (RAMTIP)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

- (U) Development of Laser Ultrasonic Inspection System for both conventional and composite aircraft, allowing inspection of new manufactured parts/assemblies or entire aircraft that current nondestructive inspection cannot handle (e.g., the ATF). It will reduce inspection items by 75% and maintenance costs by over $ 540K/year for one ALC.
- (U) Technology for Autonomous Operational Survivability; a project to develop, test and validate autonomy and survivability technology in the operational environment. The result will be increased survivability of space systems and reduced life cycle costs.

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

D. (U) WORK PERFORMED BY: The RAMTIP Program Office (a division of the Air Force Office of Logistics Technology Application) is located at Wright-Patterson AFB, OH. Other involved organizations include: HQ USAF; Air Force Systems Command (AFSC); AFSC product divisions; AFSC laboratories; Air Force Logistics Command (AFLC); and the AFLC Centers. Major contractors are: McDonnell-Douglas, St. Louis, MO; McDonnell-Douglas, Long Beach, CA; Aerojet General, Sacramento, CA; Boeing Military Airplane Company, Wichita, KS; Lockheed Aircraft Systems, Marietta, GA, and General-Dynamics, Dallas-Ft. Worth, TX.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION: Not Applicable

G. (U) RELATED ACTIVITIES:
- (U) PE 0207133F - F-16 Program
- (U) PE 0604231F - C-17 Program
- (U) PE 0604226F - B-1B Program
- (U) PE 0207130F - F-15 Program
- (U) PE 0603256F - CV-22A Program
- (U) PE 0604268F - Aircraft Engine Component Improvement Program
- (U) PE 0708026F - PRAM Program
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

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

J. (U) MILESTONE SCHEDULE: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2621 Rapid Runway Repair	2,092	600	500	Cont	TBD
2895 Air Base Operability	7,195	6,454	6,012	Cont	TBD
3141 Camouflage, Concealment, and Deception	4,500	4,100	0	0	TBD
Total	13,787	11,154	6,512	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Sustained airfield operations are a prerequisite for a successful air campaign. Base and theater commanders must have the capability and resources to defend their main or forward airfields and to return them to operational status after sustaining an attack. This program focuses on integrating numerous ongoing efforts and providing for full-scale development for selected systems.

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

1. (U) Project 2621, Rapid Runway Repair (RRR): This full-scale development program will provide the technology, procedures, and equipment to rapidly repair large, deep craters in runways and taxiways as well as smaller, pothole-sized craters caused by enemy munitions.

(U) FY 1989 Accomplishments:
- (U) Completed Folded Fiberglass Mat development and procurement specifications for an air transportable crater capping repair capability.
- (U) Fielded station marker post runway reference system.
- (U) Continued review of alternative materials and equipment for runway repair suitability.
- (U) Initiated contract to provide technical orders for RRR systems.

(U) FY 1990 Planned Program:
- (U) Complete IOT&E for Folded Fiberglass Mats and initiate production.
- (U) Complete testing of asphalt anchor for AM2 and Folded Fiberglass Mats.
- (U) Test and decide on production of minimum operating strip (MOS) marking system.
- (U) Continue to test new materials for runway repair suitability.

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

2. (U) Project 2895, Air Base Operability Air Base Operability integrates operational concepts to improve sortie generation capability should an attack occur on or close to an air base.

(U) FY 1989 Accomplishments:
- (U) Continued Mobile Armored Reconnaissance Vehicle/Stand-off Munitions Disrupter (MARV/SMUD) development and test.
- (U) Awarded Full Scale Development contract for the Survivable Base Recovery After Attack (BRAAT) Communications System (SBCS).
- (U) Continued development of Contingency Airfield Lighting System (CALS).

(U) FY 1990 Planned Program:
- (U) Complete MARV/SMUD development and test.
- (U) Continue development of the SBCS.
- (U) Complete redesign and retest of M-60 tank Oracle blade for clearing sub-munitions off runways.
- (U) Complete development of the CALS and initiate production.

(U) FY 1991 Planned Program:
- (U) Complete FSD for the SBCS and initiate production.

(U) Work Performed By: Program contractors are Sumaria Systems Inc., Wakefield MA for SBCS; Multi-Electric Inc, Chicago IL for CALS; Saco Defense Inc., Saco ME for MARV/SMUD; and Alpine Industries, Ogden UT for the M-60 Oracle blade. The in-house development organizations responsible for elements of the program are Electronic Systems Division, Hansom AFB MA; Aeronautical Systems Division, Wright-Patterson AFB OH; and Munitions System Division, Eglin AFB FL.

(U) Related Activities:
- (U) This project transitions advanced development efforts in:
  -- (U) Program Element #0603307F, Air Base Operability Advanced Development
- (U) Procurement is executed through:
  -- (U) Program Element #0102896F, Base Operations, Defensive.
  -- (U) Program Element #0207595F, Base Communications, Tactical Air Forces.
  -- (U) Program Element #0207596F, Base Operations, Tactical Air Forces.
  -- (U) Program Element #0401896F, Base Operations.
  -- (U) Program Element #0702896F, Base Operations (Logistics).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

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

(U) Other Procurement (BA 4, P-1 Line Item 195 & 201; BA 5, P-1 Line Item 132):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
CALS			12,095	Continuing	TBD
SBCS	6,627	3,203	3,777	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 3141, Camouflage, Concealment, And Deception (CCD): This project embraces the full spectrum of camouflage, concealment, and deception methods to mitigate the effectiveness of enemy attacks against air bases.

(U) FY 1989 Accomplishments:
- (U) Completed tests of radar reflectors.
- (U) Continued development of false operating surfaces, smoke obscurant system, and lightweight camouflage nets.
- (U) Completed IOT&E and initiated production of aircraft decoy system.
- (U) Initiated industry analysis to identify systems and capabilities to support advanced multispectral CCD to meet visual, infrared, and millimeter wave threats.

(U) FY 1990 Planned Program:
- (U) Complete development, IOT&E, and initiate production of lightweight camouflage nets, smoke obscurant system, and false operating surfaces.

(U) FY 1991 Planned Program:
- (U) None.

(U) Work Performed By: Program contractor is Durodyne Incorporated, Tucson AZ for aircraft decoys and Ball Corp, San Diego CA for other CCD systems. The in-house development organization responsible for the program is Aeronautical Systems Division, Wright-Patterson AFB OH.

(U) Related Activities:
- (U) Program Element #0208028F, Camouflage, Concealment, and Deception.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

(U) Other Procurement (BA 4 P-1 Line Item 195):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
CCD Kits	3,922	18,205	0	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

- (U) Decide between the asphalt planer and compaction methods of reducing upheaval.
- (U) Continue evaluation of United Kingdom Flood Grout System for crater and spall repair.
- (U) Complete Repair Quality Criteria (RQC) testing and documentation for fighter aircraft to enable operation over minimum quality repairs.
- (U) Support Environmental Protection Agency directed polymer clean up efforts.

(U) FY 1991 Planned Program:
- (U) Decide on suitability of Flood Grout system for advanced Rapid Runway Repair system.
- (U) Buy MOS Marking System.
- (U) Begin RQC for heavy aircraft.
- (U) Begin Full Scale Development of a repair capability that can be used for small craters (spalls) caused by either 30 mm cannon strafing or by anti-material submunitions.

(U) Work Performed By: Program contractor is BDM MSC, Panama City FL. The in-house development organizations responsible for elements of the program are the Air Force Engineering and Services Center, Tyndall AFB FL; Munitions System Division, Eglin AFB FL; and the Air Force Weapons Laboratory, Kirtland AFB NM.

(U) Related Activities:
- (U) This project transitions advanced development efforts in:
  -- (U) Program Element #0602206F, Civil Engineering & Environmental QA
  -- (U) Program Element #0603307F, Air Base Operability Advanced Development
  -- (U) Program Element #0603723F, Civil/Environmental Engr Tech
- (U) Procurement is executed through:
  -- (U) Program Element #0207596F, Base Operations, Tactical Air Forces.
  -- (U) Program Element #0401896F, Base Operations.
  -- (U) Program Element #0702896F, Base Operations (Logistics).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds ($ in thousands):
(U) Other Procurement (BA4, P-1 Line Item 195):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
RRR Kits	3,346	7,350	3,946	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604703F Budget Activity: #4 - Tactical Programs
PE Title: Aeromedical/Chemical Defense Systems

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2866 Aeromedical/Chemical Defense Systems	6,680	5,847	7,499	Cont	TBD
Total	6,680	5,847	7,499	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Air Force has limited capability to treat and evacuate wartime casualties from a chemical or conventional warfare environment. This program will develop field medical equipment and systems for this purpose to fulfill Air Force unique needs. This program will also provide tactical and strategic aeromedical evacuation systems for which the Air Force is the lead DOD agency.

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

(U) Project 2866, Aeromedical/Chemical Defense Systems: Urgent requirements have been identified by the major commands to sustain effective operations when chemical warfare is introduced into a conventional conflict. The ability to isolate casualties from further chemical agent contamination, decontaminate them, and quickly treat them is essential to getting the minimally injured back to their units. This project will significantly increase our capability of fighting and sustaining air base operations in a chemical environment. In conjunction, the rapid aeromedical evacuation of the more seriously injured casualties to higher echelons of medical care, with more treatment capability, is essential to the success of the Air Force medical mission.

(U) FY 1989 Accomplishments:

- (U) Accepted the Survivable Collective Protection System-Medical (SCPS-M) installed at Phelps-Collins ANGB, Alpena, MI as the training asset for ANG and Reserve forces. Installation of SCPS-M with increased air conditioning capacity (IAC) at Sheppard AFB, TX was completed. HQ USAF/SG approved production for USAFE.
- (U) Received a prototype frozen blood shipping container which will be integral to the Transportable Blood Transshipment Center (TBTC) system. The TBTC will provide both liquid and frozen blood products to combat zones. Conducted an Acquisition Strategy Panel.

Program Element: #0604703F Budget Activity: #4 - Tactical Programs
PE Title: Aeromedical/Chemical Defense Systems

- (U) Development, through Critical Design Review (CDR), of the Civil Reserve Air Fleet Aeromedical Evacuation Shipsets Program (CRAF AESS) which will increase strategic aeromedical evacuation capability up to 100 percent.
- (U) Conducted and completed Development Test and Evaluation (DT&E) of the Transportable Airborne Therapeutic Station (TATS). Demonstrated the TATS/C141B aircraft interface and loading requirements. Initiated OT&E.

(U) FY 1990 Planned Program:
- (U) Acquire SCPS-M technical orders and provisioning data. Production contract for Denmark will be signed. Installation of three SCPS-Ms on Bitburg AB, GE will begin.
- (U) Complete TBTC draft request for proposal (RFP) for release in February 1990. Release a final RFP in July 1990.
- (U) Complete CRAF AESS Full Scale Development (FSD) program and initiate acquisition of 94 Boeing 767 conversion shipsets for Military Airlift Command (MAC).
- (U) Completion of TATS OT&E. Exercise production option for thirty-eight (38) TATS Units. TATS Program Management Responsibility Transfer (PMRT) to Warner Robins Air Logistics Center, Georgia.

(U) FY 1991 Planned Program:
- (U) Prepare production procurement package for SCPS-M to support PACAF requirements.
- (U) Initiate acquisition of 33 McDonnell-Douglas MD-80 CRAF shipsets for MAC.
- (U) Initiate TBTC FSD program.

(U) Work Performed By: Project is managed by the Aeromedical/ Casualty System Program Office, Human Systems Division, Brooks AFB, Texas. The contractors are Systems Research Laboratories, Beavercreek, OH; E-Systems, Greenville, TX; Krug Intl, Dayton, OH; and Battelle Memorial Institute, Columbus, OH.

(U) Related Activities:
- (U) Program Element #0602202F, Human Systems Technology.
- (U) Program Element #0604601F, Chemical Defense Equipment.
- (U) Program Element #0603231F, Crew Systems and Personnel Protection Technology.
- (U) The Army is DOD lead for Chemical Warfare Defense; this project works Air Force unique requirements.
- (U) No unnecessary duplication of effort within AF or DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604704F Budget Activity: #4 - Tactical Programs
PE Title: Common Support Equipment

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2479 Common Support Equipment Development	877	765	1,013	Cont.	TBD
3759 Air Force Office of Support Equipment Management (AFOSEM)	378	323	409	Cont.	TBD
3852 60,000 Pound Capacity Aircraft Transporter Loader *	0	5,879	13,697	4,274	23,850
Total	1,255	6,967	15,119	Cont.	TBD

* Project 3852 is a FY 1990 new start.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This full scale development (FSD) program fields more efficient, multi-functional aircraft ground support equipment (SE) with increased capabilities to meet the operational needs of Tactical, Strategic and Special Operations Forces. Special emphasis is placed upon developing smaller, lighter SE to reduce airlift requirements and enhance SE transparency during combat. It also implements the AFOSEM objective to develop and promote the use of standardized SE and improve interoperability of the military services by automating and continually updating MIL-HDBK-300 for SE acquisition management needs. This program also develops software for planning tools such as the Support Equipment Acquisition Management System (SEAMS) and automation of SE data bases to support planning, budgeting, and development activities. Beginning in FY 1990 this program also funds development of a special purpose (non-off the shelf) vehicle which is necessary to fill a unique Air Force requirement for a 60,000 pound capacity aircraft cargo loader.

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

1. (U) Project 2479, Common Support Equipment Development: This project develops and tests aircraft SE to fill a continuing need for more combat effectiveness, lower life cycle costs, and greater returns on investment. The Advanced X-Ray System (AXES) will be rugged, high resolution x-ray system which integrates new technology for use on aircraft, engines, and missiles. The Self-Generating Nitrogen Servicing Cart (SGNSC) will provide the ability to generate and store high pressure gaseous nitrogen in a self-contained portable unit. The SGNSC will eliminate the use of liquid nitrogen (cryogenic) systems for the production of gaseous nitrogen.

(U) FY 1989 Accomplishments:
- (U) Completed a Request For Information (RFI) for AXES.
- (U) Completed and released a Request For Proposals (RFP) for AXES.

Program Element: #0604704F Budget Activity: #4 - Tactical Programs
PE Title: Common Support Equipment

- (U) Completed the Technical Performance Analysis and Cost Benefit Analysis for the SGNSC.

(U) FY 1990 Planned Program:
- (U) Award the AXES contract.
- (U) Conduct design reviews (PDR & CDR) and initiate Development Test & Evaluation for AXES.
- (U) Write a Test Plan and conduct operational suitability test of SGNSC.
- (U) Draft the performance characteristics, specifications, SOW, and Instructions to Offerors to enable release of the draft RFP for development of SGNSC.
- (U) Perform design studies, develop prototype and perform Development Test & Evaluation for the GPGS Enhanced Mobility System.

(U) FY 1991 Planned Program:
- (U) Complete configuration audits and initiate AXES production.
- (U) Conduct Operational Test & Evaluation on AXES.
- (U) Complete all pre-award notifications and issue a Request For Proposals for SGNSC.

(U) Work Performed By: The top contractors are Teledyne Continental Motors, Mobile, AL; Modern Technologies Corporation, Dayton, OH; and Libby Corporation, Kansas City, MO. The in-house developing organization is the Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson Air Force Base OH.

(U) Related Activities:
- (U) Close cooperation is maintained with other services via the Joint Logistics Commanders Panel for Aviation Support Equipment.
- (U) Close cooperation is maintained within the Air Force through the Aircraft Ground Support Equipment Working Group.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds ($ in Thousands): Procurement Funding Source: 3010 Appropriations, Budget Program 1200, Common Support Equipment.

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Advanced X-Ray System (AXES)	0	0	1,980	4,443	6,423
Ground Power Generator System (GPGS)	0	71,569	91,849	184,469	396,742

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0604704F Budget Activity: #4 - Tactical Programs
PE Title: Common Support Equipment

2. (U) Project 3759, Air Force Office of Support Equipment Management: This project develops automation software and system enhancements for the SEAMS. This includes automation of MIL-HDBK-300 and development of line drawing capability, interchangeable substitute listings, SE multiple characteristics data, the ability to screen proposed support equipment recommendations for comparison with existing items, and an interface with the Air Force Equipment Management System (AFEMS) to automatically extract data from existing tables of allowance and reliability and maintainability records.

(U) FY 1989 Accomplishments:
- (U) Increased the SE item data base to include over 9,600 items.
- (U) Expanded the automated SEAMS data base to capture Standard and Preferred Items, Common Hand Tools, and Modular Automatic Test Equipment data.
- (U) Developed an automated SEAMS problem reporting system.

(U) FY 1990 Planned Program:
- (U) Develop within SEAMS an Input and Quality Assurance system with multiple data entry capabilities.
- (U) Develop within SEAMS an automated Munitions Materiel Handling Equipment module.
- (U) Develop within SEAMS an automated data extraction/entry system.
- (U) Develop an automated SE Acquisition Training Course.
- (U) Develop/Conduct SE Acquisition Training Seminars.

(U) FY 1991 Planned program:
- (U) Develop an AFEMS interface for SEAMS.
- (U) Develop automatic SE budget preparation and pricing tools.
- (U) Develop an automated SE roadmap.

(U) Work Performed By: The top contractors are Southwest Research Institute, San Antonio, TX and Systems and Applied Sciences Corporation, Fairborn, OH. The in-house developing organization is the Air Force Logistics Command, Air Force Acquisition and Logistics Center, Wright-Patterson AFB, OH.

(U) Related Activities:
- (U) Close cooperation is maintained with other services via the Joint Logistics Commanders Panel for Aviation Support Equipment.
- (U) Close cooperation is maintained within the Air Force through the Aircraft Ground Support Equipment Working Group.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604704F
PE Title: Common Support Equipment
Project Number: 3852
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
60K Loader *	0	5,879	13,697	4,274	23,850

* This project is a FY 1990 new start.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The 60,000 pound (60K) transporter loader is being procured to alleviate operational deficiencies and provide a replacement for the aging 40K, wide body elevator, and lower lobe loaders. The 60K loader will be the backbone of MAC's strategic loading capability to include the C-17 and Civil Reserve Air Fleet. This loader will be an integral part of the 463L System Ground Handling Family with the ability to load all DOD cargo to include palletized (Army) 60,000 pound airdrop-rigged loads, and be capable of rolling on and/or off the C-141, C-5, and C-17 without shoring for minimum turn-around times in a wartime surge. It will greatly enhance mean time between failure and be capable of loading 463L pallets, commercial pallets, type V airdrop platforms, Container Delivery System (CDS) loads, LD3 containers, International Standard Organizational (ISO) containers, and rolling stock.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Completed Statement of Need (SON), System Operation Requirements Document (SORD), Program Management Directive (PMD), Test and Evaluation Master Plan (TEMP).
   - (U) Released the Request For Proposals (RFP).
   - (U) Acquisition Program Baseline submitted and approved.

2. (U) FY 1990 Planned Program:
   - (U) Initiate engineering design work.
   - (U) Award two prototype development contracts.
   - (U) Perform engineering design tests.
   - (U) Begin development of engineering drawings.
   - (U) Initiate first and/or second article development.

3. (U) FY 1991 Planned Program:
   - (U) Conduct preliminary and critical design reviews.
   - (U) Complete engineering design development.
   - (U) Begin development of prototypes.
   - (U) Conduct engineering tests and continue drawing development.

4. (U) Program to Completion:
   - (U) Conduct developmental tests and evaluation of the prototypes.

Program Element: #0604704F Project Number: 3852
PE Title: Common Support Equipment Budget Activity: #4 - Tactical Programs

- (U) Conduct initial operational test and evaluation.
- (U) Award a production contract with separate multi-year options for a total planned procurement of 320 production units.

D. (U) Work Performed By: The top contractors are Southwest Mobile Systems, St Louis, MO; Oshkosh Truck Corp, Oshkosh, WI; FMC Corporation, Orlando, FL; Teledyne Continental Motors, Muskegon, MI; and Cochran Airport Systems, Pebble Beach, Ca. The in-house developing organization is the Air Force Logistics Command, Warner Robins Air Logistics Center, Robins Air Force Base, GA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: The RFP was released five months late (22 August 1989) due to extended time to develop the Systems Operational Requirements Document and completion of an Independent Sufficiency Review (ISR).
3. (U) COST CHANGES: The FY 1991 cost increase of $6.2 million was due to the initial under estimate of funds and the failure to include an R&M Assurance Program and expanded Logistics Support Analysis Program. Completion of an Independent Cost Estimate and the ISR confirmed the needed additional funds.

F. (U) PROGRAM DOCUMENTATION:
- (U) HQ MAC Statement of Operational Need, 002-89, February 1989.
- (U) HQ MAC Systems Operational Requirements Document, 002-89-1, May 89.

G. (U) Related Activities:
- (U) Inter-service integration is assured through the Military Airlift Command, Airlift Concepts and Requirements Agency, Scott AFB, IL.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) Other Appropriation Funds: Procurement Funding Source: 3080 Appropriations are programmed in FY93 thru FY97.

I. (U) International Cooperative Agreements: None.

J. (U) MILESTONE SCHEDULE:

1.	(U) Award prototype contracts	April 1990
2.	(U) Preliminary Design Review	October 1990
3.	(U) Critical Design Review	July 1991
4.	(U) Start Developmental Test and Evaluation (DT&E)	August 1992
5.	(U) Start Initial Operational Test and Evaluation	February 1993
6.	(U) Award production contract	August 1993
7.	(U) Delivery of first article	October 1994

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604706F Budget Activity: #4 - Tactical Programs
PE Title: Life Support Systems

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
412A Life Support Systems	3,776	4,930	8,915	Cont	TBD
2952 F-111 Cluster Parachute	6,200	50	0	0	15,071
3111 Aircraft Mishap Prevention Program	983	910	2,071	5,964	9,705
3812 COMBAT EDGE	6,024	7,047	1,600	0	17,777
Total	16,983	12,937	12,586	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the only Air Force program element devoted to engineering development of life support equipment and contains a number of joint service endeavors. Project 412A provides for centralized management and full-scale development (FSD) of life support equipment and subsystems necessary to assure functional capability of aircrews throughout all mission environments and to enhance safe escape, descent, survival, and recovery in emergency situations. It also provides for development, test, and standardization of emergency equipment and protective clothing and devices for non-flying personnel. Project 2952 is a safety modification to the parachute system of the F-111 Crew Escape Module to lower descent velocity and thereby reduce the frequency and severity of spinal injuries to ejecting crew members. Project 3111 will develop a management information system to reduce loss of aircrew lives and aircraft due to human factors. Project 3812 will accelerate development and fielding of a positive pressure breathing system for F-15 and F-16 crew members to help reduce the number of G-loss of consciousness incidents with these aircraft.

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

1. (U) Project 412A, Life Support Systems: Provides centralized development of Air Force Life Support equipment and subsystems as well as selected items of joint service equipment. Satisfies operational command requirements for improved Life Support equipment to maximize aircrew capability throughout all environments, and to enhance survivability in emergency situations.

(U) FY 1989 Accomplishments:
- (U) Began Water Activated Mask Release System (WAMRS) Development Test and Evaluation (DT&E).
- (U) Awarded Advanced Concept Ejection Seat (ACES) II restraint emergency release system contract and began testing.
- (U) Awarded HGU-53P helmet production contract.
- (U) Continued fielding high flow anti-G valve.
- (U) Fielded LPU-9/P automatic life preserver.

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Program Element: #0604706F Budget Activity: #4 - Tactical Programs
PE Title: Life Support Systems

(U) FY 1990 Planned Program:
- (U) WAMRS IOT&E.
- (U) Continue fielding LPU-9/P and begin fielding HGU-53/P.
- (U) Award FSD contract on Active Noise Reduction (ANR).
- (U) Begin ACES II Advanced Recovery Sequencer (ARS) sled testing.
- (U) Award contract for FSD of B-1 Thin Profile Parachute (TPP).

(U) FY 1991 Planned Program:
- (U) Field WAMRS.
- (U) Continue B-1 TPP.
- (U) Complete ARS sled testing.
- (U) Begin night vision system FSD.
- (U) Award Thermal Flashblindness Protective Device FSD contract.
- (U) Release RFP for Universal Seawater Activated Release System SEAWARS.

(U) Work Performed By: Air Force Systems Command's Human Systems Division (HSD), Brooks AFB, TX, manages the Life Support Systems, Project 412A. Support is also provided by other service organizations. The major contractors involved in this project include: Douglas Aircraft Company, Long Beach, CA; Boeing Advanced Systems, Seattle, WA; Motorola, Phoenix, AZ; Gentex, Carbondale, PA; Conax Florida Corp., St Petersburg, FL; H. Koch & Sons, Anaheim, CA; and S-Tron Corp., Redwood City, CA.

(U) Related Activities:
- (U) PE #0602201F, Aerospace Flight Dynamics.
- (U) PE #0602202F, Aerospace Biotechnology.
- (U) PE #0603211F, Aerospace Structures/Materials.
- (U) PE #0603231F, Crew Systems Technology.
- (U) PE #0602723A, Clothing, Equipment and Shelter Technology.
- (U) PE #0604204A, Air Mobility Support Equipment.
- (U) PE #0602241F, Ejection Seat Bio-Dynamics.
- (U) PE #0602758N, Biomedical Technology.
- (U) PE #0603216N, Mission Oriented Clothing and Devices. All efforts within this program are coordinated with the other services via a formal Tri-Service steering committee, established in 1980 to promote standardization and prevent duplication of effort.
- (U) PE #0604264N, Aviation Personnel Life Support System.
- (U) PE #0603216N, Aircrew System Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0604706F Budget Activity: #4 - Tactical Programs
PE Title: Life Support Systems

2. (U) Project 2952, F-111 Cluster Parachute: The goal of this project is to reduce the frequency and severity of spinal injuries incurred by ejecting F-111 crew members when the Crew Escape Module (CEM) impacts the ground. This is achieved by replacing the current single-canopy parachute in the CEM by a cluster of three parachutes, thereby lowering impact velocity.

(U) FY 1989 Accomplishments:
- (U) Continued parachute design.
- (U) Continued air drop and began sled tests.

(U) FY 1990 Planned Program:
- (U) Continue air drop and sled tests.

(U) FY 1991 Planned Program:
- (U) Complete tests and submit test report.

(U) Work Performed By: HSD manages Project 2952, but the work is performed by Air Force Logistics Command (AFLC), Sacramento Air Logistics Center (ALC), McClellan AFB, CA. General Dynamics Corporation, Fort Worth, TX is one of the two contractors, and the project is also supported by the National Aeronautics and Space Administration, Dryden Flight Research Facility, Edwards AFB, CA and DOE, Sandia National Laboratories, Albuquerque, NM.

(U) Related Activities: None. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not applicable.

3. (U) Project 3111, Aircraft Mishap Prevention Program: This project develops a management information system which is oriented to the analysis of aircraft mishaps. The results of this analysis will assist the Air Force in the reduction of aircraft mishaps and the loss of human life. This project will develop a central operational system within the Air Force Inspection and Safety Center.

(U) FY 1989 Accomplishments:
- (U) Refined and updated prototype aircraft supplements.
- (U) Initiated requirements analyses and trade-off studies.

(U) FY 1990 Planned Program:
- (U) Program baseline: March
- (U) RFP release: April
- (U) Contract award: July

(U) FY 1991 Planned Program:
- (U) PDR.

Program Element: #0604706F Budget Activity: #4 - Tactical Programs
PE Title: Life Support Systems

(U) Work Performed By: HSD, Brooks AFB, TX manages project 3111. A tasking currently exists with BDM Corp., Albuquerque, NM.

(U) Related Activities:
- (U) PE #0603231F, Crew Systems Technology.
- (U) PE #0602241F, Ejection Seat Bio-Dynamics.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

4. (U) Project 3812, COMBAT EDGE: This project will accelerate development and fielding of a positive pressure breathing (PPB) system for F-15 and F-16 crew members. It will use the G-protection aspects that have been under development in the Tactical Life Support System (TLSS). These include the lower body anti-G suit garment, an upper torso anti-G garment, a lightweight helmet modified with a tensioning bladder, a new oxygen mask, and a modification to the existing oxygen regulator.

(U) FY 1989 Accomplishments:
- (U) Approved acquisition plan.
- (U) Awarded FSD contract.
- (U) Conducted preliminary design review.
- (U) Conducted critical design review.
- (U) Began qualification testing.
- (U) Awarded low rate initial production I (LRIP I) contract.

(U) FY 1990 Planned Program:
- (U) Conduct DT&E and IOT&E.
- (U) Award LRIP II contract.

(U) FY 1991 Planned Program:
- (U) Transition to full scale production.

(U) Work Performed By: HSD, Brooks AFB, TX manages project 3812. Boeing Advanced Systems, Seattle, WA is the prime contractor with Gentex Corp., Carbondale, PA as the main subcontractor.

(U) Related Activities:
- (U) PE #0602201F, Aerospace Flight Dynamics.
- (U) PE #0602202F, Aerospace Biotechnology.
- (U) PE #0603211F, Aerospace Structures/Materials.
- (U) PE #0603231F, Crew Systems Technology.
- (U) PE #0602241F, Ejection Seat Bio-Dynamics.
- (U) PE #0602758N, Biomedical Technology.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604706F Budget Activity: #4 - Tactical Programs
PE Title: Life Support Systems

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Appropriation					
Aircraft Proc (BP 1100) PE 27133F Class V Mod			12,026	Cont	TBD

(U) International Cooperative Agreements: COMBAT EDGE will be releasable to F-16 European Participating Group and Foreign Military Sales countries; however, no such agreements are currently under negotiation.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604707F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Weather Systems (Eng Development)

A. (U) RDT&E RESOURCES ($ in Thousands)

Project Number	Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0001	Weather Systems (Engineering Development)	8,420	4,775	5,361	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element provides engineering development of weather systems that will eliminate critical shortfalls in weather support to Air Force and Army operations. Efforts include: (a) Automated Weather Distribution System (AWDS): Automates most weather data handling tasks within each Air Weather Service weather station at major Air Force bases, some Army installations, and Air Force tactical facilities. AWDS preplanned product improvement (P3I) will enhance interoperability, communications, graphics and data ingest capabilities. (b) Next Generation Weather Radar (NEXRAD): A joint Departments of Defense, Commerce, and Transportation development and procurement effort to provide a greatly improved storm detection and warning capability. (c) Battlefield Weather Observation and Forecast System (BWOFS): Consists of two separate, complimentary parts - the Electro-Optical Tactical Decision Aide (EOTDA) for data application and the Pre-Strike Surveillance and Reconnaissance System (PRESSURS) for data acquisition.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 0001, Weather Systems (Engineering Development): Develops equipment and techniques for a badly needed upgrade of Air Force Air Weather Service (AWS) support.

(U) FY 1989 Accomplishments:
- (U) AWDS: Awarded three production contracts for Executive system. Completed evaluation of AWDS enhancements by refining specifications. Developed P3I implementation plan.
- (U) NEXRAD: Completed the final phase of IOT&E.
- (U) BWOFS: Completed EOTDA weather data software interface and interface with Defense Mapping Agency data. Completed specifications and RFP for Unmanned Air Reconnaissance System (UARS) weather sensor FSD. Developed and coordinated engineering change proposal for integrating PRESSURS on the Advanced Tactical Air Recon System on board the UARS. Developed specifications for the miniaturization of the Concept Validation Phase PRESSURS sensors and studied miniaturizing the data acquisition storage system.

(U) FY 1990 Planned Program:
- (U) AWDS: Down-select to one or more production contractor(s) for 208 units. Complete technical feasibility/cost studies for P3I. Begin rapid prototyping of P3I enhancement specifications upon deployment of AWDS executive system.
- (U) BWOFS: Complete integration of EOTDA onto PACAF & USAFE C2 systems. Continue analysis of alternative PRESSURS sen-

sors. Examine manned aircraft applicability of PRESSURS. Develop rapid deployment planning document for PRESSURS.

(U) FY 1991 Planned Program:
- (U) AWDS: Continue P3I enhancement prototyping and development efforts. Begin prototype deployment for testing.
- (U) BWOFS: Begin EOTDA integration efforts for SAC. Continue alternative PRESSURS sensors review. Complete reviews of PRESSURS RFP and program for potential FY94 FSD start.

(U) Work Performed By: AWDS development and production are managed by Electronic Systems Division, Hanscom AFB, MA. The prime development contractor was the Canadian Commercial Corp, Ottawa, Canada. MacDonald, Dettwiler & Associates, Ltd, Richmond, British Columbia, Canada was the prime subcontractor. The AWDS production contractors are Unisys Corp, Salt Lake City, UT; Contel, Westlake Village, CA; and Federal Electric Corp (ITT), Santa Maria, CA. NEXRAD development is managed by the Joint System Program Office within the National Weather Service, National Oceanic and Atmospheric Administration, Department of Commerce. The NEXRAD contractor is Unisys Corp, Detroit, MI.

(U) Related Activities:
- (U) Program Element #0603707F, Weather Systems Advanced Development.
- (U) Program Element #0305111F, Weather Service.
- (U) Program Element #0207217F, Follow-on Tactical Reconnaissance System.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds ($ in Thousands):
Other Procurement, PE 0305111F (BA 83):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost (AWDS)	21,584	27,475	25,259	43,600	134,318
Fixed/Transportable Quantities	25/0	38/0	35/1	88/19	188/20
Cost (NEXRAD)	26,491	19,625	19,590	71,473	160,895
Complete Radar/User Set Quantities	7/22	5/17	5/17	21/32	44/103

(U) International Cooperative Agreements: AWDS Full Scale Development (FY 1984 - FY 1988) was accomplished through the joint United States-Canada Production and Development Sharing Program. Through this program, the Canadian government funded half ($14 million) of the development contract. The prime contractor was Canadian Commercial Corp, Ottawa, Canada. MacDonald, Dettwiler & Associates, Ltd, Richmond, British Columbia, Canada was the major subcontractor.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Civil Engineering/Aircraft Support Equipment

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2054 Aerospace Facilities Engineering Development	437 *	272 *	272	Cont.	TBD
2505 Aircraft Fire Fighting, Suppression and Rescue	969	761	900	Cont.	TBD
2674 Tactical Shelters	948	925	748	Cont.	TBD
3080 Generic Integrated Maintenance Diagnostics	3138	**	**	N/A	N/A
3788 Environmental Quality	1627*	272	271	Cont.	TBD
Total	7119	2230	2191	Cont.	TBD

* Project 3788, Environmental Quality, was created in FY 1988 to allow better management of this critical development area. It is not a new start; all work was previously being done under project 2054, Aerospace Facilities Engineering Development.
** Beginning in FY 1990, funding for Project 3080, Generic Integrated Maintenance Diagnostics, is in *PE 0604247F, Modular Automatic Test Equipment.*

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program funds the development, testing and evaluation of materials, equipment and procedures in four separate areas: a) Facilities Engineering improves the operational effectiveness, survivability, durability, and longevity of air base pavements, buildings and utilities; the overall objective is to provide an infrastructure that effectively supports the USAF mission, contributes to high sortie rates, is less susceptible to damage from enemy actions or natural disasters, and is more rapidly returned to service if damaged. b) Fire Fighting, Suppression and Rescue develops new concepts and technology applications to increase fire fighting support of combat operations, to improve base recovery after attack capabilities, and to reduce fire risks to personnel and resources. c) Tactical Shelters is the USAF portion of a tri-service effort to develop standardized, low maintenance, survivable shelters and shelter accessories. Products must be easily mobilized and compatible with air, sea and land transport systems to effectively support high-mobility aircraft support, command and control, communications, medical, and data processing units for the tactical and strategic forces. d) Environmental Quality reduces long-term disposal/cleanup costs and helps ensure USAF compliance with Environmental Protection Agency (EPA) regulations through development of means to identify hazardous waste and pollutant sources, reduce output of sources, mitigate the effects of wastes and pollutants, and dispose of wastes when contamination occurs. Special needs of various operational theaters, including those peculiar to the rapid deployment forces are addressed.

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2054, Aerospace Facilities Engineering Development: Develops equipment, materials, and procedures to improve the operational effectiveness of aerospace facilities.

(U) FY 1989 Accomplishments:
- (U) Initiated development of expedient repair kits for battle-damaged POL distribution systems, the first in a series of expedient repair kits for air base utility systems.

(U) FY 1990 Planned Program:
- (U) Conclude development of the expedient POL system repair kit.

(U) FY 1991 Planned Program:
- (U) Initiate development of a rapid damage assessment system for electrical power distribution systems.

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

(U) Work Performed By: Work is performed by the University of New Mexico Research Institute, Albuquerque, NM; the Department of Energy, Idaho Operations Office, Boise, ID; Applied Research Associates, Albuquerque, NM; and the Department of Energy Oakridge Laboratories, Oakridge, TN. The in-house developing organization is the Air Force Engineering and Services Center, Tyndall AFB, FL.

(U) Related Activities:
- (U) Program Element #0603723F, Civil and Environmental Engineering Technology.
- (U) Close cooperation is maintained with other services via the Joint Services Civil Engineering Research and Development Coordinating Group.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None

(U) International Cooperative Agreements: None

2. (U) Project 2505, Fire Fighting, Suppression, and Rescue: Develops improved fire fighting, suppression and rescue equipment, materials, and methods to increase fire protection readiness, mobility, and effectiveness.

(U) FY 1989 Accomplishments:
- (U) Continued evaluation of an improved crash/rescue vehicle.
- (U) Proceeded with preparations for a contract to

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

develop an automatic fire suppression system for hardened aircraft shelters (HAS).

(U) FY 1990 Planned Program:
- (U) Continue contract preparations for the HAS fire suppression system.
- (U) Initiate full-scale development of a remotely controlled vehicle to combat fires on munitions-laden aircraft and in munitions storage and other high danger areas.

(U) FY 1991 Planned Program:
- (U) Complete development of the remotely controlled fire fighting vehicle.
- (U) Initiate development of a post-attack assessment system.
- (U) Complete development of the post-attack assessment system.
- (U) Initiate development of a robotic fire sentry.

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

(U) Work Performed By: Work is performed by Applied Research Associates, Albuquerque, NM; the Battelle Corporation, Columbus, OH; and the Department of Energy Oakridge Laboratories, Oakridge, TN. The in-house developing organization is the Air Force Engineering and Services Center, Tyndall AFB, FL.

(U) Related Activities:
- (U) Program Element #0603723F, Civil and Environmental Engineering Technology.
- (U) Close cooperation is maintained with other services via the Joint Services Civil Engineering Research and Development Coordinating Group.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None

(U) International Cooperative Agreements: None

3. (U) Project 2674, Tactical Shelters: Provides for joint service development and acquisition support of tactical shelter systems, to improve and standardize shelter designs throughout DOD.

(U) FY 1989 Accomplishments:
- (U) Continued development and testing of an International Standards Organization (ISO) loading jack system and full-scale development of an ISO adapter pallet.
- (U) Continued development of variable speed environmental control units (ECUs), and continued a three-year study

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

of chromate vs non-chromate paints and primers.
- (U) Continued a joint USAF/US Army/USN/USMC reliability/maintainability documentation program for shelters.
- (U) Continued finite element analyses of structural components to determine strength requirements.
- (U) Continued efforts to develop new shelter materials and electromagnetic pulse/electromagnetic interference (EMP/EMI) protection.
- (U) Continued contract development of shelters for specific uses, such as for standard tactical military vehicles.

(U) FY 1990 Planned Program:
- (U) Continue development of two separate advanced design prototype shelters.
- (U) Complete testing of paints and primers, and complete development of the ECUs.
- (U) Conduct evaluation of off-the-shelf jack systems and the adapter pallet.
- (U) Continue reliability/maintainability efforts.
- (U) Continue work on vehicle-specific shelters.
- (U) Continue finite element analyses of structural components to determine strength requirements.
- (U) Begin development and acquisition of ISO loading jack systems.
- (U) Initiate development of chemical warfare hardening kits.
- (U) Assess effectiveness of current equipment performance in the field.

(U) FY 1991 Planned Program:
- (U) Complete development of advanced design prototype shelters.
- (U) Complete development of the EMP simulator.
- (U) Continue reliability/maintainability data collection.
- (U) Continue new material and manufacturing process development efforts.
- (U) Continue EMP/EMI and chem warfare hardening development.
- (U) Publish a plan for shelter evolution/applications.

(U) FY 1991 Planned Program:
- (U) Continue new material development efforts.
- (U) Investigate outyear requirements and plan new shelter technology development.
- (U) Continue EMP/EMI and chem warfare hardening development.
- (U) Begin FSD of advanced design shelter.

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

(U) Work Performed By: Work is performed by the University of Dayton Research Institute, Dayton, OH. The in-house developing organization is Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA.

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

(U) Related Activities:
- (U) Close coordination is maintained with other services via the Joint Committee on Tactical Shelters.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None

(U) International Cooperative Agreements: None

4. (U) Project 3788, Environmental Quality: Develops means to identify hazardous waste and pollutant sources, reduce output of sources, mitigate the effects of wastes and pollutants, and provide cost-effective disposal of waste.

(U) FY 1989 Accomplishments:
- (U) Continued development of biodegradable solvents and cleaners for industrial processes.
- (U) Continued work on treatment of contaminated groundwater and monitoring devices for JP-4 releases.
- (U) Continued development of biodegradable chemicals.
- (U) Initiated development of systems for VOC control.
- (U) Initiated development of monitoring techniques to reduce costs of permitting hazardous waste incinerators.

(U) FY 1990 Planned Program:
- (U) Complete development of biodegradable chemicals.
- (U) Continue work on water treatment and JP-4 monitoring.
- (U) Continue work on VOC control systems.
- (U) Continue development of monitoring techniques to reduce costs of permitting hazardous waste incinerators.

(U) FY 1991 Planned Program:
- (U) Complete development of JP-4 monitoring devices.
- (U) Complete development of VOC control systems.
- (U) Complete development of monitoring techniques to reduce costs of permitting hazardous waste incinerators.
- (U) Continue work on treatment of contaminated ground water.

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

(U) Work Performed By: Work is performed jointly with the Environmental Protection Agency (EPA) and the Department of Energy Idaho National Engineering Laboratory, Idaho Falls, ID. The in-house developing organization is the Air Force Engineering and Services Center, Tyndall AFB, FL.

(U) Related Activities:
- (U) Program Element #0603723F, Civil and Environmental Engineering Technology.

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

- (U) Close cooperation is maintained with other services via the Joint Services Civil Engineering Research and Development Coordinating Group.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None

(U) International Cooperative Agreements: None

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604711F Budget Activity: #3-Strategic Programs
PE Title: System Survivability (Nuclear Effects)

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

Project Number & Title		FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3429	B-1B EMP Test	5,375	2,700	0	0	20,128
3763	S/V Assessment of Aerospace Systems	2,679	4,926	8,839	Cont	TBD
TOTAL		8,054	7,626	8,839	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Develops and demonstrates the engineering capability required for high confidence verification, hardening, and maintenance of Air Force and DOD aerospace, aircraft, and missile systems which must operate and survive in a nuclear environment. Project 3429 funds the Electromagnetic Pulse (EMP) Design Verification Test of the B-1B. Project 3763 determines through analysis and testing the survivability/vulnerability (S/V) of Air Force and DOD aerospace systems to nuclear effects. Establishes EMP standards and specifications for Air Force and DOD programs. Areas this program supports are: strategic bombers, tactical fighters, airlift, and missiles. The nature of threat to Air Force systems requires that they be able to operate in a variety of nuclear environments. To insure system survivability in these environments, the Air Force needs hardening materials, analytical techniques, and test methods to develop reliable, cost-effective hardening techniques and to verify/assess system hardness.

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

1. (U) Project 3763, S/V Assessment of Aerospace Systems: Supports the development and validation of advanced nuclear hardening techniques and HM/HS techniques for aircraft and missile systems. The nuclear survivability/vulnerability (S/V) of selected systems is determined by analysis and testing. The engineering techniques developed under this project are transferred to Air Force Product Divisions and Operating Commands for application to new aerospace systems under development or existing systems in operation.

(U) FY 1989 Accomplishments:
- (U) Prototype Ellipticus Antenna built and field mapped at
- (U) Weapons Laboratory (WL), Kirtland AFB, NM.
  -- (U) Continuous wave antenna with fixed pattern similar to the Horizontal Polarized Dipole at WL
- (U) Prototypoe Single Point Excitation for Hardness Surveillance (SPEHS) hand held tester demonstrated at Oklahoma City Air Logistics Center (OC-ALC).
  -- (U) Potential savings of 400 manhours on E-3A alone

Program Element: #0604711F Budget Activity: #3-Strategic Programs
PE Title: System Survivability (Nuclear Effects)

- (U) Hardness Surveillance Illuminator at OC-ALC evaluated up to 1 GHz with positive results.
- (U) Portable MIL-STD-1553 BUS monitoring system developed.
  -- (U) Capable of predicting and detecting upset consequences
  -- (U) B-1B system lab test at Edwards AFB, CA, Jun 89
- (U) Initial draft EMP hardening design handbook completed.

(U) FY 1990 Planned Program:
- (U) Complete SPEHS development and transition to OC-ALC (AFSC Funds)
- (U) Complete development of square wave direct drive system
  -- (U) Provides wider frequency band for testing
- (U) Coordinated final draft of EMP hardening handbook
- (U) Completed upset testing and design fault tolerance guidelines
  -- (U) BUS monitor to be tested on B-1B aircraft at OC-ALC
- (U) 2169A coupling analysis
- (U) Begin integration of HM/HS testers and long-range HM/HS plan
  -- (U) Coordinated effort with OC-ALC

(U) FY 1991 Planned Program:
- (U) Publish EMP hardening handbook as MIL Handbook
- (U) Complete work on composite waveforms for direct drive
- (U) Begin development of improved simulation for 2169A

(U) Work Performed By: Project managed by the Air Force Weapons Laboratory, Kirtland AFB, NM. Primary civilian contractor: United Engineering, Inc, Albuquerque, NM.

(U) Related Activities:
- (U) Program Element #0602601F, Advanced Weapons
- (U) Program Element #0603605F, Advanced Weapons Technology
- (U) Program Element #0604747F, Electromagnetic Radiation Test Facilities.
- (U) Program Element #0701111F, Aircraft and C^3 S/V Maintenance.
- (U) There is no unnecessary duplication of efforts in the Air Force or DOD programs. The Under Secretary of Defense for Acquisition has established a joint DNA/Multi-Agency Cooperative EMP Hardening Technology Program to coordinate the efforts of DNA and the services in developing EMP hardening technology, and has established a Defense EMP Standards and Specifications Program that gives the Air Force the responsibility for aircraft standards within DOD.

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

(U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604725F Budget Activity: 4 - Tactical Programs
PE Title: Combat Identification Systems

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2598 Mark XV USAF Unique Development	1,355	0	0	0	0
2751 Indirect ID Subsystem	7,591	4,406	0	0	14,544
3592 Mark XV Tri-Service Core	64,841	29,631	0	0	179,327*
3756 TACS NCIR	8,825	0	0	0	10,770
TOTAL	82,612	34,037	0	0	204,641

*includes Project 2598 + Project 3592 funds

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element accomplishes engineering development of systems that will provide reliable long-range identification (ID) of airborne targets in all-weather and hostile electromagnetic countermeasures environments. [

(U) Program Budget Decision 812 cancelled Mark XV in PE64725F. Project 2751 was inadvertently cancelled with Mark XV. $4.4M of FY90 appropriation will be used for Project 2751 to fund $1.6M effort in FY90 and $2.8M effort in FY91. Follow-on funding will be submitted during the FY92 POM.

Program Element: #0604725F Budget Activity: 4 - Tactical Programs
PE Title: Combat Identification Systems

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

1. (U) Project 2598, Mark XV USAF Unique Development: This project funds engineering design, testing, development and integration of Air Force unique efforts for Mark XV development of a unique interrogator for the E-3 AWACS.

(U) FY 1989 Accomplishements:
- (U) Study for E-3 interrogator design on contract.
- (U) Initial study results delivered.

(U) FY 1990 Planned Program:
- (U) Program is currently under review. A program decision on program continuation will be made by DOD no later than 30 Mar 90. Current plans are to cancel the project after 30 Mar 90.

(U) FY 1991 Planned Program:
- Not Applicable

(U) Related Activities:

- (U) Program Element 0603742F, Combat Identification Technology.
- (U) Program Element 0603790F, NATO Cooperative RDT&E.
- (U) Program Element 0603790A, NATO Cooperative RDT&E.
- (U) Program Element 0603790N, NATO Cooperative RDT&E.
- (U) Program Element 0603267N, NATO Future Identification System.
- (U) Program Element 0603515N, Advanced Identification Techniques.
- (U) Program Element 0603706A, Identification Friend or Foe (IFF) Developments.
- (U) Program Element 0604211N, Air Traffic Control Radar Beacon System/Mark XII.
- (U) Program Element 0604709A, IFF Equipment.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

- Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2751, Indirect Identification Subsystem:
This project develops Noncooperative Target Recognition (NCTR) capability for Air Force Command, Control, and Communications (C3) platforms (e.g., ground Tactical Air Control System (TACS), E-3). This effort is directed

Program Element: #0604725F Budget Activity: 4 - Tactical Programs
PE Title: Combat Identification Systems

toward providing high confidence indirect identification capability, and investigates using existing/future sensors with processing and correlation techniques to improve the overall C3 identification process.

[ ] This capability is needed to provide a complete air combat situation and to control information to the battlefield commander to enable the optimum allocation of limited resources against a numerically superior enemy.

(U) FY 1989 Accomplishments:
- (U) As a result of a review of user requirements, and programmatic and funding perturbations, a re-structure of the program was initiated to better meet operational requirements within the funding constraints.

(U) FY 1990 Planned Program:
- (U) Initiate a feasibility study for adapting existing [ ] for Ground TACS operational requirements.
- (U) Continue development of a multi-source data fusion capability for the USAF Ground TACS.

(U) FY 1991 Planned Program:
- (U) Continue a feasibility study for adapting existing [ ] for Ground TACS operational requirements.
- (U) Continue development of a multi-source data correlation capability for the the USAF Ground TACS.

(U) WORK PERFORMED BY: The Indirect Sub-systems program is managed by the Combat Identification System - Indirect Sub-system program office (CIS-ISS) at Electronic Systems Division, Air Force Systems Command, Hanscom Air Force Base, MA. Support is also provided by the MITRE Corporation, Bedford, MA. The contractor will be Litton, Van Nuys, CA.

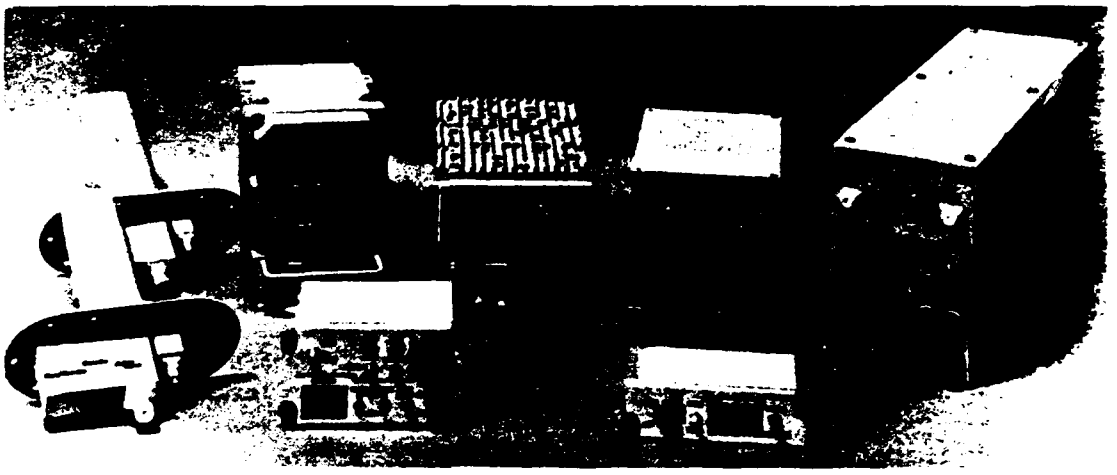
(U) Related Activities:
- (U) Program Element 0603742F, Combat Identification Technology.
- (U) Program Element 0603515N, Advanced Identification Techniques.
- (U) Program Element 0603706A, Identification Friend or Foe (IFF) Developments.
- (U) Program Element 0604709A, IFF Equipment.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriations: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604725F Budget Activity: #4-Tactical Programs
PE Title: Combat Identification Systems
Project Title: Mark XV Tri-Service Core Development



POPULAR NAME: Mark XV IFF

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

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	MSII 1 Qtr	Program Termination	N/A	N/A
Engineering Milestones	System Design Review (SDR)	Complete SDR Actions	N/A	N/A
T&E Milestones	TEMP Accomplished	N/A	N/A	N/A
Contract Milestones	FSD Contract Award 2 Qtr	N/A	N/A	N/A
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract *	48,686	15,807	0	N/A
Support Contract *	4,343	3,423	0	N/A
In-House Support *	2,342	2,000	0	N/A
GFE/ Other *	10,825	8,235	0	N/A
Total *	66,196	29,465	0	N/A

* includes Project 2598 + Project 3592 fund

Program Element: #0604725F Budget Activity: #4-Tactical Programs
PE Title: Combat Identification Systems

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project funds the Tri-Service (Air Force led) core Mark XV IFF program. The Mark XV is the US implementation of the NATO Identification System, Question and Answer Component. The United States is cooperating with the other NATO nations to develop interoperable future identification equipment. The full scale development phase of the program started in FY89. The Mark XV is designed to replace the aging Mark XII system. The thrust of this project is the design, integration, and testing of the Mark XV system on tri-sevice core platforms (F-15, F-18, Hawk, EH-60, Ticonderoga, and Spruance). The results of such tests supports the basis for validating the interoperability agreement with NATO.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) The Milestone II review was held on 21 Dec 88. FSD contract awarded 3 Feb 89. Allied Signal Corporation (Bendix) selected for FSD.
- (U) Acquisition Decision Memorandum was issued on 2 Feb 89.
- (U) Technical agreement on J-band complete.

(U) FY 1990 Planned Program:
- (U) System Design Review conducted in Dec 89.
- (U) Conduct critical near-term program activity through 30 Mar 90.
- (U) Program is currently under review. A program decision on whether the program will continue will be made by DOD no later than 30 Mar. Current plans are to cancel the program after 30 Mar 90.

(U) FY 1991 Planned Program:
- (U) Not Applicable.

(U) Program to Completion:
- (U) Not Applicable.

D. (U) WORK PERFORMED BY: The Mark XV IFF program (Projects 2598 & 3592) is managed by the Mark XV IFF System Program Office at the Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson AFB, OH. Support is also provided by the Electromagnetic Compatibility Analysis Center, Annapolis, MD. For full scale development (FSD), Allied-Bendix will be the lead contractor and Raytheon, Marlborough, MA, the follower.

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

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Current plans are to terminate program.
3. (U) COST CHANGES: FY 90 estimate changes are due to restructuring of program. $34.04M allocated to Mark XV program for termination and to fund Indirect ID project.

Program Element: #0604725F Budget Activity: #4-Tactical Programs
PE Title: Combat Identification Systems

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-79, Ground-to-Air Identification, Jan 79
- (U) TAF SON 305-79, Air-to-Air Identification, Jan 79
- (U) JMENS for Improved Identification, Sep 80
- (U) Multi-Command Required Operational Capability (MROC 20-83), Jul 84
- (U) Milestones II Acquisition Decision Memorandum, Feb 89
- (U) TAF 304-79-I/II-A, System Operational Requirement Document, Jan 89
- (U) STANAG 4162, NATO Final Report to the Tri-Service Group on Communications and Electronic Equipment by the Sub-Group on the future NATO Identification System, AC/302-D/47, 19 Dec 86

G. (U) RELATED ACTIVITIES:
- (U) Program Element 0603742, Combat Identification Technology
  Program Element 0603790F, NATO Cooperative RDT&E
  Program Element 0603790A, NATO Cooperative RDT&E
  Program Element 0603790N, NATO Cooperative RDT&E
  Program Element 0603267N, NATO Future Identification System
  Program Element 0603515N, Advanced Identification Techniques
  Program Element 0603706A, Identification Friend or Foe (IFF) Developments
  Program Element 0604211N, Identification Friend or Foe Systems
  Program Element 0604709A, IFF Equipment
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Project 3529, Mark XV Tri-Service Core Development, includes a Memorandum of Understanding with Italy to participate in FSD. This MOU was signed in Jul 89.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Qualification/Acceptance Testing (ADMs)	Sep 86 - Feb 87	Testing successful
ADM Integration/Shakedown of Test Aircraft	Mar - Jun 87	Integration Subcontractor ESI, Inc. Waco, TX
Lab Parametric Testing	Dec 86- Jun 87	Completed successfully by Bendix and Texas Instruments with Gov't approved test plans Final Report: 8 Feb 88

Program Element: #0604725F Budget Activity: #4-Tactical Programs
PE Title: Combat Identification Systems

Flight Testing US Prime Contractors	Apr - Nov 87	Successfully completed by 4950th TW and NATC at WPAFB, OH and Patuxent River, MD Final Reports: Late Mar 88
US Interoperability Tests	Apr - Nov 87	Gov't conducted successfully Final Reports: Late Mar 88
Plug Compatibility Tests Demonstration	Oct - Nov 87	Army/Navy conducted at NESEA St Inigoes, MD Final Reports: Late Mar 88
NATO Interoperability Tests	Oct - Nov 87	Successful demonstration with US, UK, FR, and GE equipments Final Reports: Late Mar 88
Test and Evaluation Master Plan (TEMP)	submitted Nov 89	Tri-Service coordinated test planning document awaiting OSD review and approval

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Results

DOD review in progress through 30 March 90. Current planning is to cancel the program at 30 Mar 90.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604733F
PE Title: Surface Defense Suppression
Project Number: 3006
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title GBU-15 P^3I

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
GBU-15 P^3I	42,435	8,922	11,158	15,112	180,388
Total	42,435	8,922	11,158	15,112	180,388

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program develops an improved data link for the GBU-15 guided glide bomb. The improved data link provides the GBU-15 with an antijam data link to ensure total system performance in current and projected dense electronic countermeasure environments. This program also develops advanced support equipment to replace current GBU-15 support equipment. The advanced support equipment provides increased efficiency, reliability, and mobility. Reliability will be increased sixfold (500 hours mean time between failures versus 80 hours for the old support equipment). The two-man portable modules of the advanced support equipment greatly increase mobility compared with the older 875 pound single unit support equipment. This program also develops the AGM-130A air-to-ground missile which is a Preplanned Product Improvement (P^3I) of the GBU-15. The AGM-130A has a 2,000 pound warhead, television (TV) or imaging infrared (IIR) seeker, and a rocket motor for extended range. The extended range of the AGM-130A reduces delivery aircraft attrition by allowing launch from outside target point defenses. The AGM-130 can use the improved data link and advanced support equipment being developed for the GBU-15. The AGM-130A will have the capability to attack vertical and horizontal targets from standoff range, outside terminal area defenses, in day and night, and in an electronic countermeasures environment. The AGM-130A will be delivered from F-111F and F-15E aircraft. The BLU-109 hardened target penetrating warhead is planned to be integrated with the AGM-130 in the future.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued GBU-15 improved data link full scale development.
   - (U) Started GBU-15 advanced support equipment development.
   - (U) Completed AGM-130A DT&E with the TV seeker.
   - (U) Started AGM-130A IOT&E with the TV seeker.

Program Element: #0604733F
PE Title: Surface Defense Suppression
Project Number: 3006
Budget Activity: #4 - Tactical Programs

2. (U) FY 1990 Planned Program:
   - (U) Continue improved data link development and award contract for production special tooling/special test equipment.
   - (U) Continue full scale development of advanced support equipment.
   - (U) Complete AGM-130A IOT&E with the TV seeker.
   - (U) Start integration of AGM-130A with IIR seeker.
   - (U) Start integration of AGM-130A with F-15E.
   - (U) Start production of the AGM-130A.

3. (U) FY 1991 Planned Program:
   - (U) Continue improved data link development and start production.
   - (U) Continue full scale development of advanced support equipment.
   - (U) Continue integration of AGM-130A with IIR seeker.
   - (U) Continue integration of AGM-130A with F-15E.
   - (U) Continue development of advanced support equipment.

4. (U) Program to Completion:
   - (U) Complete development and start production of advanced support equipment.
   - (U) Complete development of the improved data link.
   - (U) Continue production of improved data link.
   - (U) Complete integration of AGM-130A with IIR seeker and F-15E.
   - (U) Develop AGM-130 horizontal and vertical hardened target attack capability.
   - (U) Integrate BLU-109 hardened target penetrating bomb with AGM-130.

D. (U) WORK PERFORMED BY: Program management is provided by the Deputy for Air-to-Surface Guided Weapons at the Munitions Systems Division (MSD), Eglin Air Force Base FL. Major contractors are Rockwell International (GBU-15 and AGM-130A prime contractor), Duluth GA; Hughes Aircraft Co. (current GBU-15 data link contractor), Culver City/Canoga Park CA; and Hughes Georgia Inc (HGI), LaGrange GA (IIR seeker contractor). Harris/Magnavox team, Melbourne FL is the contractor for the improved data link. The contractor for the advanced support equipment program is General Dynamics, San Diego, CA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:
   1. (U) TECHNICAL CHANGES: Added development of AGM-130 horizontal and vertical hardened target attack capability, integration on the F-15E aircraft and integration of IIR seeker on the AGM-130 missile.
   2. (U) SCHEDULE CHANGES: Improved data link production delayed 10 months. Advanced support equipment FSD start and production delayed by 6 months.
   3. (U) COST CHANGES: Added a total of $19,088 in R&D in FYs 1991, 1992, and 1993.

F. (U) PROGRAM DOCUMENTATION:
   - (U) SON TAF 301-86, Nov 87
   - (U) SORD TAF 301-86-I/II/III-A, Jul 89
   - (U) TEMP, Jun 89

Program Element: #0604733F
PE Title: Surface Defense Suppression
Project Number: 3006
Budget Activity: #4 - Tactical Programs

G. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(U) PROCUREMENT:					
- (U) Aircraft Procurement PE 0207165F (BA 4, P-1 Line Item TBD)					
Cost	-0-	4,396	17,985	52,506	74,887
IDL Pod Quantity	-0-	-0-	15	130	145
- (U) Other Procurement PE 0207165F (BA 4, P-1 Line Item TBD)					
Cost	-0-	-0-	-0-	50,283	50,283
ASE Quantity	-0-	-0-	-0-	25	25
- (U) Other Procurement PE 0208030F (BA 4, P-1 Line Item TBD)					
Cost	-0-	930	25,854	96,929	123,713
IDL Quantity	-0-	0	224	895	1,119
- (U) Missile Procurement PE 0207165F (BA 4, P-1 Line Item 14)					
Cost	-0-	*32,000	38,434	1,031,610	1,102,044
AGM-130A Quantity	-0-	28	63	3957	4048

*Air Force will submit a FY 90 reprogramming request to procure missiles

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

J. (U) MILESTONE SCHEDULE:

1. (U) AGM-130A FSD Start	September 1984
2. (U) AGM-130A DT&E/IOT&E Start	September 1985
3. (U) AGM-130A Critical Design Review Complete	May 1986
4. (U) Improved Data Link FSD Start	November 1986
5. (U) Advanced Support Equipment FSD Start	November 1990
6. (U) AGM-130A IIIA Decision	2nd Quarter FY 1990
7. (U) Improved Data Link Low Rate Production Award	3rd Quarter FY 1991
8. (U) AGM-130A IIIB Decision	1st Quarter FY 1992
9. (U) Advanced Support Equipment Procurement	4th Quarter FY 1992

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604735F
PE Title: Range Improvement
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2152 Mission/Engineering Support	4,698	3,000	3,100	Cont	TBD
2286 Tactical Air Forces Range Equipment	6,514	3,473	5,632	Cont	TBD
3320 Strategic Air Command Range Equipment	6,214	8,100	4,083	Cont	TBD
3321 Electronic Combat Test Resources	2,368*	45,725	65,928	Cont	TBD
6510 Flight Test Threat Systems Simulators	402**	20,665	22,185	Cont	TBD
Total	20,196***	80,963	100,928	Cont	TBD

* In FY 88 and FY 89 project 3321 was funded from other PEs by additional amounts of $26.6M and $34.8M respectively.

** In FY 89, $20M was moved into OSD PE 0605134D to perform the same types of work.

*** In FY 88 and FY 89, funding for this PE in the amounts of $26.6M and $54.8M, respectively, was located in other PEs.

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Range Improvement Program (RIP) contributes to the qualitative improvement of our combat forces by developing instrumentation and air defense threat simulator systems to increase the effectiveness of development and operational testing, training, and large scale exercises.

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

1. (U) Project 2152, Mission/Engineering Support: Provides basic operating support, system software acquisition, electronic combat (EC) test requirements collection, consolidation, review and support and systems engineering support such as studies, assessments, and analyses.

(U) FY 1989 Accomplishments:

- (U) Continued RIP basic operating support, system software acquisition and systems engineering support.
- (U) Used $1.7M increase to fund studies for establishing an EC test capability at Utah Test and Training Range.
- (U) Continued to develop interoperability between the Air Force MDS and Navy TACTS Ranges.

Program Element: 0604735F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Range Improvement

(U) FY 1990 Planned Program:

- (U) Continue RIP basic operating support, system software acquisition, and systems engineering support.
- (U) Continue to develop interoperability between the Air Force MDS and Navy TACTS Ranges.

(U) FY 1991 Planned Program:

- (U) Continue RIP basic operating support, system software acquisition, and systems engineering support.
- (U) Continue to develop interoperability between the Air Force MDS and Navy TACTS Ranges.

(U) Work Performed by: VSE Corporation, Fort Walton Beach, FL.

(U) Related Activities: There is no unnecessary duplication of effort in the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ in Thousands): None.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

2. (U) Project 2286, Tactical Air Forces Range Equipment: Provides for the development and procurement of electronic, telecommunications, and instrumentation equipment/systems for the tactical operational test and training ranges worldwide. The primary developmental efforts include Air Combat Maneuverability Instrumentation (ACMI)/Measurement and Debriefing System (MDS); aircraft interface requirements for proper data transmission from the ACMI pods to the aircraft; Smokewinder pods which provide visual cues to aircrews firing simulated missiles during training; the Automated Electronic Countermeasures Analysis System which provides real-time ECM feedback to aircrews during training missions; and advanced threat training emitters which provide training on the latest threat systems.

(U) FY 1989 Accomplishments:

- (U) Continued development of ACMI enhancements and software upgrades.
- (U) Continued to support development of aircraft interface with ACMI pods, and weapon simulations.
- (U) Began software development for a Smokewinder pod with laser receivers for the Army's National Training Center (NTC) range, development of a Red Forces Command and Control (RFC^2) capability for the Nellis ranges.

Program Element: #0604735F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Range Improvement

(U) FY 1990 Planned Program:

- (U) Continue to develop aircraft interface with ACMI pods, ACMI/Measurement and Debriefing System (MDS) software upgrades, smokewinder pods, and AECMAS.

(U) FY 1991 Planned Program:

- (U) Continue to develop aircraft interface with ACMI pods, and ACMI/MDS software upgrades.
- (U) Begin ACMI software upgrades for joint Air Force/Army training at NTC, and continue to support development of AECMAS.

(U) Work Performed by: This program is managed by the Munitions Systems Division, Eglin AFB, FL. Major contractors include Cubic Corporation, San Diego, CA, (Air Combat Maneuvering Instrumentation System); and Georgia Institute of Technology, Atlanta, GA. Names and locations of some contractors are classified.

(U) RELATED ACTIVITIES:

- (U) Navy and Army also engage in threat simulator development.
- (U) All USAF requirements for threat simulators, and all developments proposed for inclusion in this project, submitted for review by the CROSSBOW-S Committee reporting to the DoD Executive Committee on Threat Simulators (EXCOM).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.
- (U) T&E investments for some new tri-Service common threat simulators are funded in PE 0604904D, Threat Instrumentation Development.

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement (PE 0207429F):					
Funds	16,012	6,231	7,831	Cont	TBD
Quantity	104	40	45	N/A	N/A
Other Procurement (PE 0207429F):					
Funds	49,262	47,760	27,831	Cont	TBD
Quantity	N/A	N/A	N/A	N/A	N/A

(U) International Cooperative Agreements: None.

Program Element: #0604735F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Range Improvement

3. Project 3320, Strategic Air Command Range Equipment: This project provides the same type of range equipment, instrumentation and training emitter systems for SAC training ranges as does project 2286 for the tactical forces. The primary effort supports the development of a new Strategic Training Route Complex (STRC) for strategic bomber crew training and the development of the emitter system equipment to be used on the STRC to create a more realistic combat environment.

(U) FY 1989 Accomplishments:

- (U) Began STRC initial operational test and evaluation (OT&E) planning, and Air Combat Maneuvering and Instrumentation (ACMI) bomber interface.

(U) FY 1990 Planned Program:

- (U) Continue STRC OT&E and begin Advanced Threat Emitter System Trainer (ATEST) development.
- (U) Continue ACMI bomber interface development.

(U) FY 1991 Planned Program:

- (U) Continue STRC planning, ACMI bomber interface development, and ATEST development.

(U) Work Performed by: This program is managed by the Munitions Systems Division, Eglin AFB, FL. Major contractors include General Dynamics Corporation, Fort Worth, TX, (AN/MST-TIA) - Multiple Threat Emitter System); Metric Corporation, Fort Walton Beach, FL, (AN/MPQ-T3 - Multiple Threat Emitter); Martin-Marietta, Denver, CO, (AN/MSR-T4 - Electronic Warfare Signal Analyzer); Cubic Corporation, San Diego, CA, (Air Combat Maneuvering Instrumentation System); and American Electronics Laboratories, Lansdale, PA, (AN/MLQ-T4 - Ground Jammer), and Georgia Institute of Technology, Atlanta, GA. Names and locations of some contractors are classified.

(U) Related Activities:

- (U) Navy and Army also engage in threat simulator development.
- (U) All USAF requirements for threat simulators, and all developments proposed for inclusion in this project, submitted for review by the CROSSBOW-S Committee reporting to the DoD Executive Committee on Threat Simulators (EXCOM).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.
- (U) T&E investments for some new tri-Service common threat simulators are funded in PE 0604904D, Threat Instrumentation Development.

Program Element: #0604735F Budget Activity: #6 - Defense-Wide
PE Title: Range Improvement Mission Support

(U) OTHER APPROPRIATION FUNDS ($ In Thousands):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement (PE 0101897F):					
Funds	8,119	4,541	111	Cont	TBD
Quantity	N/A	N/A	N/A	N/A	N/A
Other Procurement (PE 0101897F):					
Funds	60,535	74,770	39,463	Cont	Cont
Quantity	N/A	N/A	N/A	N/A	N/A

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 3321
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title: Electronic Combat Test Resources

Popular Name (N/A)	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	2,368*	45,725	65,928	Cont	TBD

* In FY 1989 $34.8M additional project funds were provided from other PEs as follows:
$32.3M - PE 0604270 - EW Development
$ 2.5M - PE 0604755 - Improved Capability for DT&E

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project develops, fabricates and validates digital models, hybrid simulators, integration/effectiveness test facilities, and range systems for detailed development and evaluation of potential electronic combat (EC) systems and techniques. The Electronic Combat Digital Evaluation System (ECDES) and Red Mission Analysis (RMA) will be digital simulations intended to provide a research, development, and evaluation resource for EC system engineering requirements/specification analysis, design tradeoffs, test design, and weapon system effectiveness/survivability analysis. The two major hybrid simulation facilities funded by this project are the Air Force Electronic Warfare Evaluation Simulator (AFEWES) and the Real-Time Electromagnetic Digitally Controlled Analyzer and Processor (REDCAP). These facilities provide closed-loop, man-in-the-loop, electronic combat effectiveness testing in secure laboratory environments. AFEWES provides simulation of the EC terminal threat environment (the shooters), while REDCAP provides simulation of the surveillance, early warning, battle management, and command, control, and communications (C3) functions of an Integrated Air Defense System (IADS) threat environment (minus the shooters). Together, these facilities provide realistic laboratory simulations of the entire IADS to permit effective definition, design and evaluation of new/improved countermeasures equipment in precisely controlled environments. This project funds the upgrade of three facilities at Eglin AFB, FL, the Pre-Flight Integration of Munitions and Electronic Systems (PRIMES) Facility, the Guided Weapons Evaluation Facility (GWEF),and the Electromagnetic Threat Environment (EMTE), to facilitate vulnerability assessments of offensive avionics and electronic counter-countermeasures (ECCM) testing. This project also provides for the acquisition, maintenance and continuing update of a precision antenna test range employing reconditioned shells of actual USAF combat aircraft. The range is used during advanced and full-scale development programs to test and evaluate new EC

Program Element: #0604735F Project Number: 3321
PE Title: Range Improvement Budget Activity: #6 - Defense- Wide Mission Support

antennas and antenna installations on board actual aircraft to determine radiation patterns. Starting in FY91, this project will also fund the continued Operation and Maintenance (O&M) and Improvement and Modernization (I&M) of the AF Anechoic Facility (AFAF) at Edwards AFB, CA. Prior to FY91, the AFAF was funded as a production acceptance facility by the B-1B program. Finally, this project provides funds for improvements/upgrades to the Radar Test Facility (RTF), a ground test facility for testing the vulnerability of U.S. airborne radars to electronic countermeasures (ECM). These programs permit extensive testing before flight test at a fraction of the cost.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:

- (U) Continued development of on-going AFEWES upgrades (TWS-4, TWS-8, Ground Clutter Generator (GPSR). Complete TWS-4. (PE 64270F)
- (U) Continued work on Phase II of the AFEWES TWS-10 development. (PE 64270F)
- (U) Continued work on the four new AFEWES upgrade projects (Reconfigurable Airborne Interceptor (RAI) simulation, Multiple Environment Generator (MEG) upgrade, Infrared Laboratory Expansion (IRLE), Test Director System Development, begun under the Phase I AFEWES Integrated Upgrade (AIU) contract. (PE 64270F)
- (U) Continued work on the three REDCAP upgrades (SUAWACS BM/C3, IADS, EW/GCI Radars) begun under the Phase I contract. (PE 64270F)
- (U) Awarded Phase II AIU contract, which continues the four ongoing projects to completion and provide for six additional projects (i.e., TWS-11 Missile, Reconfigurable Surface-to-Air (RSAM) simulator, Advanced Environment Generator (AEG), EW/GCI radar integration, Airborne Clutter Generator (GSAR), and Technique Evaluation Equipment). Begin work on the TWS-11 Missile. (PE 64270F)
- (U) Completed EO, MMW, and PAAS antenna range upgrades. (PE 64270F)
- (U) Continued ECCM upgrades of PRIMES, GWEF, and EMTE, (PE 64755F)
- (U) Awarded contract for Phase I of F-15 radar (APG-70) test bench acquisition.

2. (U) FY 1990 Planned Program:

- (U) Complete TWS-8 and GPSR.
- (U) Continue TWS-10 development.
- (U) Continue development on the AFEWES TWS-11 Missile, RAI,

Program Element: #0604735F Project Number: 3321
PE Title: Range Improvement Budget Activity: #6 - Defense- Wide Mission Support

MEG upgrade, IRLE and TDS under the Phase II AIU contract.
- (U) Start work on RSAM Simulator and GSAR.
- (U) Continue work on the three REDCAP upgrades. Award Phase II contract for completion of efforts begun under Phase I.
- (U) Continue antenna range upgrade, based on user requirements.
- (U) Continue ECCM upgrades of PRIMES, GWEF, and EMTE.
- (U) Complete Phase I of APG-70 test bench acquisition for the Range Test Facility.
- (U) Award Phase II contract for APG-70 test bench.

3. (U) FY 1991 Planned Program:

- (U) Achieve IOC on TWS-10, MEG upgrade, IR expansion and TDS.
- (U) Continue work on AFEWES upgrades under the Phase II contract.
- (U) Achieve IOC of the AFEWES RAI Simulator.
- (U) Continue work on REDCAP upgrades under the Phase II contract.
- (U) Continue antenna range upgrades, based on user requirements.
- (U) Continue ECCM upgrades of PRIMES, GWEF, and EMTE.
- (U) Complete Phase II of APG-70 acquisition.
- (U) Award Phase III contract.

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

D. (U) WORK PERFORMED BY: Portions of this project are managed by Aeronautical Systems Division, Wright-Patterson AFB, OH; Armament Division, Eglin AFB, FL; Rome Air Development Center, Griffiss AFB, NY; and the 4484 Test Squadron, Tyndall AFB, FL. Major contractors include General Dynamics Corporation, Fort Worth, TX and Calspan Corporation, Buffalo, NY.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY: The $10.0M decrease in FY 90 was due to a Congressional cut. The $2,106M decrease in FY 91 was due to internal AF reprogramming.

F. (U) PROGRAM DOCUMENTATION:

(U) SAC SON 3-79, 20 Jun 80
TAF ROC 305-76, 18 Jan 77
SAC SON 08-81, 28 Jul 82

G. (U) RELATED ACTIVITIES:

- (U) Navy and Army also engage in threat simulator development.
- (U) All USAF requirements for threat simulators, and all developments proposed for inclusion in this project, submitted for review by the CROSSBOW-S Committee reporting

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 3321
Budget Activity: #6 - Defense- Wide Mission Support

to the DoD Executive Committee on Threat Simulators (EXCOM).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.
- (U) T&E investments for some new tri-Service common threat simulators are funded in PE 0604904D, Test Instrumentation Development.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

2Q90: REDCAP Upgrade Phase II contract award.
3Q90: AFEWES TWS-8 IOC.
4Q91: AFEWES TWS-10 IOC.
4Q91: AFEWES RAI IOC.
2Q92: AFEWES TWS-11 IOC.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 6510
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title: Flight Test Threat Systems Simulators

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(N/A)	402*	20,665	22,185	Cont	TBD

* In FY 1989 $20.M additional funds were provided from PE 0605134D as a result of OSD consolidation.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project funds the development of test quality simulators of the advanced Soviet air defense radar equipment. The simulators will be used in flight testing our new aircraft radars and avionics system's electronic warfare capability. This project also funds the simulator modifications necessary to maintain existing simulators to the current intelligence baseline. This project fills a continuing and expanding need to flight test and evaluate new, and newly modified, electronic combat (EC) equipment prior to production. To be effective, this testing must be conducted in an environment which accurately simulates the EC environment to include enemy threat radar simulators. In the past, the adaptability of airborne electronic countermeasure (ECM) systems was quite limited; however, new radar warning receiver signal processing technology and techniques and smart jamming systems are highly adaptive and allow ECM system flexibility. It is extremely difficult to construct a creditable test for such ECM equipment without a large number of different instrumented threat systems to cover the entire threat spectrum.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:

- (U) Continued development on the HAVE PEWTER and HAVE COPPER simulators.
- (U) Continue simulator modifications.

3. (U) FY 1990 Planned Program:

- (U) Continue development on the HAVE PEWTER and HAVE COPPER simulators and begin development of 2S6 simulator.
- (U) Continue simulator modifications.

4. (U) FY 1991 Planned Program:

Program Element: #0604735F Project Number: 6510
PE Title: Range Improvement Budget Activity: #6 - Defense - Wide Mission Support

- (U) Continue development on the HAVE PEWTER, HAVE COPPER and 2S6 threat simulators

- (U) Continue to modify existing simulators to incorporate latest intelligence information.

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

D. (U) WORK PERFORMED BY: This program is managed by the Munitions System Division, Eglin AFB, FL. Major contractors include General Dynamics Corporation, Fort Worth, TX, and Georgia Institute of Technology, Atlanta, GA. Names and locations of some contractors are classified.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY: FY90 funds were cut $22.911M due to the cancellation of an advanced threat simulator program.

F. (U) PROGRAM DOCUMENTATION:

- (U) SAC SON 3-79, 20 Jun 80
  TAF ROC 305-76, 18 Jan 77
  SAC SON 08-81, 28 Jul 82

G. (U) RELATED ACTIVITIES:

- (U) Navy and Army also engage in threat simulator development.
- (U) All USAF requirements for threat simulators, and all developments proposed for inclusion in this project, submitted for review by the CROSSBOW-S Committee reporting to the DoD Executive Committee on Threat Simulators (EXCOM).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.
- (U) T&E investments for some new tri-Service common threat simulators are funded in PE 0604904D, Threat Instrumentation Development.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

3Q91: HAVE PEWTER IOC.
4Q91: HAVE COPPER IOC.
4Q93: 2S6 IOC

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604740F Budget Activity: #4-Tactical Programs
PE Title: Computer Resources Management Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2239 Computer Security Technology	1,409	1,160	1,724	Cont	TBD
2522 Requirements Analysis	1,250	1,215	1,270	Cont	TBD
2523 Management Control Technology	540	1,443	1,818	Cont	TBD
2524 Policy and Procedure Guidance	833	890	235	Cont	TBD
2526 Software Engineering Tools & Methods	715	776	692	Cont	TBD
2983 Logistics Info Mgt Spt Sys (LIMSS)	4,700	4,431	4,921	Cont	TBD
3315 Automation of Technical Information (ATI) Computer Aided Logistics Support (CALS)	3,513	1,747	1,950	Cont	TBD
Total	12,960	11,662	12,610	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is an engineering development program that addresses problems of acquiring mission critical computer resources (MCCR) embedded in Air Force systems. This PE is a primary vehicle for transferring the products of advanced development efforts in computer technology into system applications. The objectives are to identify, develop and transfer into operational use tools, techniques and computer technology advances that support the following: (1) Providing secure, reliable, adaptable, maintainable, and survivable systems; (2) Reducing software life cycle costs; (3) Providing timely development and support of MCCR products; (4) Enhancing AF personnel ability to acquire and support systems by providing guidance on policy, procedures, and training; and (5) Providing a totally integrated capability to create, accept, retrieve and store digital (paperless) technical information for life cycle support for Air Force Logistics Information Systems.

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

1. (U) Project 2239, Computer Security Technology: Develop and apply computer security (COMPUSEC) products to support Air Force/DOD operations, and disseminate information on COMPUSEC issues and solutions. This project achieves its objectives by focusing on the demonstration and transition of security proven systems and mechanisms. Direction is taken from security policies and regulations such as National Security Decision Directive 145, Office of Management and Budget Circular A-130 and DOD Directive 5200.8.

Program Element: 0604740F Budget Activity: #4-Tactical Programs
PE Title: Computer Resource Management Technology

(U) FY 1989 Accomplishments:
- (U) Continued Security Products (Security Pro) Program task - awarded contract for general purpose MLS products.

(U) FY 1990 Planned Program:
- (U) Continue Security Pro Program task.

(U) FY 1991 Planned Program:
- (U) Continue Security Pro task.
- (U) Initiate an Ada software verification system task.

(U) Worked Performed By: Work is performed by the MITRE Corp., Bedford, MA.

(U) Related Activities:
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0603752F, DOD Software Engineering Institute.
- (U) Program Element #0303401F, Communications Security.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

2. (U) Project 2522, Requirements Analysis: Develop and apply tools that provide Air Force program offices with rapid insight into the technical performance, cost, schedule, and high risk implications of stated computer resources system requirements. These tools structure and control changing requirements; explore performance and supportability trade-offs; and examine alternatives prior to making hardware, software, and financial commitments.

(U) FY 1989 Accomplishments:
- (U) Continued development of Display Rapid Prototyping & Simulation (DRPS) system.

(U) FY 1990 Planned Program:
- (U) Continue development of DRPS.
- (U) Initiate a User Requirements System (URS) task.

(U) FY 1991 Planned Program:
- (U) Begin development of the Rapid Prototyping System (RPS).
- (U) Initiate a Tool for Tailoring Software Test Requirements task.
- (U) Initiate a Standard Generalized Markup Language (SGML) based assistant to aid in analyzing software and system specifications (i.e. Hypertext).

Program Element: 0604740F Budget Activity: #4-Tactical Programs
PE Title: Computer Resource Management Technology

(U) Work Performed By: Work is performed by Aerospace Corp., Los Angeles, CA and the Hughes Aircraft Company, Fullerton, CA.

(U) Related Activities:
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0603752F, DOD Software Engineering Institute.
- (U) Program Element #0603756F, DOD Software Initiative.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

3. (U) Project 2523, Management Control Technology: Develop and evaluate methods for estimating software development costs and defining acquisition strategies and practices that aid in the control of mission-critical computer resources. Efforts will support the Joint Logistics Commanders (JLC) objectives to eliminate unnecessary duplication and proliferation of software acquisition standards and practices among the three Services.

(U) FY 1989 Accomplishments:
- (U) Continued funding JLC Support Activities.
- (U) Published, through the JLC, DOD-HDBK-267 (implementation of DOD-STD-2167A) and DOD-HDBK-268 (implementation of DOD-STD-2168).

(U) FY 1990 Planned Program:
- (U) Initiate a Corporate MCCR Technical Management System (TMS) task to improve MCCR contract management.
- (U) Continue funding JLC Support Activities.
- (U) Transition an Acquisition Managers Quality Specification Tool (AMQST) developed by RADC under PE 63728F.
- (U) Initiate activities to monitor, track, and manage software development capabilities.

(U) FY 1991 Planned Program:
- (U) Continue TMS task.
- (U) Continue software development capabilities activities.
- (U) Initiate an Avionics Reliability Design Tool task.
- (U) Initiate a Joint STARS IV&V testing/tracking Tool task.
- (U) Initiate a program to implement the 26 recommendations in the Air Force Studies Board report "Adapting Software Development Policies to Modern Technology" as described in the Software Management Initiatives Implementation Plan.

(U) Work Performed By: Work is performed by the Advanced Technology Corp., Reston, VA.

Program Element: 0604740F Budget Activity: #4-Tactical Programs
PE Title: Computer Resource Management Technology

(U) Related Activities:
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0603752F, DOD Software Engineering
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Apppropriation Funds: None.

(U) International Cooperative Agreements: None.

4. Project 2524 Policy and Procedures Guidance: Develop comprehensive support guidance and procedures which lead to improvements in the planning, acquisition, and support of mission critical computer resources. Through the use of guidebooks, video tapes, multimedia training methods, and automated management aids, this project will provide training to Air Force personnel in software acquisition management.

(U) FY 1989 Accomplishments:
- (U) Continued the Mission Critical Computer Resource Acquisition Library System (MALS) task.
- (U) Completed the Instructional Support System (ISS) task.
- (U) Continued the Computer Resources Acquisition Course Computer Aided Instruction (CRAC CAI) task.
- (U) Initiated Courseware Transportability Initiative (CTI) task.

(U) FY 1990 Planned Program:
- (U) Complete the Acquire CD-ROM task.
- (U) Complete the CRAC CAI task.
- (U) Continue CTI tasks.
- (U) Initiate a Software Guidebooks Update (SAGU) task.

(U) FY 1991 Planned Program:
- (U) Complete the CTI task.
- (U) Continue SAGU task.

(U) Work Performed By: Work is performed by the Transportation Systems Center, Cambridge, MA.

(U) Related Activities:
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0603752F, DOD Software Engineering Institute.
- (U) Program Element #0603756F, DOD Software Initiative.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

Program Element: 0604740F Budget Activity: #4-Tactical Programs
PE Title: Computer Resource Management Technology

5. (U) Project 2526, Software Engineering Tools and Methods: Develop and implement a comprehensive set of integrated tools to improve the software development, acquisition, and support process. In addition, this project will place major emphasis on providing planning and support for the introduction of the Ada High Order Language (HOL) into the Air Force and the introduction of Artificial Intelligence to improve engineering approaches. An ongoing responsibility is to conduct Ada technology transition-providing the Ada community with information on Ada related methodologies and technologies.

(U) FY 1989 Accomplishments:
- (U) Completed the Expert Missile Maintenance Aid (EMMA) task.
- (U) Continued the Portable Natural Language Database Interface (PNLDBI) task - developed a test suite and applied the product to the MAC-Plan program.
- (U) Initiated a Common Ada Missile Packages (CAMP) Reusability Training (CAMP-3) task.

(U) FY 1990 Planned Program:
- (U) Continue the PNLDBI task- publish a knowledge engineering document.
- (U) Complete CAMP-3 task.
- (U) Initiate an EMMA-II task; include testing coverage of a family of tactical munitions to increase system reliability and maintainability.
- (U) Transition an Aircrew Scheduler Expert System task deveeeloped by RADC.

(U) FY 1991 Planned Program:
- (U) Complete the PNLDBI task.
- (U) Continue EMMA-II task.
- (U) Initiate a Flexible Customization Methodology task.

(U) Work Performed By: Work is performed by the MITRE Corp., Bedford, MA; General Electric Company, Schenectady NY; Raytheon Corp., Bedford, MA; and Rockwell International, Anaheim, CA.

(U) Related Activities:
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0603752F, DOD Software Engineering Institute.
- (U) Program Element #0603756F, DOD Software Initiative.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

Program Element: 0604740F Budget Activity: #4-Tactical Programs
PE Title: Computer Resource Management Technology

6. (U) Project 2983, Logistics Information Management Support System LIMSS): This is a long term develcpment effort to provide a standard architecture and a Communications, Command and Control (C3) infrastructure that will network various logistics information systems. This will improve wartime capability by improving information access, timeliness, and accuracy. The program will provide a broad plan to integrate the various logistics information systems being developed autonomously.

(U) FY 1989 Accomplishments:
- (U) Continued work on the paperless maintenance environment at the model base (Mather AFB) and worked toward expanding to a second base.
- (U) Final copy of the Maintenance Architecture was delivered.
- (U) Initiated work on the Logistics Supply Architecture.
- (U) Began work on the Engineering and Services Architecture.

(U) FY 1990 Planned Program:
- (U) Continue work at the model base and expand further.
- (U) Update the Logistics C-CS Plan and the Transportation Architecture.
- (U) Release the Logistics Supply Architecture final document.
- (U) Update the LIMSS data base.
- (U) Release the draft Engineering and Services Architecture.

(U) FY 1991 Planned Program:
- (U) Update the Maintenance Architecture.
- (U) Update the LIMSS data base.
- (U) Release the final Engineering and Services Architecture.

(U) Program To Completion:
- (U) This is a continuing program.

(U) Work Performed By: Work is performed by the Transportation Systems Center (TSC), Cambridge, MA.

(U) Related Activities:
- (U) There is no unnecessary duplication of effort in the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

7. (U) Project 3315, Computer Aided Acquisition and Logistics Support (CALS): DOD Defense Guidance and Office of the Secretary of Defense (OSD) funding initiatives have emphasized the need to improve the preparation, delivery, use and updating of digital technical information used in the design, manufacture, maintenance and operation of DOD weapon systems.

Program Element: 0604740F Budget Activity: #4-Tactical Programs
PE Title: Computer Resource Management Technology

(U) FY 1989 Accomplishments:
- (U) A CALS demonstration was accomplished on the Advanced Tactical Fighter (2nd contractor team).
- (U) The Logistic Support Analysis (LSA) and Product Definition Data (PDD) Modular Plans were completed.

(U) FY 1990 Planned Program:
- (U) The integrated automation of processes across the TO, LSA, and PDD modules will be completed.
- (U) Operational feedback will be collected and used to modify the integrated automation plan.

(U) FY 1991 Planned Program:
- (U) An integrated Weapon System Data Base Planning Module will be created to implement a data base containing weapon system product and supportability data.

(U) Work Performed By: Work is performed by the TSC, Cambridge, MA; Dynatrend, Cambridge, MA; and Unisys, Cambridge, MA.

(U) Related Activities:
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604747F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Electromagnetic Radiation (EMR) Test Facilities

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1209 EMP Simulation Test Facilities	4,202	3,345	3,830	Cont	TBD
2064 HAVE NOTE	1,051	836	958	Continuing	N/A
Total	5,253	4,181	4,788	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Funds operation, maintenance, and improvement of test facilities used by weapon system program offices to determine ability of systems to operate in nuclear (Project 1209) and non-nuclear (Project 2064) electromagnetic environments. Users pay for the actual costs of their tests.

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

1. (U) Project 1209, EMP Simulation Test Facilities: Funds acquisition and support of Air Force Weapons Laboratory (AFWL) test facilities which simulate nuclear electromagnetic pulse (EMP) environments in which weapon systems may be required to operate. The principal EMP simulators, used to test aircraft and large missiles, are the Vertically and Horizontally Polarized Dipoles (VPD and HPD) and the TRESTLE. The AFWL/Los Alamos Electromagnetic Calibration and Simulation (ALECS) Facility, a smaller simulator, is used to test small missiles and communications equipment. Additional capabilities include portable EMP generators for remote site tests and a laboratory used for testing individual electronic components.

(U) FY 1989 Accomplishments:
- (U) Continued tests of Small ICBM Hard Mobile Launcher.
- (U) Tested third Astarte aircraft.
- (U) Began tests of the EC-135 for the Air Force.
- (U) Augmented maintenance and spares provisioning for a new data acquisition system to maximize data acquisition rates and minimize test costs for users.
- (U) Continued support to the EMP Test Aircraft (EMPTAC) and other technology programs.

(U) FY 1990 Planned Program:
- (U) Continue tests of the B-1B and the EC-135.
- (U) Begin tests of the 4 Electronic Service Switching System for the Defense Communications Agency.
- (U) Begin tests of the SRAM-II for the Air Force.
- (U) Continue EMPTAC support, software and pulser developments, and maintenance and spares provisioning for the new data acquisition system.

Program Element: #0604747F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Electromagnetic Radiation (EMR) Test Facilities

(U) FY 1991 Planned Program:
- (U) Continue 4 Electronic Service Switching System, EC-135, and SRAM II tests.
- (U) Continue EMP Test Aircraft support, software and pulser developments, and maintenance and spares provisioning for the new data acquisition system.

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

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM, manages Project 1209. BDM International, Inc., McLean, VA, is the facilities support contractor.

(U) Related Activities:

- (U) Program Element 0604711F, Systems Survivability.
- (U) Program Element 0602601F, Advanced Weapons.
- (U) Program Element 0603605F, Advanced Radiation Techniques.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

2. (U) Project 2064, HAVE NOTE: Develops, acquires, and supports test facilities which simulate the non-nuclear electromagnetic environments in which weapon and command, control and communication (C3) systems must be able to operate. Air-launched weapons and C3 systems are tested in these facilities to assess their susceptibility to non-nuclear electromagnetic radiation from hostile or friendly sources such as radios, radars, jammers, or other electronic devices. For periods of time comparable to the duration of a mission, these facilities can illuminate the weapon with a replica of environments it may encounter in flight. The principal non-nuclear test facility is the Electromagnetic Compatibility Analysis Facility (EMCAF), an anechoic chamber where air-launched weapons can be radiated by a variety of signals. In addition to its primary use in characterizing system susceptibility, the test data is also used to update test methods, acquisition specifications, design standards, and maintenance technical orders to ensure that the weapon system is immune to those radio frequency emanations which it may encounter during its life cycle.

(U) FY 1989 Accomplishments:
- (U) Continued testing Infrared Search and Track System and Sensor-Fuzed Weapon.
- (U) Began initial EMR assessments for AMRAAM Producibility Enhancement Program.
- (U) Began planning for tests of the GBU-15/AGM-130 Improved Data Link.
- (U) Continued upgrades to the EMCAF, the Rapid-Evaluation Chamber, and test methodologies and data bases.

Program Element: #0604747F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Electromagnetic Radiation (EMR) Test Facilities

(U) FY 1990 Planned Program:
- (U) Complete vulnerability assessments of the Improved Data Link and the AMRAAM Producibility Enhancement Program hardware.
- (U) Conduct preliminary evaluation of the Modular Standoff Weapon (MSW).
- (U) Initiate design of a new, Multi-mode Targeting System to support advanced weapon system evaluations.
- (U) Continue upgrades to test methodologies and data bases.

(U) FY 1991 Planned Program:
- (U) Continue MSW vulnerability assessment.
- (U) Conduct preliminary evaluation of the Autonomously Guided Weapon.
- (U) Continue development of Multi-mode Targeting System.
- (U) Continue upgrades to test methodologies and data bases.

(U) Work Performed By: Project 2064 is managed by Rome Air Development Center, Griffiss Air Force Base, NY. Contractors include Rome Research Corp., New Hartford, NY; Advanced Electromagnetics, Albuquerque, NM; and the University of Colorado, Colorado Springs, CO.

(U) Related Activities:
- (U) HAVE NOTE is the Air Force implementation of the DoD Special Electromagnetic Interference Project, which directs the Services to test air-launched weapons for electromagnetic interference and to share test results and conclusions.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604750F
PE Title: Intelligence Equipment Budget Activity: #4 - Tactical Programs

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	FY 1992 Estimate	To Complete	Total Program
1174 Intelligence Security Equipment	893	925	982	1,010	Cont	TBD
1955 Air Force Indications and Warning (AFI&W)	1,510	0	0	0	Cont	20,750
2053 Foreign Technology Division Intelligence Processes	2,375	2,597	2,929	2,988	Cont	TBD
TOTAL	4,778	3,522	3,911	3,998	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element supports USAF operating commands by performing the engineering development of ground equipment and/or techniques to streamline the processing, integration, display and distribution of intelligence data. Developed software will reduce the time required for the exploitation of intelligence data by Air Force agencies producing strategic, tactical, and scientific and technical intelligence products. Equipment and techniques are also developed to counter the foreign intelligence threat to the USAF mission.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 1174, Intelligence Security Equipment: This program develops equipment and systems to support the Air Force Office of Special Investigations (AFOSI) in its Technical Surveillance Countermeasures (TSCM) mission. The state-of-the-art in electronics and[.] This is the only program performing research and development on equipment to[.] The AFOSI needs this research and development to maintain it's counterespionage mission capability and to protect the Air Force investment in advanced technology.

(U) FY 1989 Accomplishments:
- (U) Completed development of an

Program Element: 0604750F
PE Title: Intelligence Equipment Budget Activity: #4 - Tactical Programs

- (U) Evaluated system for use in TSCM operations. Follow-on effort under consideration to correct deficiencies.
- (U) Completed a feasibility study and demonstration of

(U) FY 1990 Planned Program:
- (U) Finish
- (U) Start development of a
- (U) Develop a prototype of the

(U) FY 1991 Planned Program:
- (U) Develop software to support
- (U) Develop

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

(U) Work Performed By: UNISYS Corporation, Salt Lake City, UT.

(U) Related Activities:
- (U) Program Element 0305127F, Foreign Counterintelligence.
- (U) Program Element 0305128F, Security and Investigative Activities.
- (U) Coordination with the which reviews all projects to preclude duplication of effort.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

2. (U) (U) Project 1955, Air Force Indications and Warning (I&W): This project was completed in FY 1989.

3. (U) Project 2053, Foreign Technology Division (FTD) Intelligence Processes: FTD's mission is to acquire evaluate, analyze and report foreign scientific and technological progress in response to Department of Defense The advent of

Program Element: 0604750F
PE Title: Intelligence Equipment Budget Activity: #4 - Tactical Programs

[This project improves the FTD capability to evaluate, analyze, and report on foreign scientific and technical information and material and to provide timely and accurate threat assessments of foreign weapon system technology. These improvements will assist in responding to intelligence requirements vital to weapon system developers, research and development planners, and national level agencies.

(U) FY 1989 Accomplishments:
- (U) Began upgrade of Advanced Systematic Analysis Production to
- (U) Completed determination of equations needed to model the
- (U) Completed initial algorithms and software to aid in the analysis of
- (U) Initiated development of computer-aided design tool to simulate

(U) FY 1990 Planned Program:
- (U) Initiate development of
- (U) Start development of software code to particle beam weapon radiation cone device.
- (U) Complete development of a computer program to model
- (U) Initiate development of new technology modules for the ELINT Tudor System.

(U) FY 1991 Planned Program:
- (U) Complete development of
- (U) Initiate development of

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

(U) Work Performed By: Martin Marietta, Orlando FL; Rockwell Power Services, Albuquerque, NM; HRB Systems State College PA

(U) Related Activities: PE 0301310F (FTD). There is no unnecessary duplication of effort within the Air Force or Department of Defense.

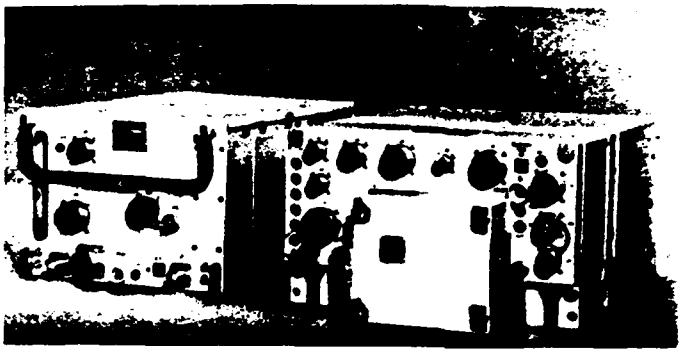
(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604754F
PE Title: Joint Tactical Information Distribution System (JTIDS)
Project Number: P771
Budget Activity: #4 - Tactical Programs

Project Title: JTIDS



POPULAR NAME: JTIDS

A. (U) SCHEDULE/BUDGET INFORMATION ($ in Thousands)

SCHEDULE	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Class 2 LRIP Prod Dec	LRIP LOT 2 Prod Dec	LRIP LOT 3 Prod Dec	Class 2 IOC
Engineering Milestones	N/A	N/A	N/A	N/A
T&E Milestones	Pre DAB test Complete	Post DAB DT/OT	F-15 Ph II DT/OT	N/A
Contract Milestones	N/A	N/A	PDR CDR	FCA/PCA Production Decision
BUDGET ($000)	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	19,398	11,044	20,888	9,691
Support Contract	22,645	4,062	8,288	54,506
In House Support	2,067	1,522	1,533	5,870
GFE/ Other	4,654	1,023	7,603	16,851
Total	48,764	17,651	38,312	86,918

Program Element: # 0604754F
PE Title: Joint Tactical Information Distribution System (JTIDS)
Project Number: P771
Budget Activity: #4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The objective of this program is to provide command and control of air defense resources, pilot situational awareness, avoiding fratricide and dual targeting. It is a highly jam resistant, secure digital information distribution system for use in a tactical combat environment. The Joint Tactical Information Distribution System (JTIDS) is a joint development employing Time Division Multiple Access (TDMA), and spread spectrum techniques. The system will permit rapid and secure exchange of essential command, control, and force status information among terminals in the tactical theatre.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Continued system integration and software development for the MCE.
   - (U) Began reliability growth plan.
   - (U) Completed follow-on DT/OT Pre-DAB testing.

2. (U) FY 1990 Planned Program:
   - (U) Continue system integration and software development for the F-15 and MCE.
   - (U) Begin DT/OT Block 30/35 for E-3 (will test JTIDS).
   - (U) Begin integration of JTIDS into Joint STARS.
   - (U) Begin Peculiar Support Equipment development for E-3.
   - (U) Begin production of JTIDS Class 2 terminals for the F-15.
   - (U) Begin Class 2 product improvement.
   - (U) Begin first software update for production configuration.

3. (U) FY 1991 Planned Program:
   - (U) Continue Peculiar Support Equipment development for E-3.
   - (U) Continue LRIP.
   - (U) MS-OT-IIB.
   - (U) MS-OT-IIA.

4. (U) Program to Completion:
   - (U) Start production of the JTIDS Class 2H for the JSTARS.
   - (U) Start production of the JTIDS Class 2 for the Modular Control Equipment (MCE) in 1993.
   - (U) Navy Tech Eval/Op Eval.

Program Element: # 0604754F
PE Title: Joint Tactical Information Distribution System (JTIDS)
Project Number: P771
Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY: The Joint Program Office, located at the Electronic Systems Division, Hanscom AFB, MA. Work is also being done at the Aeronautical Systems Division, Wright-Patterson AFB, OH; and the Electromagnetic Compatibility Analysis Center (ECAC), Annapolis, MD. Major contractors are: Electronic Systems Division Plessey Electronics Systems Corp. (Class 2 terminal Full Scale Development Leader), Totowa, NJ; McDonnell Douglas Aircraft Corporation (Class 2 terminal integration into the F-15), St Louis, MO; and MITRE Corporation (System Engineering support), Bedford, MA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None.

2. (U) SCHEDULE CHANGES: LRIP for F-15 delayed from Oct 89 to Feb 90. New Baseline established.

3. (U) COST CHANGES: FY 1990 decreased (supports the latest President's Budget).

F. (U) PROGRAM DOCUMENTATION:
- (U) TAC/PACAF/USAFE Required Operational Capability (ROC) 306-74, February 1974
- (U) Joint Integrated Logistics Support Plan, 16 June 1989
- (U) JTIDS System Operations Concept (SOC), 15 March 1987
- (U) Decision Coordinating Paper (DCP), 6 June 1989
- (U) JTIDS Program Baseline, 11 October 1989
- (U) Test and Evaluation Master Plan (TEMP), Signed by Services, 21 August 1989

G. (U) RELATED ACTIVITIES:
- (U) The JTIDS development is managed by a jointly manned program office.
- (U) This program element funds Air Force unique aspects of development, prototype fabrication, integration and test of the JTIDS terminal equipment for the F-15 and Modular Control Equipment (MCE).
- (U) Basic JTIDS Class 2 terminal development is funded under OSD PE 0604771D. Related Army and Navy program elements are PE 0604702A and PE 0205604N respectively.
- (U) There is no unnecessary duplication of effort within the Air Force or Department of Defense.

Program Element: # 0604754F
PE Title: Joint Tactical Information Distribution System (JTIDS)
Project Number: P771
Budget Activity: #4 - Tactical Programs

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

1. (U) PROCUREMENT:

	FY 1989 ACTUAL	FY 1990 ESTIMATE	FY 1991 ESTIMATE	Total PROGRAM
Aircraft Procurement, BA				
F-15 JTIDS Mod (PE 27130F)	30.6	40.0	0	84.6

2. (U) MILITARY CONSTRUCTION: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The US and UK entered into an agreement in September 1983 for the UK's development and acquisition of JTIDS Class 2 equipment. The US and UK have a common requirement for an interoperable system, and a common objective to encourage the acceptance of JTIDS within NATO in the interest of interoperability. The UK has based its JTIDS FSD program on the US Class 2 terminal that will be installed in the F-15. The agreement covers bilateral understandings associated with this equipment and technology. The UK's Class 2 development is intended for the Toronado as well as UK E-3 aircraft. This development is nearing completion. Negotiations for cooperative production are ongoing. France is also procuring JTIDS Class 2H terminals for its E-3 aircraft. The French JTIDS buy is dependent upon the successful US development and integration efforts for the Class 2 terminal.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
DT&E	Oct 85 - Oct 86	60 objectives tested - two concerns were reliability and data transfer between the Class 2 and host interface unit.
IOT&E McAir Sim	Aug 86 - Sep 86	AFOTEC pilots were better equipped to evaluate JTIDS and make more efficient use of test range/flight time.
IOT&E	Oct 86 - Feb 87	Increased pilot's situational awareness. Not one case of fratricide or dual targeting.

Program Element: # 0604754F
PE Title: Joint Tactical Information Distribution System (JTIDS)

Project Number: P771
Budget Activity: #4 - Tactical Programs

Event	Date	Results
Multi-service	Feb 87 - Apr 87	Demonstrated potential for service interoperability.
Pre-DAB DT/OT	Jan 89 - May 89	Resolved test issues required to be completed for LRIP decision

T&E ACTIVITY (TO COMPLETION)

Event	Date	Remarks
Follow on DT/OT	Apr 87 - Apr 91	AFOTEC monitor ongoing in plant DT/OT reliability verification testing and flight testing.
Post-DAB Phase I DT/OT	Oct 89 - Oct 90	Eglin AFB DT/OT flight testing of further Class 2 terminal improvements and untested functions.
TEMP		Revised TEMP will be resubmitted to OSD in Mar 1990.
F-15 Integration representative	Jan 91 - Dec 91	DT/OT flight test of production F-15 Class 2 terminals.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604755F
PE Title: Improved Capability for DT&E

Budget Activity: 6 - Defense - Wide Mission Support

A. (U) RESOURCES ($ in thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2880 4950th Test Wing	5,020	3,293	1,186	Continuing	TBD
3120 3246th Test Wing	11,002	12,050	8,004	Continuing	TBD
3285 Arnold Engineering & Development Center (AEDC)	2,124	3,337	4,435	Continuing	TBD
3323 Cruise Missile Mission Control Aircraft (CMMCA)	18,835	12,853	9,188	0	52,576
3324 HAVE LINK	4,360	3,690	3,371	Continuing	TBD
3620 Air Force Flight Test Center (AFFTC)	9,928	16,306	19,536	Continuing	TBD
Total	51,269	51,529	45,720	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides the system upgrades and new systems required to adequately test and evaluate weapon and support systems in development. The program includes the engineering, development, acquisition and installation of significant new test range and instrumentation systems required to insure that the Department of Defense (DOD) Major Range and Test Facilities Base (MRTFB) test and evaluation technology is compatible with the systems it is required to test. The MRTFB is a national asset which is operated and maintained for DOD test and evaluation missions, but is available to others having a requirement for its unique capabilities.

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

1. (U) Project: 2880, 4950th Test Wing (4950 TW): The 4950 TW, Aeronautical Systems Division, Wright-Patterson AFB, OH, performs flight tests of aircraft and airborne systems, supports space vehicle tracking for the Air Force, other DOD agencies and NASA. The Wing has the capability to conduct full-scale engineering evaluations, airborne instrumentation and data reduction and flight test aircraft modification. Staging out of US and overseas bases, the Advanced Range Instrumentation Aircraft (ARIA) provides telemetry support for the NASA and DOD missile launches out of Cape Canaveral AFS, FL, and Vandenberg AFB, CA. Improvement and modernization efforts include: Integrated Data Facility (IDF), and Computer Aided Engineering (CAE). The IDF will consist of a ground-based laboratory module, a real-time test data monitoring module and a module for improved data computation and analysis. CAE is used by engineers, designers, and Computer Numerically Controlled (CNC) Machine programmers. CAE provides intelligent design tools which incorporate expert systems technology, designs standards, specialized analysis programs, and geometric/physical property calculation capabilities.

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PE Title: Improved Capability for DT&E

Budget Activity: 6 - Defense - Wide Mission Support

(U) FY 1989 Accomplishments:
- (U) Second EC-18 received remainder of ARIA modification after completion of SMILS prototype testing; instrumentation modifications continue
- (U) IDF hardware acquisition, and CAE equipment procurement will continue
- (U) New CAE capabilities include expert systems in structural design and analysis, electronic circuit simulation and design, and support of 5-axis CNC machining
- (U) System configuration included 46 CAE workstations, peripheral equipment, and local area network to allow data sharing and on-line storage of engineering data.

(U) FY 1990 Planned Program:
- (U) In FY 90 the principal work will be performed in the IDF task which will provide an enhanced support capability for processing flight test data.
- (U) Acquisition of CMMCA CAD tapes for O&M and future modification support will be initiated.
- (U) First article flight test of ARIA scoring systems is scheduled third quarter FY 90 with IOC in fourth quarter FY 90.
- (U) Eight remaining CAE workstations will be delivered and all production will be transferred to new CAE system.

(U) FY 1991 Planned Program:
- (U) In FY 91 work will continue on the IDF project.
- (U) Acquisition of CMMCA tapes for O&M and future modification continues.

(U) WORK PERFORMED BY: Applied Physics Laboratory/Johns Hopkins University, Laurel, MD (4950 TW); E-Systems, Greenville, TX.

(U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F) and benefits all weapon systems test programs which come to the ranges and centers. GPS/TSPI equipment and T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

2. (U) Project: 3120, 3246th Test Wing (3246 TW): The 3246 TW is located at Eglin AFB, FL, and is responsible for Air Force nonnuclear armament development. The 3246 TW, as the USAF focal point for munitions integration into aeronautical systems, conducts and supports USAF weapons effectiveness testing, electronic combat testing, electronics surveillance and control

Program Element: 0604755F Budget Activity: 6 - Defense - Wide Mission Support
PE Title: Improved Capability for DT&E

testing, and aeronautical systems testing. Improvement and modernization efforts include: Seeker Development, Computer Sciences, Multipurpose Range Systems Upgrade, Armament Systems Test Environment (ASTE) Upgrade, and Preflight Integration of Munitions and Electronic Systems (PRIMES). Seeker Development provides laboratory, field, and airborne instrumentation to support development testing of precision guided weapons and aircraft systems. Computer Sciences includes acquisition of subsystems to improve and modernize the Eglin computer sciences facility. Multipurpose Range Systems Upgrade provides for upgrading Airborne Instrumentation and Multipurpose Instrumentation (MPI) systems to meet the test requirements of increasingly complex weapons systems. ASTE Upgrade provides for the modernization of the major data collection systems for weapons test missions to enhance the ability to define lethality and safe separation characteristics for aircraft munitions. PRIMES provides the instrumentation to conduct preflight test and evaluation of total integrated weapon systems a secure anechoic chamber.

(U) FY 1989 Accomplishments:

- (U) Seeker Development included a Seeker Vulnerability Evaluation capability to test active infrared countermeasures and a capability to test weapon systems for detection and deactivation of optical tracking systems. Work also began to define the realistic level of countermeasure simulators, obscurant generators, and instrumentation required for the scenario ranges.
- (U) Computer Sciences included contract award for the Image Data Automated Processing System (IDAPS) which will be used for stores separation data reduction in support of the F-15, F-16, and B-1.
- (U) MPI Range Systems Upgrade acquired ground telemetry receiving, tracking and data handling equipment for a dual complex mission support capability.
- (U) ASTE Upgrades included improvements in the areas of cinetheodolites, photo-optic cameras, high-speed video cameras, explosive instrumentation, warhead and fuze test systems, and gun ranges.
- (U) PRIMES anechoic chamber was completed and electromagnetic enviroment simulator installed.

(U) FY 1990 Planned Program:

- (U) Computer Sciences will acquire a mission audio systems for the Central Control Facility which will provide communications for existing and planned test control rooms to all remote range resources, a joint acquisition with AFFTC.
- (U) PRIMES will complete the multiple signal environments.
- (U) MPI upgrades for range telemetry microwave systems and range support systems will continue.
- (U) Additional Seeker Development equipment for millimeter wave simulations will be acquired.

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PE Title: Improved Capability for DT&E

Budget Activity: 6 - Defense - Wide Mission Support

(U) FY 1991 Planned Program:
- (U) ASTE low altitude advanced video trackers will be added to the range.
- (U) PRIMES will expand signal densities.
- (U) Initial indoor Seeker Development simulation capability for millimeter-wave systems will be completed.
- (U) Computer Sciences will acquire the real-time display equipment needed to instrument new control and analysis rooms.
- (U) The Seeker Test Van will be upgraded to support IR and MMW countermeasures.

(U) WORK PERFORMED BY: Datron Systems, Simivalley, CA (T/M Systems); RAMTEC, Div, Emerson, Canoga Park, Ca (PRIMES); Marconi, Atlanta, Ga (Seeker Development).

(U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F) and benefits all weapon systems test programs which come to the ranges and centers. GPS/TSPI equipment and T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

3. (U) Project: 3285, Arnold Engineering and Development Center (AEDC): AEDC, Arnold AFB, TN, provides ground environmental test support for aeronautical, missile and space programs. The center has three facilities: 1) Von Karman Gas Dynamic Facility (VKF) which performs aerodynamic testing of scale model aircraft, missile and space systems, testing of large and full-scale satellites, sensors and space vehicles in a simulated space environment and projectiles (both high performance and conventional guns) at various altitudes and reentry conditions; 2) Engine Test Facility (ETF) which provides altitude environmental testing for aircraft, missile and spacecraft propulsion systems including turbojets, turbofans, and both liquid and solid propellant rockets; and 3) Propulsion Wind Tunnel Facility (PWT) which provides testing of large-scale models, and in some cases, full scale engine inlet combinations, missiles and space boosters together with their propulsion systems. AEDC supports programs for NASA, such as Space Transportation System, SDI interceptors, the Navy Tomahawk and provides technology support to the Department of Energy. These facilities are national assets that provide unique test capabilities not available elsewhere. Improvement and Modernization efforts for AEDC keep these unique capabilities abreast of the weapon system technology under test.

(U) FY 1989 Accomplishments:
- (U) Large Rocket Test Facility (J-6) activation and validation began.
- (U) High Pressure/Temperature Test Cell T-3 modification began.
- (U) Modification of Aeroballistic Range G began.

(U) FY 1990 Planned Program:
- (U) The principal efforts will continue the J-6 activation/ validation and Test Cell T-3 modification in FY 90.

(U) FY 1991 Planned Program:
- (U) J-6 activation and validation continues.
- (U) Test Cell T-3 modification continues.
- (U) Data acquisition and processing system modernization begins.

(U) WORK PERFORMED BY: Calspan Field Services, Inc, Buffalo, NY and AEDC in house resources.

(U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F) and benefits all weapon systems test programs which come to the ranges and centers. GPS/TSPI equipment and T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Milcon	0	50.0	66.0	109.3	0	225.3

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

3. (U) Project: 3323, Cruise Missile Mission Control Aircraft (CMMCA): The existing test support scenario for cruise missile testing requires a fleet of up to 17 aircraft to provide visual safety chase, telemetry collection and tanker support. Some cruise missile test missions also require Airborne Warning and Control System (AWACS) aircraft for radar flight following. This support scenario is resource intensive and the visual safety chase precludes testing in other than visual meteoro-logical flight conditions. The Cruise Missile Mission Control Aircraft (CMMCA) will consolidate telemetry support, mission control functions, and radar safety chase and flight following capabilities for cruise missile testing into a single C-18 airborne platform. Consequently, the CMMCA will reduce the requirements for visual chase, Airborne Warning and Control System (AWACS) and tanker support, and will allow cruise missile testing in instrument meteorological conditions. Although the CMMCA will replace visual safety chase for the majority of cruise missile test missions,

developmental cruise missiles, and those containing classified payloads will still require a visual safety chase after launch. Two C-18 aircraft currently in the Air Force inventory will be configured to be CMMCA and, when operational, will support approximately 70 cruise missile test missions per year.

(U) FY 1989 Accomplishments:
- (U) Aircraft modification design and Critical Design Review completed.
- (U) Modification of the first EC-18 initiated.
- (U) Cockpit modification on second EC-18 completed.

(U) FY 1990 Planned Program:
- (U) First Flight of the CMMCA is planned for the third quarter.
- (U) Delivery of the first aircraft to the 4950 Test Wing and IOC are planned in the fourth quarter of FY 90.

(U) FY 1991 Planned Program:
- (U) Modification of the second EC-18 will be initiated.
- (U) Second CMMCA delivery is planned for the fourth quarter.

(U) WORK PERFORMED BY: Electro-Space Industries, Richardson, Tx and Aeronautical Systems Division, Wright-Patterson Air Force Base, OH.

(U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F) and benefits all weapon systems test programs which come to the ranges and centers. GPS/TSPI equipment and T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

4. (U) Project: 3324, HAVE LINK: The Air Force HAVE LINK program implements Office of the Secretary of Defense direction to protect weapons systems design information and test data on test ranges. The HAVE LINK program implements corrective measures to eliminate identified vulnerabilities subject to exploitation by hostile intelligence collection agencies.

(U) FY 1989 Accomplishments:
- (U) AD secured computer data links.
- (U) AEDC continued installing data communications systems which can be encrypted.
- (U) AFFTC continued secure communications and telemetry encryption equipment purchases and upgrades to existing facilities to meet TEMPEST requirements.
- (U) 4950 TW began encryption equipment purchases.

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Budget Activity: 6 - Defense - Wide Mission Support

(U) FY 1990 Planned Program:
- (U) Continue secure voice communications, telemetry encryption, secure video, data and radio transmission equipment, and upgrades to existing facilities to meet TEMPEST requirements.

(U) FY 1991 Planed Program:
- (U) Continue secure voice communications, telemetry encryption, secure video, data and radio transmission equipment, and upgrades to existing facilities to meet TEMPEST requirements.

(U) WORK PERFORMED BY: In house resources of the four test activities served by this program.

(U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F) and benefits all weapon systems test programs which come to the ranges and centers. GPS/TSPI equipment and T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

AMENDED FY 1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604755F
PE Title: Improved Capability for DT&E
Project Number: 3620
Budget Activity: 6 - Defense wide Mission Support

A. (U) RESOURCES ($ in thousands)

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Air Force Flight Test Center (AFFTC)	9,928	16,306	19,536	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITY: The AFFTC, located at Edwards AFB, conducts and supports development test and evaluation and operational test and evaluation of aircraft and aircraft systems, aerospace research vehicles, unmanned miniature vehicles, cruise missiles, parachute delivery/recovery systems and cargo handling systems are also evaluated. Recovery support and engineering evaluation is provided to the Space Shuttle program and other transatmospheric vehicles. AFFTC operates the USAF Test Pilot School (TPS). Major improvement tasks are discussed in the remaining narrative. Integrated Flight Data Processing System (IFDAPS) is a distributed processing system for Time Space Positioning Information (TSPI) and telemetry engineering unit data, based upon mini-computers which can be expanded with modular segments. Advanced Range Data System (ARDS) is a highly accurate TSPI data and communications system which takes advantage of the NAVSTAR Global Positioning System (GPS). The Electronic Combat Integrated Test Capability (ECITC) will allow ground testing of the entire aircraft's integrated network software, including all flight control features as well as all avionics. The Physical Measurement Facility (PMF) project will provide for major upgrade or development of physical measurement capabilities at the AFFTC such as the weight and balance system, horizontal thrust stands, moment of inertia facilities and multi-dimensional thrust stand.

C. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PLANS:

(U) FY 1989 Accomplishments:
- (U) Continued ARDs processor software development and hardware integration for first GPS Range System.
- (U) AFFTC Range Instrumentation Upgrade included acquisition of voice communication switch hardware, data transmission upgrades to WSMC, local upgrades for fiber optic data transmission, telemetry vans and sites, and completion of a video theodolite.
- (U) Airborne Instrumentation Support continued FY 1988 efforts and acquired airborne recorders and data acquisition units for Test Pilot School aircraft.
- (U) Procured IFDAPS real-time data analysis subsystems hardware and software.
- (U) ECITC acquisition planning and system definition begins for near term AFAF upgrades.

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Budget Activity: 6 - Defense wide Mission Support

(U) FY 1990 Planned Program:
- (U) Integrate GPS range equipment with the first ARDs processor and begin procuring four remaining systems.
- (U) AFFTC Range Instrumentation includes site preparation for voice communication hardware, upgrade of data transmission between Edwards AFB and China Lake NWC, and completion of a telemetry site and vans.
- (U) Airborne Instrumentation Support continues to upgrade laboratory equipment to support ATIS and upgrades telemetry antennas for the Test Pilot School.
- (U) Upgrade of IFDAPS display work stations and improvements of the processor.

(U) FY 1991 Planned Program:
- (U) Purchase and integration of Advanced Range Data System equipment will continue.
- (U) AFFTC Range Instrumentation Upgrade purchases control room voice communication hardware,begins initial integration, begins digital data transmission hardware procurement for Edwards AFB and UTTR link, and continues telemetry antenna upgrades.
- (U) PMF begins planning for Multi-dimensional Thrust Stand and implements optical and IR measurement improvements.
- (U) Continues ECITC planning, system design of primary equipment procurement and integration of ECITC with the Air Force Anechoic Facility.
- (U) Installation and checkout of IFDAPS upgrades will be completed and initial planning will begin for the next generation Advanced Data Acquisition and Processing System.

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

D. (U) WORK PERFORMED BY: Computer Science Corporation, Lompoc, CA; Ball Systems Engineering, San Diego, CA; Scientific Applications International Corporation, Los Angeles, CA and AFFTC inhouse efforts.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. ENGINEERING CHANGES: Not Applicable
2. SCHEDULE CHANGES: Not Applicable
3. COST CHANGES: Not Applicable

F. (U) PROGRAM DOCUMENTATION:

- (U) PMD 2164(4)/64755F Improved Capability for DT&E, 10 Mar 89

G. (U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F). PE 0604755F contains funding for high priority range support projects. In addition, the improved capabilities benefit all weapon systems test

Program Element: 0604755F
PE Title: Improved Capability for DT&E

Project Number: 3620
Budget Activity: 6 - Defense wide Mission Support

programs which come to the ranges and centers. GPS/TSPI equipment and T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604756F Budget Activity: #4 - Tactical Programs
PE Title: Side Looking Airborne Radar (SLAR)

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2037 SLAR Sensors	5,216	8,155	4,135	Cont	TBD
Total	5,216	8,155	4,135	Cont	TBD

B. (S) BRIEF DESCRIPTION OF ELEMENT: The SLAR program develops advanced components and subsystems for high resolution imaging radars. These components are capable of collecting radar imagery of ground targets from airborne platforms, transmitting the data to ground stations, and processing and exploiting intelligence information from the imagery. Imaging radar systems provide standoff reconnaissance for targets in day/night or all-weather conditions. Advanced systems with components developed in this program element can collect, process, exploit, and report intelligence information[.]

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

1. (U) Project 2037, SLAR Sensors: Develops advanced airborne and ground SLAR components.

(U) FY 1989 Accomplishments:
- (U) The ASARS Processing Segment (APS) software development continued.
- (U) Began APS training and integration support for the TR-1 Ground Station (TRIGS).

(U) FY 1990 Planned Program:
- (U) Complete all APS development and support equipment efforts.
- (U) Continue APS training and integration support for TRIGS.

(U) FY 1991 Planned Program:
- (U) Complete APS training and integration support.
- (S) Begin a design study to implement[ ] for better wartime performance.

(U) Work Performed By: The major contractor for SLAR is Hughes Radar Systems Group, Culver City, CA.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604756F Budget Activity: #4 - Tactical Programs
PE Title: Side Looking Airborne Radar (SLAR)

(U) Related Activities:
- (U) Program Element #0207215F, TR-1 Squadrons
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604770F
PE Title: Joint STARS

Project: N/A
Budget Activity: # 4 - Tactical Programs

Project Title: N/A



POPULAR NAME: Joint STARS

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

SCHEDULE	FY 1989	FY 1990	FY 1991	TO COMPLETE
Program Milestones	N/A	OFD 1 4th Qtr FY 91	N/A	DAB IIIA 2nd Qtr FY 93
Eng. Milestones	System Crit Design Review Nov 1988 1st Radar Flt Dec 1988	FSD Flight Testing Continues	System Level Performance Verification 3rd Qtr FY 1991	N/A
T&E Milestones	N/A	N/A	Comb Gov't DT/IOT&E Begins Jun 1991	DT/IOT&E Complete 4th Qtr FY 94
Contract Milestones	N/A	N/A	FSD Block II Contract FY 1991	Production LL Contract 2nd Qtr FY 1992
BUDGET (000)	FY 1989	FY 1990	FY 1991	PROGRAM TOTAL (TO COMPLETE)
Major Contract	149.900	54.300	150.750	(TBD)
Support Contract	26.900	8.700	27.200	(TBD)
In-House Support	8.800	800	6.400	(TBD)
GFE/ Other	46.512	24.283	48.133	(TBD)
TOTAL	232.112	88.083	232.483	(TBD)

Program Element: #0604770F Project: N/A
PE Title: Joint STARS Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: A critical need exists for an effective capability to delay, disrupt, and destroy first and second echelon Warsaw Pact armored forces. Also, there is a critical need for a rapidly deployable capability for use in less intense conflicts in contingency areas. To meet these needs, the Air Force and the Army initiated the Joint Surveillance Target Attack Radar System (Joint STARS) with the Air Force as lead Service. Using moving target indicator and synthetic aperture radar techniques, Joint STARS will provide information to delay/disrupt/destroy mobile targets in the enemy second echelon. Joint STARS is unique because it is a closed loop system for real time detection, tracking, and attack of enemy ground moving targets. Joint STARS integrates the accurate attack of those forces by providing position updates and exact enemy locations to direct attack aircraft, artillery, and standoff weapons.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) The MILVAX upgrade was accomplished.
   - (U) The first radar flight occurred in December 1988.
   - (U) The Self-Defense Suite (SDS) Study was initiated in July 1989.
   - (U) Early Engineering Flight Test (EEFT) was completed in March 1989 and sucessfully demonstrated that the major technical issues of the development program had been resolved.
   - (U) Contractor flight tests have demonstrated Wide Area Surveillance (WAS), Moving Target Indication (MTI), Surveillance and Control Data Link (SCDL) and basic Operation and Control functions.
   - (U) The software evaluation throughout contractor testing was started and continues with the prototype EEFT code being replaced with fully developed software and building up to the system functionality in preparation for verification testing.

2. (U) FY 1990 Planned Program:
   - (U) Contractor flight tests will prove out the full system in preparation for a System Level Performance Verification (SLPV).
   - (U) A short Operational Field Demonstration (OFD-1) will be accomplished in Europe to provide initial orientation of U.S. European and NATO Commanders to Joint STARS capabilities.
   - (U) The Self Defense Suite will be defined from the study effort.

3. (U) FY 1991 Planned Program:
   - (U) SLPV will start and the system will be certified to begin the government DT/IOT&E.
   - (U) A second Operational Field Demonstration (OFD-2) will be accomplished in Europe to support Joint in-theater exercises.
   - (U) The 3rd FSD aircraft and modifications, including Group 1 upgrades, will be placed on contract.

4. (U) Program to Completion:
   - (U) Long Lead decision 2nd Qtr FY 92.
   - (U) Milestone IIIA (LRIP) 2nd Qtr FY 93.
   - (U) Government DT/IOT&E will be completed.

Program Element: #0604770F Project: N/A
Title: Joint STARS Budget Activity: # 4 - Tactical Programs

- (U) Milestone IIIB Full Production decision 1st Qtr FY 95
- (U) Follow-on Operational Test and Evaluation will be conducted.
- (U) The Joint STARS system will be deployed worldwide.

D. (U) WORK PERFORMED BY: The major contractors are Grumman Melbourne Systems Division, Melbourne FL and Motorola Corp, Tempe AZ. The Joint Program Office is located at Electronics Systems Division, Hanscom AFB MA, and the Army Communications and Electronics Command is located at Ft Monmouth NJ.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: Oct 89 Defense Acquisition Board (DAB) decision directed used versus new Boeing 707 aircraft as the production platform. A third used FSD aircraft was authorized. Two of the three FSD platforms will be refurbished in production for a total of 21 production platforms. The Oct 89 DAB also approved additional funding to add system capability, necessary for the user to meet Initial Operational Capability.
2. (U) SCHEDULE CHANGES: Production long lead funding based on SLPV results is now planned for FY 92 vs previous DAB III schedule for FY 91. DAB IIIB is now scheduled for 1st Qtr FY 95. IOC has been changed from FY 96 to FY 97.
3. (U) COST CHANGES: Additional funds were added in FY 91 for acquisition of the third FSD aircraft and for the non-recurring engineering required for production transition. The Oct 89 DAB added funds to support the additional required IOC capability development.

F. (U) PROGRAM DOCUMENTATION:

- (U)	TAF SON 309-82 (S)	Jun 82
- (U)	USAF/USA MOU	Apr 85
- (U)	JSORD (S)	Oct 89
- (U)	OUE 1 (S)	Feb 88
- (U)	DCP (DAB IIB) (S)	Apr 88
- (U)	ADM (DAB IIB)	Jul 88
- (U)	DCP (Oct 89 DAB)	Oct 89
- (U)	ADM (Oct 89 DAB)	Nov 89

G. (U) RELATED ACTIVITIES:

- (U) PE 0603790D, Joint STARS NATO Cooperative Development Project.
- (U) PE 0604770A, The Army RDT&E Joint STARS program.
- (U) The Army Joint STARS Ground Station Module procurement is funded under Army Other Procurement Program.
- (U) PE 0604270F, Electronic Warfare, contains $139.2 million of RDT&E funds to develop/test the Self-Defense Suite for the E-8 aircraft.
- (U) PEs 0603770F and 0604770F/0604770D replace PEs 0603747F and 0604616F, Pave Mover.
- (U) In May 1982 OSD designated the Air Force as the lead Service.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604770F Project: N/A
PE Title: Joint STARS Budget Activity: # 4 - Tactical Programs

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

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. (U) Procurement: PE 0207581F/(BA4)					
Cost	0	0	0	(TBD)	(TBD)
Quantity				21	21
2. (U) Military Construction:					
	0	0	0	(TBD)	(TBD)

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The Air Force initiated a Joint STARS NATO Cooperative R&D program (PE 0603790D, Project 3639) in FY 1987. This program funded promising development and study efforts in a cooperative R&D program to strengthen ties between the US and our Allies, avoid wasteful duplication of effort among the NATO Allies and enhance NATO Rationalization, Standardization, and Interoperability among developing Stand Off Surveillance and Target Acquisition Systems (SOSTAS). There are three on-going cooperative efforts. First is a US/UK joint Stand-Off Radar Program Studies (SORPROS) that includes: (1) alternate platform studies; (2) platform threat vulnerability studies; (3) impact of SOR integration into existing C^3I networks; and (4) the impacts of SOR on the NATO Follow-On Forces Attack (FOFA) doctrine. These are funded by $2.5 million of FY 1987 Nunn Amendment funds. Second, $2.1 million of Nunn funds are funding a program to study and design a SOSTAS interoperable data link (SIDL). Three standoff SOSTAS systems are now under development by three NATO nations: the US (Joint STARS); France (Orchidee); and Italy (Creso). Third is the Airborne Radar Demonstrator System (ARDS), a cooperative agreement for demonstrating a combined ground and airborne radar for wide-area surveillance. This agreement has been signed by the US, France, and the UK. The Army is the executive agent for the ARDS. Details are provided in the Army documentation for PE 0604770A.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
CDT&E	4th Qtr FY 88 - 4th Qtr FY 89	Successful flight tests accomplished thru phase VI.

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Contractor DT&E	Present - 3rd Qtr FY 91	Includes SLPV
Government DT/IOT&E	4th Qtr FY 91 - 4th Qtr FY 92	
Mod/Upgrade/Test	1st Qtr FY 92 - 1st Tqr FY 94	Install, checkout, Gov't test
IOT&E	2nd Qtr FY 94 - 4th Qtr FY 94	Dedicated IOT&E

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604779F Budget Activity: #4-Tactical Programs
PE Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)

A. (U) RESOURCES ($ In Thousands)

Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
JINTACCS	5,707	6,271	6,632	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
JINTACCS is a joint interoperability program to improve the operational effectiveness of service (Army, Navy, Air Force and Marine Corps) Tactical Command & Control (C^2) Systems used in support of joint operations. The program element supports Air Force participation in the JINTACCS Program with the Army, Navy and Air Force, and the Joint Tactical Command, Control and Communications (C^3) Agency which acts as the Executive Agent. Service and agency activities are governed by jointly agreed upon and Joint Chiefs of Staff (JCS) approved documentation including Technical Interface Concepts and Technical Interface Design Plans. Close liaison across each of the Service JINTACCS programs precludes duplication of efforts. Elements of the Tactical Air Intelligence System, E-3 Airborne Warning and Control System, and Joint Tactical Information Distribution System (JTIDS) participate in this program. The JINTACCS program (formerly GAMO) is directed by JCS Memorandum (SM) 205-72 dated 1 April 1971, as modified by a Secretary of Defense memorandum, "Reorganization of the DoD Program to Achieve Interoperability of Tactical C^2 Systems for Ground and Amphibious Military Operation (GAMO)," dated 2 Aug 1977. The program complies with requirements of DoD Directive 4630.5, "Compatibility and Interoperability of Tactical C^3 and Intelligence (C^3I) Systems." The structure of the program is established by the JINTACCS Program Summary which is reviewed and approved annually by the Assistant Secretary of Defense for C^3I. Tactical Air Forces Required Operational Capability 306-74 (validated 4 Oct 74) is the requirement supporting JTIDS.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) Completed development of phase 1 of generic Message Text Format (MTF) parser; began study of phase 2.
- (U) Completed development on 10 combat service supported messages.
- (U) Finalized test baseline for Tactical Digital Information Link "J" (TADIL-J).

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Program Element: #0604779F Budget Activity: #4-Tactical Programs
PE Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)

(U) FY 1990 Planned Program:
- (U) Continue development of generic MIF parser.
- (U) Continue development of TADIL-J capability for the F-15.
- (U) Begin Air Force/joint service testing of TADIL-J message standard and TADIL-J implementation for the F-15.
- (U) Support research of technical integration in US, NATO, DoD, and intelligence data base element structures.
- (U) Evaluate USMTFs by operator-generated queries.

(U) FY 1991 Planned Program:
- (U) Field initial version of generic MIF parser.
- (U) Continue the development of the TADIL-J capability, to integrate the E-3 Operational Facilities (OPFACs) in Air Force test facilities.
- (U) Continue Air Force/joint service testing of the TADIL-J message standard and the TADIL-J in the F-15 and E-3.
- (U) Support development of architecture to implement integrated data element structures into all C I systems.

(U) Program Plan to Completion:
- (U) This is a continuing program.
- (U) Support functional segment testing for compatibility and interoperability and operational effectiveness demonstrations.
- (U) Complete the TADIL-J test capability for the Participating Test Unit (PTU).

(U) WORK PERFORMED BY: The Tactical Air Command (HQ TAC/DRI), Langley AFB, VA, has the coordinating and implementing authority. Management responsibility for R&D funding is assigned to the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. The Tactical Air Command provides operational support, involving a PIU at the Air Force Tactical Systems Interoperability Support Center at Langley AFB, VA, to support compatibility and interoperability testing and operational effectiveness demonstrations. The JINTACCS contractors are Martin Marietta, Denver, CO; and the MITRE Corporation, a Federal Contractor Research Center, located at Bedford, MA.

Program Element: #0604779F Budget Activity: #4-Tactical Programs
PE Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)

(U) Related Activities:

- (U) Service and Agency related JINTACCS program elements/projects are: PE 060478M, Joint Interoperability for Tactical Command and Control Systems; PE 0604779N, JINTACCS Program; PE 0604779A, JINTACCS; PE 0208045D, C^3 Interoperability (Joint Tactical C^3 Agency); and PE 0208298D, Management Headquarters.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

F. (U) Other Appropriation Funds: Not Applicable.

G. (U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605101F Budget Activity: #6-Defense-Wide Mission Support
PE Title: Project Air Force

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	TO Complete	Total Program
060510F Project AIR FORCE,	21,881	23,320	24,611	Cont	TBD
Total	21,881	23,320	24,611	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Program funds Project Air Force (PAF), AF Studies and Analysis Federally Funded Research and Development Center. It provides for continuing analytical research across a broad spectrum of issues and concerns. PAF research agenda are focused primarily on mid- to long-term concerns. Results and analytical findings directly impact senior management deliberations on major issues. Air Force Advisory Group (AFAG), chaired by AF Vice Chief, reviews, monitors, and approves PAF research effort. Each project is initiated, processed, and approved IAW AFR 20-9 which requires General Officer (or SES equivalent) sponsorship and involvement on a continuing basis.

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

1. (U) Project PE #0605101F, Project AIR FORCE:

(U) FY 1989 Accomplishments:
- (U) PAF organized into five research programs: National Security Strategies, Theater Forces, Technology Applications, Resource Management and Strategic Forces.
- (U) In addition to those efforts continued from FY 1988, particularly in the areas of deterrence, TACAIR in NATO, and combat support, research included studies on evaluating AAFCE air campaign alternatives; reducing NATO and Pact TACAIR in CFE; the Congressionally mandated Small ICBM study; the future of allied air power in NATO's Central Region; the evolution of Soviet defense policy; future options for the National Aerospace Plane; and Space Launch Vehicle Choices for 1990-2010.

(U) FY 1990 Planned Program:
- (U) Research will continue on those topics identified as major issues by the Air Force Advisory Group. The research will focus on the implications for the Air Force of the ongoing arms control negotiations, the rapidly changing world scene, increasingly constrained defense budgets, and the resultant national security strategy and military force structures. Specific research areas include TACAIR employment in a post-CFE environment; roles, missions and force mix for the future strategic aerodynamic forces; close air support issues and options; the future US Air Force role in NATO; policy issues surrounding AF space operations; the role of China and Japan in U.S. regional strategy; and alternative methods for maintenance and support.

(U) FY 1991 Planned Program:
- (U) While specific topics will naturally evolve, research will continue in those major areas where PAF can make unique contributions to the AF. Major research efforts

will cover deterrence, global and regional security trends, space-based capabilities, revised theater-level campaign models and balancing risks and rewards in system acquisition policy. Special emphasis will likely continue on implications for U.S. national security strategy and AF force structure of developments in the Soviet Union and Eastern Europe, on the ramifications of prospective and negotiated arms control agreements, and on budgetary and capability issues for the AF of the future.

(U) Work Performed By: The RAND Corporation, Santa Monica, CA.

(U) Related Activities:
- (U) PAF efforts span functional and organizational boundaries as a result; the research conducted relates to a wide spectrum of AF activities.
- (U) The results are deposited with the Defense Technical Information Center for appropriate dissemination to other qualified recipients.
- (U) To assure relevance and to prevent unnecessary duplication, each newly proposed research effort is reviewed by the AF Assistant Chief of Staff for Studies and Analysis.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605306F Budget Activity: #6-Defense Wide Mission Support
PE Title: Ranch Hand II Epidemiology Study

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2767 Ranch Hand II Epidemiology Study					
	313	1,375	1,524	Continuing	TBD
Total	313	1,375	1,524	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program was directed in 1980 by the Assistant to the President of the United States for Domestic Affairs and Policy upon the recommendation of the Interagency Working Group on the Possible Long-Term Effects of Phenoxy Herbicides and Contaminants. As a result of this Presidential direction, PE 0605306F was established to conduct a 20-year epidemiology investigation of approximately 1200 Air Force personnel who were involved with aerial spraying of herbicides in Vietnam from 1962 to 1971 (Operation Ranch Hand). The objective of this investigation is to determine whether long-term health effects exist and can be attributed to occupational exposure to phenoxy herbicides and their associated dioxins. Dioxin is an unwanted by-product from manufacturing 2,4,5-T (herbicides) which were combined to make Herbicide Orange.

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

(U) Project 2767, Ranch Hand II Epidemiology Study: This project involves a 20-year study that compares USAF Ranch Hand personnel to other USAF crew members and support personnel who were not exposed to herbicides while serving in Vietnam. Analyses of yearly mortality rates and the past and present health status of the study population were begun in 1982, with follow-on health examinations scheduled at the 3, 5, 10, 15, and 20 year time periods. A recent discovery in Lab Techniques now enables the accurate measurement of the amount of exposure to dioxin that the Ranch Hand veterans have received. Before this development, the estimates of exposure among the Ranch Hand personnel have been based on several assumptions and extrapolations (gallons of herbicide sprayed each month and the number of men assigned). However, using a new method developed by the Centers for Disease Control, the blood serum level of dioxin can be accurately assayed to provide definitive exposure assessments for each Ranch Hand study participant.

(U) FY 1989 Accomplishments:
- (U) Completed and published the mortality and update report.
- (U) Completed serum dioxin assays on exposed participants.
- (U) Initiated serum dioxin analysis.
- (U) Completed morbidity analysis on year-5 data.
- (U) Completed database of fertility data.

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Program Element: $0605306F Budget Activity: #6-Defense Wide Mission Support
PE Title: Ranch Hand II Epidemiology Study

(U) FY 1990 Planned Program:
- (U) Complete serum dioxin assays on all participants.
- (U) Complete analysis of dioxin levels in blood.
- (U) Complete and publish year-5 morbidity report.
- (U) Complete fertility analysis and publish report.
- (U) Continue analysis of the prevalence of mortality.
- (U) Continue uploading and analysis of statistical database management

(U) FY 1991 Planned Program:
- (U) Complete and Publish year-5 morbidity report with dioxin exposure.
- (U) Continue mortality analysis update.
- (U) Continue data base management.
- (U) Release request for proposal for year-10 study.

(U) Work Performed By: This program is conducted by the Epidemiology Division of the USAF School of Aerospace Medicine, Brooks AFB, TX, with program management provided by the Acquisition-Support Division of the Human Systems Program Offices, Human Systems Division, Brooks AFB, TX. The prime contractor is Science Applications International, McLean, VA, and the subcontractors are the Scripps Research Foundation, La Jolla, CA, and the National Opinion Research Center, Chicago, IL.

(U) Related Activities: There is no unnecessary duplication of effort within the Air Force or the Department of Defense. In fact, this is the only study concerning Agent Orange health effects that is currently ongoing within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605708F
PE Title: NAV/RADAR/SLED-TRACK Test Support

Budget Activity: 6 - Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06TG 6585th Test Group Support	17,294	19,032	23,223	Cont	N/A
2900 RATSCAT Upgrade	2,000	1,600	2,000	2,000	Cont	N/A
688G Aircraft Navigation System Verification	1,500	2,000	2,000	Cont	N/A
Total	20,394	23,032	27,223	Cont	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT: The 6585th Test Group at Holloman AFB, NM, and the associated facilities and modernization efforts funded here are part of the Department of Defense (DOD) Major Range and Test Facility Base (MRTFB). The MRTFB is a national asset which is operated and maintained primarily for DOD test and evaluation missions, but is also available to other users having a requirement for its unique capabilities. The unique MRTFB capabilities of the 6585th Test Group include the Central Inertial Guidance Test Facility (CIGTF), the Radar Target Scatter (RATSCAT) facility, and the High Speed Test Track.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project: 06TG, 6585th Test Group Support: The 6585th Test Group, a tenant organization at Holloman AFB, NM, adjacent to the White Sands Missile Range (WSMR), uses this funding for operations, maintenance, improvement, modernization, and personnel in four major areas. (1) The High Speed Test Track performs rocket sled testing of missile guidance, aircraft ejection systems, and other tests requiring realistic simulations of high acceleration or high velocity environments, including rain erosion degradation of reentry vehicles. The sled track is used to perform measurements of the Peacekeeper guidance systems under environmental stress conditions. The sled track is also vital for developmental testing of guidance subsystems. The track is committed to guidance testing for Peacekeeper, Small ICBM and TRIDENT D-5 as well as other non-guidance system testing. (2) The CIGTF conducts numerous guidance related test efforts, such as inertial guidance systems including integrated navigational aids such as GPS receivers and stellar trackers for aircraft, as well as for the Peacekeeper and TRIDENT missile systems, ring laser gyroscope (RLG) development, and gravitational measurements necessary for ballistic missile guidance system testing and development. (3) The RATSCAT facilities, including the RATSCAT Advanced Measurement System (RAMS), are used to measure radar cross-section (RCS) and antenna patterns on selected subscale and full-scale targets. (4) The 6586th Test Squadron provides operational and maintenance support for flight test aircraft staging out of Holloman AFB. Cargo/transport type test bed aircraft support the CIGTF in performing test and

Program Element: #0605708F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: NAV/RADAR/SLED-TRACK Test Support

evaluation of navigation systems and fighter aircraft are operated and maintained by the 6586th Test Squadron to support missile development tests on WSMR. In addition, the 6585th Test Group performs liaison duties for USAF activities on WSMR, and performs full Federal Aviation Administration coordination for all airspace users in the WSMR and Holloman AFB flying areas.

(U) FY 1989 Accomplishments:
- (U) Supported Strategic Defense Initiative (SDI), Peacekeeper, SRAM II, upgrade of Advanced Concept Ejection Seat (ACES) II, ATF ejection seat systems, ATF INS, ATF RCS, Joint Surveillance Target Attack Radar System (JSTARS), and B-52 and B-1B avionics
- (U) New RATSCAT Main Site radar system to enhance RCS measuring
- (U) New telemetry system for sled track to streamline data flow
- (U) Consolidated of sled track fabrication shops

(U) FY 1990 Planned Program:
- (U) Continue support for ACES II, ATF, Peacekeeper, SRAM II, B-1, B-2, B-52, SDI, Army Penetrator tests
- (U) Acquisition of an Improved Three-Axis Table will provide capability for testing advanced inertial systems
- (U) Computer workstations will be acquired which will afford fast, efficient analysis of data from various tests
- (U) Begin support of GPS-Aided Inertial System, and High-Accuracy Ring Laser Gyroscope
- (U) Begin precision survey of High Speed Test Track to prepare for rail realignment

(U) FY 1991 Planned Program:
- (U) Support for test mission, maintenance and upgrades continues
- (U) Continuing support for ACES II, SRAM II B-2, NASP, and SDI
- (U) Additional equipment will be acquired to secure data for various classified test missions
- (U) Completion of Advanced Reference System will provide up-to-date capability for testing of airborne INS
- (U) Begin to realign High Speed Sled Track to permit hypervelocity tests

(U) Work Performed By: The primary contractor, DynCorp of McLean, VA, operates and maintains the Radar Target Scatter (RATSCAT) facility.

(U) Related Activities: The 6585th Test Group supports testing for a wide range of high priority customer programs such as B-1B, TRIDENT, Peacekeeper, Small ICBM, AMRAAM and various classified programs involving new technology. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0605708F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: NAV/RADAR/SLED-TRACK Test Support

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

2. (U) Project: 2900, RATSCAT Upgrade. The RATSCAT main site facility is an outdoor electromagnetic laboratory which measures RCS and antenna patterns on weapon systems and subsystems, using subscale and full scale models, or actual air vehicles. RATSCAT main site is unique in its ability to characterize signatures and perform measurements on targets of all sizes. However, RATSCAT main site equipment and facilities are predominantly early 1960's vintage and need repair and modernization. The RATSCAT main site is located on the White Sands Missile Range on a dry lake bed made up of gypsum salts. These highly corrosive salts, when combined with moisture, have progressively deteriorated the RATSCAT buildings and equipment. This project addresses these facility deterioration and equipment issues by (1) the time-phased replacement of outdated test equipment, and (2) the addition of new technology equipment needed for state-of-the-art RCS testing. This program includes RAMS, which will be maintained as the premier RCS facility in DOD.

(U) FY 1989 Accomplishments:
- (U) Continued procurement of new automated RCS measurement system, Integral Radar Measurement System (IRMS)
- (U) Completed Military Construction Project of new, corrosive-resistant facilities

(U) FY 1990 Planned Program:
- (U) Complete IRMS procurement
- (U) RATSCAT Advanced Measurement Systems (RAMS) radar equipment and target support systems will be upgraded to enhance capabilities of collecting data on radar cross-sections
- (U) Efforts will begin to reduce background radar reflectivity to reduce noise in the data
- (U) Complete improvement of bi-static measurement capability

(U) FY 1991 Planned Program:
- (U) Efforts to reduce radar reflectivity to decrease background noise will continue
- (U) Continuation of RATSCAT main site upgrade

(U) Work Performed By: Test operations are organically performed by the 6585th Test Group

(U) Related Activities: Not Applicable. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

Program Element: #0605708F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: NAV/RADAR/SLED-TRACK Test Support

3. (U) Project: 688G, Aircraft Navigation System Verification. This project conducts standardized tests and evaluations of inertial and inertially-aided aircraft navigation systems for DOD aircraft and weapon delivery systems. Project 688G provides common support for these efforts with a Completely Integrated Reference Instrumentation System (CIRIS) capability. Tasks undertaken by this project include: INS and INS Aided Verification Testing, such as integrated GPS receivers, Velocity Sensor Verification Testing, Standard INS Qualification Testing, Form/Fit/Function Testing, management and maintenance of CIRIS, and facility improvement and modernization.

(U) FY 1989 Accomplishments:
- (U) Continue verification and development testing of navigation systems to include GPS-aided inertial systems
- (U) Begin support of JSTARS

(U) FY 1990 Planned Program:
- (U) Growth in GPS-aided inertial system testing will continue
- (U) Develop Advanced Reference System (ARS),a miniaturization of CIRIS into five inch diameter AIM-9 Sidewinder pod for compatibility with additional aircraft
- (U) Begin support of SRAM II and continue JSTARS support

(U) FY 1991 Planned Program:
- (U) Advanced Reference System (ARS) upgrade to the CIRIS will continue
- (U) Continue testing of aircraft navigation systems including GPS aided and GPS User Equipment (UE)

(U) Work Performed By: Test operations are organically performed by the 6585th Test Group.

(U) Related Activities: Not Applicable. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605712F
PE Title: Initial Operational Test and Evaluation (IOT&E)

Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RDT&E RESOURCES ($ In Thousands)

Title	FY 1989 Actual*	FY 1990 Estimate*	FY 1991 Estimate	To Complete	Total Program
PE TOTAL	-0-	-0-	20,884	Cont.	TBD

* Prior to FY 91, funding for Air Force IOT&E was programmed and executed in the PE of the weapon system. Beginning in FY 91 funding for the IOT&E mission was consolidated into the new PE 0605712F. This change implements Defense Management Review initiative G-1268, Single PE for IOT&E.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program funds for tests conducted to evaluate a prospective system's operational effectiveness and suitability and to identify any operational deficiencies or need for modifications in support of the acquisition process. In addition, IOT&E provides information on organizational structure, personnel, logistics requirements, doctrine and tactics. IOT&E is essentially an operational assessment of a system's performance when the complete system is tested and evaluated against operational criteria by personnel with the same qualifications as those who will operate, maintain and support the system when deployed. In general, IOT&Es are performed on new systems in development, major modifications and other systems as directed by SAF and OSD. In addition, this PE will fund for major Operational Utility Evaluations (OUEs) and Early Operational Assessments (EOAs) which support major milestones and decision points prior to the Milestone IIIB.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 PROGRAM:
- (U) 103 IOT&Es conducted in 51 different Program Elements.
- (U) Conducted by: HQ AFOTEC 29; Major Commands 74.
- (U) Major on-going tests: F-16 MSIP, Joint STARS, MILSTAR, OTH-B, F-15 TEWS, AMRAAM (completed), NAVSTAR GPS user and control segments, Sensor Fuzed Weapon, and AGM-130.

(U) FY 1990 Planned Program:
- (U) 94 IOT&Es planned in 52 different Program Elements.
- (U) Conducted by: HQ AFOTEC 25; Major Commands 69.
- (U) Major on-going tests: OTH-B (complete), SRAM II (begin), Joint STARS, HARM LCS, Peacekeeper RG, F-15 TEWS ALQ 135, US/NATO E-3 ESMS, Civil Reserve Air Fleet Aeromed Segment and MILSTAR.

(U) FY 1991 Planned Program:

- (U) Tests funded under single PE, 0605712, not individual PEs of the weapon systems.
- (U) 64 IOT&Es currently planned.
- (U) Conducted by: HQ AFOTEC 19; Major Commands 45.
- (U) Major on-going tests: E-3 enhancements (start & finish), Interactive Defense Avionics Systems (complete), Joint STARS, HARM LCS, SRAM II, Peacekeeper RG, F-15 TEWS, and JTIDS.

(U) Program to Completion:

- (U) IOT&E is a continuing program.
- (U) PMD Directed: As weapon system progresses through R&D and Prior to Milestone IIIB & DAB Decision.
- (U) Conceivably all systems in R&D will eventually under go an IOT&E.
- (U) This effort will continue as long as there is direction to perform independent operational testing on Major Weapon Systems acquisitions.

D. (U) WORK PERFORMED BY: This program element is managed by the Air Force Operational Test and Evaluation Center (AFOTEC). Test teams are established and managed by HQ AFOTEC for "Conducted" tests, and by other Major Commands for "Monitored" tests, at various locations around the world.

E. (U) RELATED ACTIVITIES: There is no unnecessary duplication of effort within the Air Force of DOD.

F. (U) OTHER APPROPRIATION FUNDS ($ In Thousands): Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

A. (U) RESOURCES ($ in thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06RB Arnold Engineering & Development Center (AEDC)	143,855	141,583	155,642	Continuing	TBD
06ZA 3246th TW (3246 TW)	53,460	51,512	52,862	Continuing	TBD
06YA Air Force Flight Test Center (AFFTC)	60,910	59,165	64,352	Continuing	TBD
06UC 4950th Test Wing (4950 TW)	42,880	42,092	45,782	Continuing	TBD
Total	301,105	294,352	318,639	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Test and Evaluation Support program provides resources to operate the above Air Force test activities which are included in the Department of Defense (DOD) Major Range and Test Facility Base (MRTFB). The MRTFB is a national asset which is operated and maintained primarily for DOD test and evaluation missions, but is also available to other users (other government agencies, commercial industry, and foreign customers) having requirements for its unique capabilities. Test facilities funded within this program include wind tunnels, rocket and jet engine test cells, space chambers, armament ranges, climatic test facilities, avionics test facilities, dry lakebed landing sites, and instrumented ranges.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project: 06RB, Arnold Engineering and Development Center (AEDC): AEDC, located at Arnold AFB, TN, provides ground environmental test support for Air Force aeronautical, missile and space programs as well as other DOD agencies, government agencies and industry programs. The center operates test facilities comprised of wind tunnels, altitude rocket and turbine engine cells, arc heaters, aeroballistic ranges, space chambers plus administrative and technical support facilities.

(U) FY 1989 Accomplishments:
- (U) Major test efforts supported Peacekeeper, SICBM, Inertial Upper Stage (IUS), Boost Surveillance Tracking System , Space Surveillance Tracking System (SSTS), Intelsat VI, NASP, Short Range Attack Missile II (SRAM II), F-16. F-15, B-1B, Minuteman, Joint Cruise Missile, SDI, and the ATF.
- (U) Turbine engine programs included F100 & F110 Improved Performance Engine (IPE) and Component Improvement Programs (CIP), and Expendable Turbine Engine Concept (ETEC).
- (U) Continued support to flight dynamics, aeropropulsion, space systems, store separations and munition programs.

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

- (U) The Aeropropulsion Systems Test Facility (ASTF) began competitive testing of the two prototype ATF engines.
- (U) Design of the J-6 Large Rocket Test Facility continued.

(U) FY 1990 Planned Program:
- (U) AEDC will continue the development of DOD weapons systems and technologies including Peacekeeper, ATF, SSTS, SRAM II, Seek Eagle, Minuteman, SICBM, plume phenomenon investigations, SDI, NASP, and classified programs.
- (U) Emphasis on turbine engine testing will involve the F100 & F110 IPE/CIP, ATF prototype engines and the AFWAL ETEC.
- (U) Continued support in the areas of flight dynamics, aerospace propulsion, ordinance technology, and space.

(U) FY 1991 Planned Program:
- (U) Program support includes Peacekeeper, Minuteman, SICBM, F-15E, NASP, ATF, F100, F110, numerous classified programs and other DOD service/Government Agencies.
- (U) Technology efforts include IR signature, flight dynamics, facility technology and foreign technology efforts.
- (U) Development of freejet propulsion testing capabilities and construction of J-6 will continue.
- (U) Hypersonic test facility planning and development efforts will continue.

(U) WORK PERFORMED BY: Primary contractors performing test support include SVERDRUP Technologies, Inc., Schneider Services, Inc. and Calspan Field Services, Inc.

(U) RELATED ACTIVITIES: The test organizations provide test and evaluation support to Air Force programs and those of other Services and government agencies. Depot Maintenance Funds to support Air Force Systems Command test and evaluation aircraft is contained in PE 0605863F, RDT&E Aircraft Support. Technical capability improvement and modernization tasks are funded in PE 0604755F, Improved Capability for DT&E. Base operating support funding for Arnold Air Force Base (AFB), TN, Eglin AFB, FL, and Edwards AFB, CA, are funded in PE 0605894F, Real Property Maintenance RDT&E, and PE 0605896F, Base Operations (RDT&E). T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

2. (U) Project: 06ZA, 3246th TW (3246 TW): The 3246 TW is located at Eglin AFB, FL, and is responsible for Air Force nonnuclear armament development. The Wing accomplishes technology research, engineering development, test, evaluation, and initial acquisition

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

of USAF nonnuclear munitions. The 3246 TW, as the USAF focal point for munitions integration into aeronautical systems; conducts and supports USAF weapons effectiveness testing, electronic combat testing, and aeronautical systems testing.

(U) FY 1989 Accomplishments:
- (U) Completed testing of the FMU-124A/B Fuse, Base Recovery Vehicle (BRV), the GPU-5A Gun Pod/F-16 integration, Aircrew Eye and Respiratory Protection (ACRP) System on the KC-135, C-130, and F-16.
- (U) Completed 11 AMRAAM launches plus two AMRAAM jetison tests.
- (U) Completed 63 F-16 and 158 F-15 Seek Eagle missions, completing certification of 14 F-15 configurations.

(U) FY 1990 Planned Program:
- (U) The range operations contract will be increased in scope to support new capabilities in PRIMES and two threat radar simulators for validation testing of electronic combat systems.
- (U) Testing of major systems including AMRAAM, B-1, MC-130 Combat Talon and SEEK EAGLE on the F-15E F-111, and F-16 will continue.
- (U) Additional test programs supported will include HAVE QUICK, AGM-130, and GBU-15/BLU-109.

(U) FY 1991 Planned Program:
- (U) The range operations contract will be increased to support two new threat radar simulators and the GWEF.
- (U) Support for, AMRAAM, DAACM and major electronic combat systems will continue.
- (U) Support of initial ATF testing will begin.

(U) WORK PERFORMED BY: Primary contractor performing test support is RCA Services.

(U) RELATED ACTIVITIES: The test organizations provide test and evaluation support to Air Force programs and those of other Services and government agencies. Depot Maintenance Funds to support Air Force Systems Command test and evaluation aircraft is contained in PE 0605863F, RDT&E Aircraft Support. Technical capability improvement and modernization tasks are funded in PE 0604755F, Improved Capability for DT&E. Base operating support funding for Arnold Air Force Base (AFB), TN, Eglin AFB, FL, and Edwards AFB, CA, are funded in PE 0605894F, Real Property Maintenance RDT&E, and PE 0605896F, Base Operations (RDT&E). T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

3. (U) Project: 06YA, Air Force Flight Test Center (AFFTC): The AFFTC, located at Edwards AFB, conducts and supports development and operational test and evaluation of aircraft and aircraft systems, aerospace research vehicles, unmanned miniature vehicles, cruise missiles, parachute delivery/recovery systems, and cargo handling systems. Recovery support and engineering evaluation is provided to the Space Shuttle program and other transatmospheric vehicles. AFFTC operates two instrumented ranges: the Edwards Flight Test Range and the Utah Test and Training Range (funded in PE 78019F by the O&M appropriation). Additionally, AFFTC operates the USAF Test Pilot School.

(U) FY 1989 Accomplishments:
- (U) Testing of B-1B, F-16, F-15, F-15E, cruise missile evaluation, MC-130H, X-29, and AFTI-16 continued.
- (U) B-2 first flight completed and initial testing began.
- (U) Classified program testing increases significantly.
- (U) The F-111 Avionics Modernization Program (AMP) starts.
- (U) Shuttle landings build to six per year.
- (U) Operational testing of cruise missiles continues.
- (U) B-2, C-17, Peace Pearl, YA-7 and ATF test preparation continues.
- (U) The emergence of avionics intensive weapon systems entering the development testing cycle presents new challenges to both ground and flight test capabilities.
- (U) B-1B Electronic Warfare testing begins in the production anechoic chamber.

(U) FY 1990 Planned Program:
- (U) Testing of B-1B, B-2, F-16, F-15, F-15E, cruise missiles, A-7, F-111D, MC-130H, X-29, AFTI-16, and F-15 STOL will continue.
- (U) Classified program testing will increase significantly.
- (U) Preparations for the C-17, NASP, ATF, and DIRS continue and initial tests of Peace Pearl and Peace Marble III begin.
- (U) Space shuttle support continues.
- (U) Space shuttle landings build to ten per year.

(U) FY 1991 Planned Program:
- (U) Testing of B-1B, B-2, MC-130H, F-15, F-15E, F-16, AFTI/F-16, X-29A, ATF, Peace Pearl, DIRS, ATARS, UARS and cruise missiles will continue.
- (U) C-17 testing will begin and NASP preparation continues.
- (U) Classified program testing will continue at a high level.
- (U) Preparations for testing avionic intensive weapon systems in both ground test facilities and flight will continue.

(U) WORK PERFORMED BY: Primary contractor performing test support is Computer Science Corporation (CSC).

(U) RELATED ACTIVITIES: The test organizations provide test and evaluation support to Air Force programs and those of other Services and Program

Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

government agencies. Depot Maintenance Funds to support Air Force Systems Command test and evaluation aircraft is contained in PE 0605863F, RDT&E Aircraft Support. Technical capability improvement and modernization tasks are funded in PE 0604755F, Improved Capability for DT&E. Base operating support funding for Arnold Air Force Base (AFB), TN, Eglin AFB, FL, and Edwards AFB, CA, are funded in PE 0605894F, Real Property Maintenance RDT&E, and PE 0605896F, Base Operations (RDT&E). T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

4. (U) Project: 06UC, 4950th Test Wing (4950 TW): The 4950th Test Wing, Aeronautical Systems Division, Wright-Patterson AFB, OH, performs flight tests of aircraft and airborne systems, supports space vehicle tracking for Air Force Systems Command's (AFSC) Space Division, other DOD agencies, and the National Aeronautics and Space Administration (NASA). The Wing operates AFSC's large testbed aircraft and flight test aircraft modification facility. Flight tests range from evaluations of electronic systems such as radar, navigation, C3, etc., to aerodynamic and structural evaluations of highly modified RDT&E aircraft. Staging out of US and overseas bases, the Advanced Range Instrumentation Aircraft (ARIA) fleet of eight aircraft provide telemetry support for the NASA and DOD missile launches.

(U) FY 1989 Accomplishments:
- (U) Continued ARIA and other flight test support for DOD & NASA programs.
- (U) Continued support in fabrication/modification and flight test to the Air Force Wright Aeronautical Laboratories and other DOD and government organizations.
- (U) ARIA fleet supported a large backlog of space vehicle launches as the Space Shuttle and expendable launch vehicle flight operations ramp up from the 1988 level.
- (U) CAD/CAM capabilities were improved, replacing older, obsolete equipment resulting in increased engineering design throughput.

(U) FY 1990 Planned Program:
- (U) Continue ARIA flight test support to DOD & NASA programs including Trident, STS, UK Polaris, SLCM, Peacekeeper, MILSTAR, DMSP and the backlog of space launches.
- (U) Continue fabrication/modification and flight test support to AFWAL, AFFTC, other DOD and government organizations.
- (U) Electronic Counter-Counter Measures Airborne Radar Test Bed (ECCM/ARTB), one Cruise Missile Mission Control Aircraft (CMMCA) and one Sonobuoy Missile Instrumentation Location

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

System (SMILS) aircraft are scheduled for initial operational capability.

(U) FY 1991 Planned Program:
- (U) The FY91 workload will increase as additional support will be provided by the ECCM/ARTB, CMMCA and SMILS.
- (U) CMMCA will become fully operational with delivery of the second aircraft.

(U) WORK PERFORMED BY: Primary contractor performing test support is E-Systems.

(U) RELATED ACTIVITIES: The test organizations provide test and evaluation support to Air Force programs and those of other Services and government agencies. Depot Maintenance Funds to support Air Force Systems Command test and evaluation aircraft is contained in PE 0605863F, RDT&E Aircraft Support. Technical capability improvement and modernization tasks are funded in PE 0604755F, Improved Capability for DT&E. Base operating support funding for Arnold Air Force Base (AFB), TN, Eglin AFB, FL, and Edwards AFB, CA, are funded in PE 0605894F, Real Property Maintenance RDT&E, and PE 0605896F, Base Operations (RDT&E). T&E Investments for some new tri-service common test capabilities are funded in PE 0604940D, Test Instrumentation Development. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605808F
PE Title: Advanced Systems Engineering/Planning

Budget Activity: #6- Defense Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Advanced Systems Engineering/Planning	17,052	6,814	9,138	Cont	TBD
Total	17,052	6,814	9,138	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is a modest investment to evaluate alternative weapon system concepts and identify acquisition strategies essential for effective planning of the Air Force's acquisition development programs. Its objective is to reduce risk by selecting the best weapon system concepts to begin acquisition and which satisfy future Air Force needs. First, analysts investigate the mission requirements and environments specified by the Air Force Major Air Commands to develop solution boundaries. Then, possible solution concepts are drawn or generated from a variety of sources. Technologies which significantly enhance warfare capabilities, which exploit adversary weaknesses, or which reduce weapon system ownership costs are evaluated for incorporation into system concepts. Finally, resident analytical capabilities are used to evaluate system approaches and configurations to determine limitations and development challenges. Evaluations of alternative system concepts are provided to Air Force Major Air Commands for developing statements of need. Due to Congressional reductions, the scope of FY 1990 concept development is restricted to immediate Air Force needs and mature technologies. FY 1991 funding is essential to begin evaluation of alternatives for tactical low-level flight training, and analysis of next generation strategic requirements for intercontinental ballistic missile and cruise missile systems.

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

(U) Advanced Systems Engineering/Planning:

(U) FY 1989 Accomplishments:
- (U) Identified critical technologies and development schedule for long-range, stand-off airfield attack weapons.
- (U) Evaluated alternative concepts to enhance accuracy of conventional cruise missiles for strategic missions.
- (U) Analyzed utility of advanced air superiority missile concepts in future battlefield and limited warfare environments.
- (U) Applied artificial intelligence approaches to reduce the number of operators of weapon systems.

Program Element: #0605808F Budget Activity: #6-
PE Title: Advanced Systems Engineering/Planning Defense Wide Mission Support

- (U) Developed advanced transport concepts to replace aging C-130s while significantly increasing productivity and survivability.
- (U) Assessed technology programs and concepts for next generation special operations aircraft to select best acquisition strategy for reduced cost.
- (U) Defined concepts to assure space-based system availability and extend on-orbit life at lower cost.

(U) FY 1990 Planned Program:
- (U) Define anti-intercept communication concepts to increase aircraft and ground station survivability in war zones.
- (U) Develop concepts for handling information such as target detection, weapons assignment, and weapons effects for restriking surviving targets in highly fluid tactical situations.
- (U) Refine concepts for the next generation intra-theater airlifter to support the Army.
- (U) Propose solutions to problems related to sustaining aircraft operating for extended durations in locations dispersed from main operating bases.

(U) FY 1991 Planned Program:
- (U) Identify affordable candidate solutions to modernize low-level flight training systems.
- (U) Analyze system requirements and define technology requirements for the next generation intercontinental ballistic missile (ICBM).
- (U) Generate high altitude conventional cruise missile concepts utilizing emerging technology propulsion systems.
- (U) Perform pre-acquisition and technology transition planning for new maintenance training system concepts.
- (U) Evaluate concepts to achieve assured communications in nuclear disturbed propagation environments.
- (U) Develop methods to improve interchange of planning data in the Allied Tactical Operations Center.

(U) Work Performed By: Technical analysis to evaluate concepts is primarily provided by two contractors: the Aerospace Corporation, El Segundo, CA; and the MITRE Corporation, Bedford, MA. Concept development is performed by numerous system contractors and analytical service companies.

(U) Related Activities:
- (U) Projects funded by this program element evaluate integrating emerging technology into candidate systems.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Assessments: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0605809F
PE Title: Dynamic Coherent Measurement System (DYCOMS)

Budget Activity: 6
Defense Wide
Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Program
4514 DYCOMS	9,053	4,968	3,369	65,141	90,000
Total	9,053	4,968	3,369	65,141	90,000

B. (U) BRIEF DESCRIPTION OF ELEMENT:
This facility is required to measure the "combat" radar cross section (RCS) of low observable (LO) airborne platforms. This test facility will support the increasing interest in applying low observables technology to aircraft and missile systems. LO technology applications include both special access and traditional design systems. Additionally, this facility is required for acceptance testing of new LO systems and recurring maintenance of the LO capability of operational assets after deployment. This system must be fully capable of diagnostic support in order to locate the specific cause of a signature deviation. Government evaluation and acceptance of LO systems must be based upon the results of realistic testing in their operational combat configuration, e.g. gear up, control surfaces in use, no pylon, etc., in the far field. When operational in FY1995, the DYCOMS LO measurement facility will be capable of meeting this requirement for supporting the various new generations of LO airborne platforms on a day-to-day basis.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN FY1991:

(U) 4514 DYNAMIC COHERENT MEASUREMENT SYSTEM: (Same as section B.)

(U) FY 1989 Accomplishments:
- Environmental Impact Statement begun
- Facility modification plans developed
- hardware specifications identified

(U) FY 1990 Planned Program:
- Long lead hardware purchased, facility modifications begun

(U) FY 1991 Planned Program:
- Continue facility modification, begin hardware installation

(U) Work Performed By:
Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. Prime contractor is EG&G Special Projects, Las Vegas, Nevada.

(U) Related Activities: The need for DYCOMS has been included in the DoD RCS Measurement Improvements Roadmap. There is no unnecessary duplication of this measurement capability within Air Force or DOD.

(U) Other Appropriation Funds: None

(U) International Cooperative Agreements: None

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FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0605863F
PE Title: RDT&E Aircraft Support

Budget Activity: 6-Defense-wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number	Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2111	3246th Test Wing	8,994	9,949	10,371	Continuing	TBD
2112	Air Force Flight Test Center	25,403	30,100	34,679	Continuing	TBD
2114	4950th Test Wing	19,749	14,200	16,743	Continuing	TBD
Total		54,146	54,249	61,793	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The RDT&E aircraft support program provides resources for maintaining Air Force Systems Command assigned test and test support coded aircraft which are included as a portion of the Department of Defense Major Range and Test Facility Base. Funds pay for depot level type maintenance such as: Programmed Depot Maintenance (PDM), the calendar-based cyclic scheduling of aircraft into depots for update/inspection; modifications and Time Compliance Technical Orders (TCTO); engine overhauls; exchangeables (recoverable components, such as fuel pumps and electric motors, returned to the depots for repairs); depot provided area assistance; and assorted equipment support that requires reimbursement. This program supports 201 RDT&E aircraft of 24 different types. Most of these aircraft are unique (pre-production, one-of-a-kind, etc.), and are highly modified and uniquely instrumented.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project: 2111, 3246th Test Wing (3246 TW): The 3246 TW, Eglin AFB, FL, is the prime USAF organization responsible for nonnuclear munitions armament development. The Wing accomplishes RDT&E and initial acquisition of USAF nonnuclear munitions; is the USAF focal point for munitions integration in aeronautical systems; and conducts USAF weapons effectiveness testing and electromagnetic warfare testing. The 3246 TW currently has the following types and quantities of test/test support aircraft assigned: A-10A(2); NC-130A(1); F-4D(5); F-4E(3); F-15A(2); F-15B(1); F-15C(1); F-15D(1); F-15E(2); F-16A(7); F-16C(2); F-111E(2); UH-1N(2); and T-38A(5). Total aircraft assigned: 36.

(U) FY 1989 Accomplishments:
- (U) PDM on one F-4D, one F-15A and one F-111 were accomplished.
- (U) Two UH-1Ns had an Analytical Condition Evaluation accomplished.
- (U) TCTOs were accomplished on one F-4D.
- (U) The Wing flew 6,816.7 hours which generated corresponding engine overhaul and exchangeable requirements.

Program Element: 0605863F Budget Activity: 6-Defense-wide Mission Support
PE Title: RDT&E Aircraft Support

(U) FY 1990 Planned Program:
- (U) PDM will be done on one F-111E and one F-15C.
- (U) The 3246 TW is projecting to fly 7,143 hours, which will generate corresponding exchangeable/engine overhaul requirements.
- (U) A backlog of $2.5M exists to adequately maintain the Wing's test support fleet.

(U) FY 1991 Planned Program:
- (U) PDM will be done on one C-130A, three F-4Ds, one F-111E and two F-4Es.
- (U) TCTOs on 4 F-4Ds, 5 F-16s, 2 T-38s, 1 NC-130A, 1 UH-IN and 2 A-10s, 2 F-15As, 6 T-38As, and 2 F-111Es.
- (U) The 3246 TW is projecting 7,053 flying hours, which will generate corresponding exchangeable and engine overhaul requirements.
- (U) A backlog of $4.0M exists to adequately maintain the Wing's test support fleet.

(U) WORK PERFORMED BY: Depot level maintenance is performed either organically (by the Air Force Logistics Command (AFLC) Air Logistics Centers (ALCs)) or contractually (with the ALCs negotiating/administering the contract). Organically, work is performed at five AFLC ALCs. Contractually, work is performed by McDonnell Douglas Corp., Tulsa, OK; Boeing Military Airplane Company, Wichita, KS; Lockheed, Marietta, GA; PEMCO, Birmingham, AL; and Vought Corp., Dallas, TX.

(U) RELATED ACTIVITIES: Operations of the aircraft supported by this program is in Test and Evaluation Support, PE0605807F. There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

2. (U) Project: 2112, Air Force Flight Test Center (AFFTC): The Air Force Flight Test Center (AFFTC), Edwards AFB, CA, conducts and supports tests of aircraft and aircraft systems, aerospace research vehicles, remotely piloted vehicles, cruise missiles and parachute delivery/recovery systems. Support for the Air Force Flight Test Center (AFFTC) aircraft located at the 6514th Test Squadron at Hill AFB, UT, is also funded within project 2112. The AFFTC currently has the following types and quantity of test/test support aircraft assigned: A-7D/F(11), NA-37B(3), B-1(2), B-2(1), B-52G(2), B-52H(2), FB-111A (1), DC-130A(1), C-130B(2), C-130H(7), F-4C(6), RF-4C(5), F-4D(3), F-4E(10), F-15A(3), F-15B(2), F-15D(4), F-15E(2), F-16A(5), F-16B(7), F-16C(4), F-16D(2), F-111A(1); F-111D(3); F-111E(1), H-1H(4), UH-1N(3), H-3E(3), CH-53A(2), T-38A(22), UV-18B(1), U-26A(1) and U-6(1). Total aircraft assigned: 127.

Program Element: 0605863F
PE Title: RDT&E Aircraft Support

Budget Activity: 6-Defense-wide Mission Support

(U) FY 1989 Accomplishments:
- (U) PDMs were done on one RF-4C and one F-111D.
- (U) TCTOs/MODs were accomplished on 6 T-38s, 5 H-1s, 2 F-4Es, 4 C-130s.
- (U) Analytical Condition Evaluation (ACE) on four HH-1Hs were completed.
- (U) One T-38 and three H-1s were painted.
- (U) AFFTC flew 24,989.8 flying hours which generated corresponding engine overhaul and exchangeable requirements.

(U) FY 1990 Planned Program:
- (U) PDMs for 1 NC-130H, and 1 NRF-4Cs are scheduled.
- (U) One HH-1H is scheduled for On-Condition Maintenance.
- (U) Seven H-1s and two CH-53As are scheduled for ACE.
- (U) PDMs for Have Phoenix is funded at $4.2M.
- (U) AFFTC is projecting 30,663 flying hours which will generate corresponding exchangeable and engine overall requirements.
- (U) A backlog of $9.2M exists to adequately maintain the AFFTC test support fleet.

(U) FY 1991 Planned Program:
- (U) PDMs on 3 NF-4Cs, 1 F-4D, 2 RF-4C, 4 F-4Es, 2 F-15s, 1 C-130B, 1 HC-130H, 1 NRF-4C, 1 F-4E, and 1 F-111D.
- (U) Seven H-1s and two CH-53As will have ACEs.
- (U) TCTOs on 2 A-7s, 4 F-15s, 13 F-16s, 3 C-130s, 2 HH-1H, 2 A-37s, 5 F-4Cs, 4 F-4Es, 1 RF-4C, 1 F-111E, and 10 T-38s.
- (U) PDMs for Have Phoenix is funded at $4.6M.
- (U) AFFTC is projecting 29,112 flying hours which will generate corresponding exchangeable/engine.
- (U) A backlog of $19.2M exists to adequately maintain the AFFTC test support fleet.

(U) WORK PERFORMED BY: Depot level maintenance is performed either organically (by the Air Force Logistics Command (AFLC) Air Logistics Centers (ALCs)) or contractually (with the ALCs negotiating/administering the contract). Organically, work is performed at five AFLC ALCs. Contractually, work is being performed by McDonnell Douglas Corp., Tulsa, OK; Boeing Military Airplane Company, Wichita, KS; Lockheed, Marietta, GA; PEMCO, Birmingham, AL; and Vought Corp., Dallas, TX.

(U) RELATED ACTIVITIES: Operations of the aircraft supported by this program is in Test and Evaluation Support, PE0605807F. There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

Program Element: 0605863F Budget Activity: 6-Defense-wide Mission Support
PE Title: RDT&E Aircraft Support

3. (U) Project: 2114, 4950th Test Wing: The 4950th Test Wing, Aeronautical Systems Division, Wright-Patterson AFB, OH, performs flight tests of aircraft and airborne systems, supports space vehicle tracking for the Space Division and other DOD and National Aeronautics and Space Administration organizations. The 4950th Test Wing currently has 36 test support aircraft assigned: C-18A(2); C-18B(1); EC-18B(4); C-135A(9); C-135E(7); C-141A(4); T-37B(1); T-39A(2); and T-39B(6). Total assigned: 36. Aeronautical Systems Division, Wright-Patterson AFB, OH, is responsible for aircraft leased to contractors, loaned to other Government agencies, or furnished to contractors under Government Furnished Property (GFP) clauses. The Air Force programs and pays for support of these aircraft through the 4950th Test Wing account. Based on current and projected FY 1989/90/91 contracts and agreements, AFSC is responsible for costs associated with one NC-131H, one NF-111A, and one NT-33A. Cost for these aircraft are included in the 4950 Test Wing Project.

(U) FY 1989 Accomplishments:
- (U) One C-18, four C-135s, and two C-141 received PDM.
- (U) Corrosion/Life Extension Mod was accomplished on two T-39s.
- (U) The 4950th Test Wing flew 7,591.4 flying hours which generated corresponding engine overhaul and exchangeable requirements.
- (U) TCTOs on four C-141s and two C-18s were accomplished.

(U) FY 1990 Planned Program:
- (U) PDM will be done on one C-18.
- (U) Corrosion & Life Extension Mod will be done on two T-39.
- (U) Special inspections must be accomplished on one NC-131 and one NT-33A.
- (U) 4950th is projecting 8,552 flying hours, which generate corresponding engine and exchangeable overhaul requirements.
- (U) A Backlog of $3.3M exists to adequately maintain the 4950TW test support fleet.

(U) FY 1991 Planned Program:
- (U) PDM are scheduled on three C-18s, one C-141 and seven C-135s.
- (U) TCTOs are scheduled on two C-141s, five C-135s, and three C-141s.
- (U) 4950th is projecting 8,740 flying hours which will generate corresponding exchangeable and engine overhaul requirements.
- (U) A backlog of $6.9M exists to adequately maintain the 4950TW test support fleet.

(U) WORK PERFORMED BY: Depot level maintenance is performed either organically (by the Air Force Logistics Command (AFLC) Air Logistics Centers (ALCs)) or contractually (with the ALCs negotiating/administering the contract). Organically, work is performed at five AFLC ALCs. Contractually, work is being

Program Element: 0605863F
PE Title: RDT&E Aircraft Support

Budget Activity: 6-Defense-wide Mission Support

performed by McDonnell Douglas Corp., Tulsa, OK; Boeing Military Airplane Company, Wichita, KS; Lockheed, Marietta, GA; PEMCO, Birmingham, AL; E-Systems, Greenville, TX; and Vought Corp., Dallas, TX.

(U) RELATED ACTIVITIES: Operations of the aircraft supported by this program is in Test and Evaluation Support, PE0605807F. There is no unnecessary duplication of effort within the Air Force or Department of Defense.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605894F
Title: Real Property Maintenance Activity (RPMA)

Budget Activity: 6-Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
8941 Operation of Utilities	14,296	15,564	17,272	Cont	TBD
8942 Maintenance and Repair of Real Property	46,987	43,905	49,086	Cont	TBD
8943 Minor Construction	3,062	3,184	3,311	Cont	TBD
8944 Other Support	18,295	18,891	22,714	Cont	TBD
Total	82,640	81,544	92,383	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element provides essential RPM operations at three Air Force Systems Command major range and test bases -- Eglin AFB FL; Edwards AFB CA; Arnold AFB TN. The account funds essential "open the doors" cost of day-to-day support so that the complex and sophisticated test mission of these organizations can be accomplished. The account finances utility operations; maintenance, repair, and minor construction of facilities; environmental compliance projects; and other civil engineering services. Past funds have not been sufficient to maintain facilities and has resulted in facilities deteriorating to the point that major contract repairs are required. In addition, the reduction in the FY 90 program comes at a time in which a substantial sum is required to correct environmental compliance problems. FY 91 funding reflects real growth required to preserve these aging national assets (replacement value - $7 billion), and correct environmental compliance problems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 8941, Operation of Utilities: This is a "must pay" account which provides support for both purchased and base produced utilities at Edwards AFB and Eglin AFB. The purchased utilities include electricity, gas, water, and sewage treatment. Our base-produced utilities consist of the operation of utility plants, distribution systems, water/sewage treatment, prime/back-up power, refrigeration/air conditioning, airfield lighting, and fuel distribution system.

(U) FY 1989 Accomplishments:
- (U) This is a "must pay" which funds for both the purchased and base produced utilities at Edwards AFB and Eglin AFB.

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FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605894F
Title: Real Property Maintenance Activity (RPMA)

Budget Activity: 6-Defense-Wide Mission Support

(U) FY 1990 Planned Program
- (U) Increase reflects a rise in purchased utility costs in excess of normal inflation and the activation of two high electrical use major test facilities.

(U) FY 1991 Planned Program:
- (U) Program will continue to increase with activation of three high electrical use major test facilities.
- (U) Program will also increase due to Edwards AFB tying into the city water system.

(U) Work Performed By:
- (U) In-house work force and various utility companies.

(U) Related Activities:
- (U) Program Element #0605807F, Test and Evaluation, provides the mission funds for utilities at Arnold AFB TN due to the fact that mission support consumes almost all utility efforts.
- (U) There is no duplicaton of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 8942, Maintenance and Repair of Real Property: This project funds the maintenance and repair (M&R) of basic infrastructure and complex test facilities to slow deterioration; ensure preservation of Air Force facility investment; and accomplish environmental compliance requirements.

(U) FY 1989 Accomplishments:
- (U) Minimal dollar availability compounded by extensive tornado damage at Eglin AFB resulted in inadequate M&R of RDT&E infrastructure/facilities and a growth in the M&R backlog to $69 million.

(U) FY 1990 Planned Program:
- (U) Congressional reduction of $13M significantly constrains bases ability to comply with federal, state, and local environmental regulations/laws and accomplish planned M&R on facilities/infrastructure.
- (U) Backlog is estimated to increase to $72 million.

(U) FY 1991 Planned Program:
- (U) Mission critical M&R requirements will be accomplished to minimize degrading effects of prior years of under funding and accelerating deterioration of physical plant.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605894F
Title: Real Property Maintenance Activity (RPMA)

Budget Activity: 6-Defense-Wide Mission Support

- (U) Increased funding will support the findings of environmental audits that identified environmental compliance problems (such as replacement of underground storage tanks, meeting air/water quality criteria, removal of hazardous and solid waste and wastewater treatment) which must be solved to forego possible fines and/or civil/criminal liabilities.

(U) Work Performed By:
- (U) In-house work force and various contractors.

(U) Related Activities:
- (U) PE 0605807F, Test and Evaluation, provides the mission funds for civilian personnel at Arnold AFB, TN since mission support consumes almost all personnel efforts.
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

3. (U) Project 8943, Minor Construction (MC): This project adapts facilities to current mission needs/standards through additions, alterations, replacements, relocations, and new facilities. The funded cost of each undertaking cannot exceed $200 thousand.

(U) FY 1989 Accomplishments:
- (U) Provided minimal MC support to RDT&E mission, leaving inadequate and antiquated facilities to accomplish research and testing.

(U) FY 1990 Planned Program:
- (U) Level of funding to satisfy minimum mission requirements.

(U) FY 1991 Planned Program:
- (U) Continuing level of effort to satisfy minimum mission requirements.

(U) Work Performed By:
- (U) In-house work force and various contractors.

(U) Related Activities:
- (U) PE 0605807F, Test and Evaluation, provides the mission funds for civilian personnel at Arnold AFB, TN since mission support consumes almost all personnel efforts.
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605894F
Title: Real Property Maintenance Activity (RPMA)

Budget Activity: 6-Defense-Wide Mission Support

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

4. (U) Project 8944, Other Support: Project provides resources for Civil Engineering services such as custodial, fire protection, refuse collection, entomology, leases, and environmental compliance (excludes maintenance and repair).

(U) FY 1989 Accomplishments:
- (U) Provided essential "must pay" health and safety services for bases to perform their mission.

(U) FY 1990 Planned Program:
- (U) Provides minimum services required to support bases' missions.
- (U) Slight increase allows us to comply with stringent environmental regulatory criteria; obtain hazardous waste storage permits and surveys; dispose of hazardous waste; pollution monitoring, and asbestos removal.

(U) FY 1991 Planned Program:
- (U) Continues minimum support services and additional funding for environmental compliance requirements
- (U) resulting from new regulatory criteria in areas such as hazardous waste storage, analyses and disposal, and pollution monitoring.

(U) Work Performed By:
- (U) In-house work force and various contractors.

(U) Related Activities:
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605896F
PE Title: Base Operation RDT&E

Budget Activity: #6-Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1 Base Operating Support					
Total	63,880	62,037	61,722	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element provides basic, essential services of base operating support at three Air Force Systems Command major range and test facility bases which are national assets--Eglin AFB FL, Edwards AFB CA, and Arnold AFB TN. The program funds bare minimum "open the doors" costs of day-to-day support. The program finances pay of people which accounts for approximately 60 percent of the total program, administrative support, security and guard services, dormitories, billeting, food services, transportation, and motor pools. Other functions supported by this program element include comptroller, chaplain, personnel, supply, documentation, publication, printing and family support centers. Family support centers are responsible for providing service members and their families assistance in coping with the demands of Air Force life. A concerted effort is being made to maintain these functions, however, the effects of inflation on contracted services, coupled with having to absorb civilian pay raises and Department of Labor wage increases, severely impact the buying power for base operating support. This program element enhances mission readiness, increases productivity, and improves retention of the career member by maintaining basic quality-of-life services.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Provided normal, yet essential, base operating support (BOS) for three AFSC bases, thus allowing various test missions to be conducted.
   - (U) Provided standard, Air Force accepted, quality-of-life services to members of the armed forces stationed at these three AFSC bases.
   - (U) A family support center was activated at Eglin AFB FL.

2. (U) FY 1990 Planned Program:
   - (U) Provides normal, yet essential, BOS functions for three AFSC bases, thus allowing various test missions to be conducted.

Program Element: #0605896F
PE Title: Base Operation RDT&E

Budget Activity: #6-Defense-Wide Mission Support

- (U) Reduction in funding will result in standard, Air Force accepted quality-of-life services being reduced to members of the Armed Forces stationed at these three AFSC bases.
- (U) As congressionally mandated, beginning FY 90, appropriated funds must support specific Morale, Welfare and Recreation activities.

3. (U) FY 1991 Planned Program:
   - (U) No BOS functions or mission changes are planned. Budget reductions coupled with the effect of inflation will result in reduced manning levels and quality-of-life services--impacting mission readiness, productivity, and retention of highly skilled career members.

4. (U) Program to Completion:
   - (U) Supports the minimum essential on-going base operations.
   - (U) Continues quality-of-life services.

5. (U) Work Performed by: Primary contractors performing support in this program included United Management Service, Inc., Toledo, OH; JRW Enterprises, Portsmouth, VA; Better Service Company, Norcross, GA; and Desert Office, Lancaster, CA.

6. (U) Related Activities:
   - (U) PE #0605807F, Test and Evaluation, provide mission support funds for three AFSC bases; Edwards, Eglin and Arnold.
   - (U) PE #0605894F, Real Property Maintenance, provides civil engineering activities to include facility projects for the three AFSC R&D managed and supported bases.
   - (U) There is no duplication of effort within the Air Force or the Department of Defense.

7. (U) Other Appropriation Funds: Not applicable.

8. (U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0701112F Budget Activity: #6-Defense-Wide
PE Title: Inventory Control Point Operations Mission Support

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

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3090 Embedded Computer Resources Support Improvement Program (ESIP)	4,399	4,621	4,881	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program funds research on advanced development of capabilities to improve the support of embedded computer systems in terms of mission responsiveness and productivity. The program encompasses automation and standardization of support processes, advanced integration support facility (AISF), readiness support, and support networks. This program is essential in view of the significant increase in embedded computer systems, including software, used in defense systems. To meet the ever increasing threat environment and requirements for mission changes, software support (maintenance and enhancements) needs have grown proportionately. ESIP leverages developments in software technology to make software support more responsive and efficient.

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

(U) Project 3090, Embedded Computer Resources Support Improvement Program. See B above for description.

(U) FY 1989 Accomplishments:
- (U) Complete initial identification of tools and methods for distributed modular Ada software.
- (U) Analyze adaptive reconfiguration technology reports.
- (U) Define multiple avionics processor monitor (MAPM) effort.
- (U) Award contract for fault tolerant Ada software efforts.
- (U) Demonstrate test bench for distributed Ada systems.
- (U) Award contract to identify tools to support Ada software.
- (U) Identify radar reprogrammability opportunities.
- (U) Define emergency reprogramming center (ERC) automated management tracking effort.
- (U) Serve as consultant for Ada compiler and support facility issues for B-2, F-15, EF-111, and F-16 program offices.
- (U) Transition modular simulation software to ISFs.

(U) FY 1990 Planned Program:
- (U) Evaluate radar rapid turnaround study for follow-on efforts.
- (U) Integrate communication/navigation/identification database into integrated electromagnetic system simulator (IESS), and install link between AISF and IESS link.
- (U) Assess modular embedded computer systems (MECS) development practices and tools for incorporation into AISF. Demonstrate prototype tools.

Program Element: #0701112F Budget Activity: #6-Defense-Wide
PE Title: Inventory Control Point Operations Mission Support

- (U) Complete Phase I of fault tolerant Ada software effort.
- (U) Initiate software instrumentation.
- (U) Start operational flight program (OFP) automated validation (AUTOVAL) effort.
- (U) Award contract for ERC automation effort.
- (U) Transition realtime network, simulation set, low cost cockpit displays for F-16 A/B to Ogden Air Logistics Center.
- (U) Initiate MAPM capability.
- (U) Start software documentation traces effort.
- (U) Demonstrate data link alternative with Warner Robins Air Logistics Center for OFP distribution.

(U) FY 1991 Planned Program:

- (U) Initiate techniques for parallel processing and artificial intelligence support.
- (U) Develop fault tolerant software techniques.
- (U) Develop distributed software support techniques.
- (U) Integrate results from MECS software study into AISF.
- (U) Complete phase I for OFP AUTOVAL effort. Demonstrate test suite execution.
- (U) Award phase II of AUTOVAL for automated test case generation.
- (U) Complete phase I for MAPM capability.
- (U) Start technology development in high payoff areas from MECS study.
- (U) Transition ERC automated management tracking system.
- (U) Integrate and evaluate software documentation tracing program.
- (U) Initiate data reduction/analysis visualization effort.

(U) Work Performed By: In-house work is done by Wright Research and Development Center, Wright-Patterson AFB, OH. The contractors are ITT, Fort Wayne, IN; TRW, Dayton, OH; Hughes, Los Angeles, CA area; ITT, Nutley, NJ; The Analytical Sciences Corporation, Reading, MA; Westinghouse, Baltimore, MD; SBE, Houston, TX; Atlantic Research Corporation, Dayton, OH; and Draper Lab, Cambridge, MA.

(U) Related Activities:

- (U) Program Element #0207133, F-16 Squadrons: AUTOVAL, MAPM, and other miscellaneous work.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

(U) International Cooperative Agreements: Not applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #072207F Budget Activity: #6 Defense-Wide Mission Support
PE Title: Depot Maintenance

A. (U) RESOURCES ($ in Thousands)
Project Number
Number & Title
3326 Precision Measurement & Calibration Equipment Development (PMCED)

	FY 89 Actual	FY 90 Estimate	FY 91 Estimate	To Complete	Total Program
	953	2428	2740	Cont	TBD
TOTAL	953	2428	2740	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Program develops, tests, & evaluates measurement standards & associated equipment for 175 base precision measurement equipment laboratories (PMELs) world-wide. Within the technology of modern weapons systems is research & development of calibration standards to support placing aircraft, bombs, & missiles on target as well as strategic defense initiatives.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project: 3326 (PMCED). Designed to develop, test, & evaluate standards & associated equipment used in the measurement & calibration of advance weapons systems & support equipment to include such high technology as lasers, microwave, millimeter wave, electro-optical, & automatic test equipment

(U) FY 1989 Accomplishments:
- (U) Develop electro-optical standards for laser-guided weapons; i.e. LANTRIN and IR Maverick.
- (U) Develop improved field temperature sensors for advanced jet engine & establish more accurate voltage measurements.

(U) FY 1990 Planned Program:
- (U) Continue with FY 89 work and develop transfer standards and measurement techniques for operational weapons systems.
- (U) Develop standards of resistance, pressure, temperature, microwave power, and magnetic fields for guidance, air data communications, and radar systems measurement requirements.

(U) FY 1991 Planned Program:
- (U) Continue and expend FY 89 & 90 work and establish a national measurement capability in targeted areas which will transfer capability, standards and measurement systems to the USAF and respective field units.

(U) Program Completion: This a continuing program.

(U) Work Performed By: National Institute of Standards & Technology (NIST) 60%, private industry 25%, universities/nonprofit institutions 10%, and Air Force Primary Standards Laboratory 5%.

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(U) Related Activities:
- (U) Work primarily accomplished by NIST and Engineering Working Groups of the Calibration Coordination Group of the Joint Technical Coordinating Group for Metrology and Calibration.
- (U) No unnecessary duplication of effort within the USAF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreement: Not Applicable.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0708011F
PE Title: Industrial Preparedness
Project Title: Manufacturing Technology

Project Number: 2865
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RDT&E RESOURCES ($ in Thousands):

	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MANTECH	96,430	85,000	72,133	Cont.	TBD.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: MANTECH is the RDT&E part of a larger Air Force industrial base program that includes many activities that impact industrial preparedness and productivity, key elements in force readiness, modernization and sustainability. MANTECH is the only dedicated manufacturing R&D done by the Air Force. MANTECH projects generate advanced manufacturing techniques, methods, processes, and equipment that make it possible to transition advanced product designs into producible, high quality, cost-efficient weapon systems and components. MANTECH is critical to maintaining a strong defense industrial base and solving manufacturing challenges that influence domestic manufacturing competitiveness.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments

- Continued program to establish manufacturing methods for composite fuselage components that will reduce fabrication costs by 50%.
- Continued exploration of better ways to make advanced materials to produce critical engine parts and advanced manufacturing methods for engine components using advanced materials and design concepts.
- Continued work on improved fabrication and inspection of very high speed integrated circuit printed wiring boards.
- Continued work on producibility of electronic subsystems, flexible microelectronics manufacturing systems, and advanced radar modules.
- Continued work on a flexible repair center concept that will reduce engine case repair time and initiate work on providing computerized reprocurement data in support of Computer Aided Acquisition and Logistics Support Program.
- Continued taking advantage of new computer manufacturing techniques and processes to reduce production lead time, non-touch and touch labor, in process inventories and manufacturing floor space requirements.

Program Element: #0708011F
PE Title: Industrial Preparedness
Project Number: 2865
Budget Activity: #6 - Defense-Wide

- Tailored latest metal cutting, cutting tools, machining data and systems technology to meet manufacturing subcontractors needs.
- Expanded efforts to revitalize machine tool industry.
- Focused on producibility and yield increases of new electronic systems using focal plane arrays, radiation hardened chips, peripheral circuits for memories and solar cells.
- Continued work on developing cost-effective manufacturing of complex shaped thermoplastics, rugate filters, and intelligent machining work stations.
- Continued support of the National Center for Manufacturing Sciences (NCMS).
- Initiated a program to scale up advanced propellant binder materials.

(U) FY 1990 Planned Program:

- Initiate activities to significantly reduce the cost of manufacturing conventional composite structures.
- Initiate programs to establish a viable industrial base to produce high temperature materials.
- Continue work on advanced manufacturing processes and fabrication techniques for propulsion components.
- Complete work on fabrication and inspection of very high speed integrated circuit printed wiring boards.
- Continue work on producibility of electronic subsystems, flexible microelectronics manufacturing systems, and advanced radar modules.
- Initiate activities to establish laser repair techniques for AFLC.
- Continue work on information management and integration technologies to reduce lead time and non-touch labor costs.
- Focus on producibility and yield increases of new electronic systems using focal plane arrays, radiation hardened chips, peripheral circuits for memories, and solar cells.
- Continue long range manufacturing science programs in composites, carbon/carbon materials and three dimensional modeling for castings.
- Continue support to machine tool industry and the National Center for Manufacturing Sciences.

(U) FY 1991 Planned Program

- Complete initial efforts on establishing techniques for thermoplastic composite airframe structures.
- Continue structural materials initiative for airframe manufacture.
- Continue efforts on materials and fabrication techniques for critical engine components.
- Complete activity focused on composite manufacture for small engines.

Program Element: #0708011F
PE Title: Industrial Preparedness
Budget Number: 2865
Budget Activity: #6 - Defense-Wide

- Continue efforts on producibility of electronic subsystems, flexible microelectronics systems, and advanced radar modules.
- Complete work on establishing a flexible repair center for engine cases and continue efforts on laser repair techniques.
- Initiate composite repair processes for ALC insertion.
- Complete activities focused on information integration applied to airframe assembly.
- Continue work on information management and integration technologies to reduce lead time and non-touch labor costs.
- Continue efforts to revitalize the domestic machine tool industry.
- Complete efforts on manufacturing techniques for focal plane arrays and solar cells.
- Complete efforts on assembly techniques for tactical missile sensors.
- Complete science base activities in composites and rugate filters.
- Continue long-range manufacturing science programs in electronic packaging, carbon materials and three-dimensional modeling for castings.

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

D. (U) WORK PERFORMED BY: MANTECH is executed by the Wright Research & Development Center, Wright-Patterson AFB, OH., Manufacturing Technology Directorate. Actual work, however, is competitively contracted for with private industry or universities. The top five contractors are General Electric Company, Evendale, OH; United Technologies Corporation, West Palm Beach, FL; Northrop Corp, Hawthorne, CA; NCMS, Ann Arbor, MI; and Texas Instruments, Dallas, TX.

E. (U) COMPARISON WITH 1990/91 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: None.
2. SCHEDULE CHANGES: None.
3. COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:

- DOD Instruction 4200.15, Manufacturing Technology, 5/85
- Defense Guidance, 12/85.

Program Element: #0708011F
PE Title: Industrial Preparedness
Budget Number: 2865
Budget Activity: #6 - Defense-Wide

G. (U) RELATED ACTIVITIES:

- The Army, Navy and Defense Logistics Agency have PE 0708011 MANTECH programs that are coordinated with this program.
- Other government agencies like NASA, the Defense Advanced Research Projects Agency, the Strategic Defense Initiative, and the National Institute of Standards & Technology (NIST) pursue manufacturing technology development.
- Individual weapon system program managers do manufacturing research specifically related to their weapon systems.
- Manufacturing technology efforts are coordinated through the DOD MANTECH Advisory Group that includes industry representatives.
- The Manufacturing Technology Directorate at Wright-Patterson AFB is the Air Force's single focal point for all manufacturing technology activity.
- The Air Force does other industrial preparedness and productivity enhancing activity such as Industrial Base Planning, the Industrial Modernization Incentives Program (IMIP), and the operating of thirteen government-owned, contractor-operated industrial plants. These are funded with procurement appropriations.
- There is no duplication of effort with the Air Force or DOD.

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

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

J. (U) MILESTONE SCHEDULE: Not Applicable. Project dedicated to manufacturing process, methods and equipment development in support of generic weapon system manufacturing needs.

FY 1991 Manufacturing Technology Program
TITLE: INDUSTRIAL PREPAREDNESS

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support
Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Support Project (Title) ID (End Items Supported) Thrust Number	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
AIRCRAFT PROCUREMENT, AIR FORCE					
A 0005 Manufacturing Methods for Thermoplastics ATF, F-16, F-15, Future Systems (1) - 1	3850	2500	1500	0	10400
A 0268 MT for Advanced Tooling Concepts - 1	0	2000	2800	3000	7800
A 0269 Advanced Oxidation Resistant Allow Powder Classified Applications - 2	1185	752	0	0	2937
A 0008 MT for Advanced Propulsion Materials Advanced Fighter Engine, Future Systems- 3	13200	8280	2480	565	61994
A 0249 Structural Materials Manufacturing Initiative Engines, Future Aircraft - 3	0	123	6392	10649	17164
A 0273 Premium Quality Ti Alloy Disk Material Advanced Engines - 3	700	1200	800	1500	4200
A 0300 Automated Fabrication of Small Engine Composite Compressor Rotors Missile Engines - 3	1085	710	654	0	2809
A 0021 Machining for Aerospace Subcontractors F-16, ATF, B-1, Advanced Systems - 6	3283	1300	0	0	12719

00773

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support

Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Support Project (Title) ID (End Items Supported) Thrust Number	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
AIRCRAFT PROCUREMENT, AIR FORCE					
A 0022 Integrated Composites Center F-15, F-18, AV-8B, ATF - 6	1000	357	0	0	8007
A 0011 MT for Solid State Microwave Circuits ATF Radar, Satellites - 4	3240	429	0	0	17504
A 0372 MT for Transmit/Receive Modules ATF Radar, Future Systems, Satellites - 4	1740	3950	6000	9700	21390
A 0181 Automated Airframe Assembly ATF, Future Systems - 6	3850	3790	1380	0	21285
A 0301 On Line Information System All Systems - 6	100	1000	2000	17900	21000
Total Aircraft Procurement, Air Force, Related			24006		

00774

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support

Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Support Project (Title) ID (End Items Supported) Thrust Number	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
MISSILE PROCUREMENT, AIR FORCE					
A 0303 Advanced Binder Materials Future Tactical Strategic Missiles - 7	500	746	1521	1000	3767
A 0032 MT for HgCdTe Focal Plane Arrays BSTS. Tactical; Systems - 8	2280	2250	1283	0	10699
A 0200 MT for Bubble Memory Peripheral Electronics DSCS, MILSTAR, Advanced Satellites - 8	785	381	0	0	1878
A 0221 MT for Radiation Hardened SOI Wafers DSCS, MILSTAR, Advanced Satellites - 8	650	1300	1300	3950	7200
A 0275 MT for Rugged, Thin GaAs Solar Cells Advanced Satellites - 8	1000	500	388	0	1938
A 0319 Electronics Producibility - IR Sensor SFW, Adv. Munitions - 9	1300	1000	200	0	2500
Total Missile Procurement, Air Force, Related			4692		

00775

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support

Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Support Project (Title) ID (End Items Supported Thrust Number	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
O&M, AIR FORCE					
A 0015 Robotic/Application/Paint Stripping	1370	415	0	0	4401
A 0187 Static & Accessory Repair Engine Repair - 5	3300	1770	0	0	7363
A 0226 Oklahoma City ALC Flexible Repair Center Engine Case Repair - 5	5500	3000	2400	0	10900
A 0255 Robotic Applications/Shot Peen Engine Repair - 5	20	1250	1000	980	3250
A 0276 SPARES (CALS) Spares Acquisition - 5	0	1000	2250	5750	9000
A 0224 Laser Paint Stripping Aircraft Repair - 5	0	300	1800	1050	3150
A 0366 Laser Blade/Vane Repair Engine Repair - 5	0	400	900	1000	2300
A 0367 Laser Solder/Desolder Electronics Repair - 5	0	100	500	2100	2700
A 0318 Robotic Deseal Airframe Repairs - 5	1500	1150	50	0	2700
Total O&M, Air Force, Related			8900		

00776

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support

Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) ID (End Items Supported) Thrust Number	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
GENERIC PROCUREMENT					
A 0010 Advanced Data Signal Processing (VHSIC) All Systems - 4	2000	853	0	0	21858
A 0245 MT for Holographic Wafer Inspection All Systems - 4	700	178	0	0	928
A 0320 Electronics Producibility - Power Supply All Systems - 4	20	200	1300	2580	4100
A 0295 Microelectronics Manufacturing Science and Technology All Systems - 4	6000	5000	6000	15500	32500
A 0339 Next Generation Controller All Systems - 6	250	5050	5175	11025	21500
A 0026 Manufacturing Technology Special Studies All Systems - 6	100	6955	6742	8047	21844
A 0308 Machine Tool Initiative All Systems - 6	2000	1564	2000	1436	7000
A 0368 MT Program Assessment & Utilization All Systems - 6	0	50	1662	1950	3662

00777

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support

Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) ID (End Items Supported) Thrust Number	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
GENERIC PROCUREMENT, AIR FORCE					
A 0374 Integrated Technology Test Bed - 6	0	30	200	770	1000
A 0369 Tool Kit All Systems - 6	0	30	500	2470	3000
A 0028 MT Program Assessment All Systems - 6	2650	2700	0	0	7043
A 0370 PDES Application All Systems - 6	0	30	500	2970	3500
A 0362 ISPRO All Systems - 6	0	10	100	490	600
Total Generic Procurement, Air Force, Related			24179		

00778

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support

Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) ID (End Items Supported)	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
R&D, AIR FORCE					
A 0182 Intelligent Machining Workstation Generic Applicability - 10	1700	809	0	0	4884
A 0183 Complex Shaped Thermoplastic Generic Applicability - 10	337	200	185	0	722
A 0191 Rugate Filters Generic Applicability - 10	522	420	72	0	2352
A 0263 Automated Airframe Assembly Generic Applicability - 10	1650	1550	634	0	4650
A 0304 Knowledge Integrated Design System Generic Applicability - 10	350	2000	1600	2000	5950
A 0305 Manufacturing Science for Carbon-Carbon Generic Applicability - 10	0	500	1500	2800	4800
A 0306 Advanced Composite Processing Generic Applicability - 10	800	1000	400	0	2200
A 0236 HBC Initiative Generic Applicability - 10	60	120	120	150	450
A 0328 Electronics Packaging Generic Applicability - 1	0	11	1000	3940	4951
A 0372 Design for Mfg, Adv Nozzle Generic Applicability - 10	0	200	700	600	1500
Total R&D, Air Force Related			6211		

Program Element: 0708011F
DoD Mission Area: 480 - Production Base Support

Budget Activity: 6 Defense Wide Mission Support

Procurement Appropriation Supported Project (Title) ID (End Items Supported) Thrust Number	FY1989 Actual	FY1990 Estimate	FY1991 Estimate	To Complete	Total Est Cost
DIRECTED PROGRAM					
A 0274 National Center for Manufacturing Science Grant Generic Application - 10	5000	7893	0	0	17893
Program Support	3200	5685	4145	N/A	N/A
Total			4145		
Overall Total			72133		

00780

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0708026F
PE Title: Productivity, Reliability, Availability, Maintainability (PRAM)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title PRAM

Popular Name	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
PRAM	19,166	19,158	20,187	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The PRAM Program responds to requirements for increased combat capability and reduced cost of ownership in new and fielded weapon systems and equipment. Program objectives are accomplished through investment in 118 active projects. Program goals include: (1) Enhancing combat mission accomplishment through improvements in reliability and maintainability of equipment, parts, and procedures; (2) Improving effectiveness of the support structure at depot and base levels through improved repair processes, inspection techniques, support equipment, and documentation; (3) Exploiting lower life cycle cost alternatives on systems through component improvements; and (4) Adding leverage to the Air Force defense budget by applying industry's technological advances to the force inventory where rapid returns on investment can be realized without extensive additional research and development.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1989 Accomplishments:
   - (U) Flight tested and qualified a new high reliability, maintenance-free battery (sealed lead acid technology) for F-4 and C-130 aircraft. Testing continues on A-10 and C-141 aircraft as well as ground support equipment to solve one of the DoD's most severe support problems.
   - (U) Prototyped and installed a stationary neutron radiography non-destructive inspection (NDI) system at Sacramento ALC to provide early corrosion detection capability for large aircraft sections (initially for the F-111 with targeted application for ATF).
   - (U) Completed design, fabrication and flight test of F-16 thermoplastic avionics enclosures to reduce weight and cost and improve producibility. Production break-in scheduled in FY 90 for F-16C/D. Technology already applied in ATF and A-12 proposals.
   - (U) Successfully demonstrated and flight tested a material for absorbing vibration on the A-10 engine inlet ring which has historically been failing due to aeroacoustic vibration with subsequent ingestion by the engine.

Program Element: #0708026F
PE Title: Productivity, Reliability, Availability, Maintainability (PRAM)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

2. (U) FY 1990 Planned Program:
   - (U) Begin the design of the E-3A Klystron Power Amplifier (KPA) Hot Mock-Up to improve the R&M on the KPA and reduce the "burn-in" time on the aircraft. Will result in 32 more E-3A sorties per year and provide Tinker AFB with an "I"-level capability for approximately 67% of the E-3A electrical problems.
   - (U) Reduce the F-16 War Reserve Material (WRM) 370 gallon fuel tanks assembly time from an unacceptable 26 man-hours to less than 10 man-hours. Change the technical orders to allow not only faster assembly by unskilled personnel but eliminate the critical fuel leak problem.
   - (U) Reduce the number of circuit card components and improve the R&M and producibility of the Doppler Velocity Sensor on the TACIT RAINBOW missile using ASCI chip technology. EEPROM will be used to provide improved repair capability and maintenance history recording.
   - (U) Design and construct a new robotic painting and stripping process for F-15 aircraft at Warner Robins ALC. Will increase the Programmed Depot Maintenance (PDM) paint capability from 20 aircraft per year to the required 200 aircraft per year. WR-ALC will be able to absorb more workload on C-141 and C-130 aircraft as well.
   - (U) Design and develop one Shop Replaceable Unit (SRU) for the main and scratch pad memory modules to replace 10 SRU designs being used on the F-15's APG-63 radar system. The project will address significant reliability and potential obsolescence problems.

3. (U) FY 1991 Planned Program:
   - (U) Replace the B-52 cartridge starter wheel assembly with a ceramic turbine wheel. This technology upgrade in ceramics will reduce production costs by 66% and weight by 15%. This prototyping, if successful, will be applicable to all cartridge starters and possibly air cycle machines.
   - (U) Design and build an Aircraft Battle Damage Repair (ABDR) Simulator to greatly enhance training of Combat Logistics Support Squadrons (CLSS) in repair of weight-saving material in current and future USAF weapon systems.
   - (U) Qualify a new corrosion resistant high temperature aluminum alloy for the F-15 C/C main wheel. This new Rapid Solidification Technology wheel will double time between maintenance intervals due to higher temperature strength and corrosion resistance. Will become the new "USAF wheel" with wide application to next generation aircraft.
   - (U) Procure and field test a commercially available aircraft avionics dehumidification system currently being used successfully on NATO F-16 aircraft. Benefits expected are significant R&M enhancements and greatly reduced corrosion in avionics equipment.

Program Element: #0708026F
PE Title: Productivity, Reliability, Availability, Maintainability (PRAM)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

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

D. (U) WORK PERFORMED BY: The PRAM Program Office (a division of the Air Force Office of Logistics Technology Application) is located at Wright-Patterson AFB, OH. Satellite PRAM offices with full time PRAM managers are located at each of the five AF Logistics Centers, the Aerospace Guidance and Metrology Center, Newark OH; and at SAC, MAC, TAC, and ATC. PRAM liaison personnel are also located at each of the other major air commands. The AF Wright Research and Development Center and AF Systems Command product divisions also participate in the PRAM Program Office. The largest participating contractors are General Dynamics, Dallas-Ft. Worth, TX; Westinghouse Corp., Baltimore, MD; McDonnell-Douglas, St. Louis, MO; and Lockheed Aircraft Systems, Marietta, GA.

E. (U) COMPARISON WITH FY 1990/91 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION: Not Applicable

G. (U) RELATED ACTIVITIES:
- (U) Complementary role with the Reliability & Maintainability Technology Insertion Program (PE0604609F) and the Aircraft Engine Component Improvement Program (CIP) (PE 0604268F) as it relates to reliability and maintainability improvements in operational engines. PRAM's charter specifically prohibits projects which are already covered by CIP however.
- (U) Firm commitments for follow on implementation of successfully completed PRAM prototyping is required before projects are approved and funded.
- (U) All PRAM projects are closely coordinated with the AF laboratories to preclude duplication of effort and to take advantage of technology advances emanating from the laboratory environment.
- (U) All PRAM projects are reviewed for potential Army/Navy interest, and dialogue is established in cases where commonality of problems exist such that solutions become DoD-wide.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

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

J. (U) MILESTONE SCHEDULE: Not Applicable.

FY1991 RDT&E DESCRIPTIVE SUMMARY

PE: #0901218F Budget Activity: #6-Defense-wide Mission Support
PE Title: Civilian Compensation Program

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Total	0	4,148	4,478	Cont	TBD

B. (U) BRIEF DESCRIPTION OR ELEMENT:
This program element provides funds for payment of civilian compensation benefits for disability due to personal injury sustained while in the performance of duty or due to employment-related disease according to the Federal Employees' Compensation Act (FECA) under 5 U.S.C. Chapter 81. The Department of Labor administers this program but charges the Department of the Air Force for its employee costs. This PE excludes manpower authorizations and costs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1989 Accomplishments:
- (U) To properly realign resources to capture true cost by appropriation, Air Staff has directed that disability compensation shall be paid from the actual appropriation generating the costs.

- (U) The amounts cited above will fund only disability compensation of personnel assigned to RDT&E activities.

- (U) This is not a new start but a realignment of charges to the proper appropriation rather than having the O&M 3400 appropriation pay for all Air Force employees. Funds to cover this R&D program will be transferred from O&M for FYs 90-94 since they were initially included in the O&M FYDP.

(U) FY 1990 Planned Program:
- (U) Continuing level of effort program to compensate employees assigned to RDT&E facilities for work related injury or disease.

(U) FY 1991 Planned Program:
- (U) Continuing level of effort program to compensate employees assigned to RDT&E facilities for work related injury or disease.

(U) Work Performed By: Private civilian health care providers including hospitals, physicians, and contractors providing nursing services, rehabilitation services, prosthetic appliances, and burial services. Bills for these services are paid by the Department of Labor, which bill the Department of the Air Force for the total cost of benefits and other payments made on account of the injury or death of employees or individuals under the jurisdiction of their agency.

(U) Related Activities:
- (U) There is no duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #1001004F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: International Activities

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2446 von Karman Institute	390	400	400	Cont	TBD
2447 SHAPE Technical Centre/AGARD/Cooperative R&D	2,724	2777	3,611	Cont	TBD
Total	3,114	3177	4,011	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program satisfies Department of Defense (DOD) executive agent responsibilities for the North Atlantic Treaty Organization (NATO) Advisory Group for Aerospace Research and Development (AGARD) in Paris, France and for the Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC) in The Hague, Netherlands; pays for United States scientists at STC; supports U.S. Air Force participation in cooperative research and development (R&D) agencies and groups; and pays the United States' share of NATO support for the von Karman Institute (VKI) in Brussels, Belgium. Support of this program is a continuing international commitment under the auspices of NATO and our mutual weapons development agreements with our allies.

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

1. (U) Project #2446, von Karman Institute: Funds the continuous U.S. share of NATO support for the von Karman Institute in Brussels, Belgium.

(U) FY 1989 Accomplishments:
- (U) Funded 12.5% of the international budget of the VKI
- (U) Supported five fellowships for U.S. students at the VKI
- (U) VKI annually graduates over 70 scientists, conducts 10 lecture series and publishes numerous technical reports

(U) FY 1990 Planned Program:
- (U) Continue funding U.S. share of VKI's international budget
- (U) Continue funding five fellowships per year
- (U) Fund initial stages of VKI/U.S. Air Force Academy cooperative program

(U) FY 1991 Planned Program:
- (U) Continue funding U.S. share of VKI's international budget
- (U) Continue funding five fellowships per year

Program Element: #1001004F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: International Activities

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

(U) Work Performed By: Not applicable.

(U) Related Activities:
- (U) Not Applicable
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements:
- (U) NATO support funding agreements.

2. (U) Project #2447, Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC)/Advisory Group for Aerospace Research and Development (AGARD)/Cooperative Research and Development (R&D): Supports USAF participation in cooperative research and development agencies and groups.

(U) FY 1989 Accomplishments:
- (U) Financially supported the participation of up to 100 experts in AGARD technical panels and working groups.
- (U) Funded 21 scientist and engineer positions at STC.
- (U) Funded all aspects of Air Force international cooperative R&D (ICR&D) to include setting up conferences, travel and per diem to attend meetings, contractor support, and operations at our European liaison offices.

(U) FY 1990 Planned Program:
- (U) Continue AGARD support
- (U) Continue funding U.S. STC positions
- (U) Continue funding ICR&D efforts

(U) FY 1991 Planned Program:
- (U) Continue AGARD support
- (U) Continue funding U.S. STC positions
- (U) Continue funding ICR&D efforts

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

Program Element: #1001004F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: International Activities

(U) Work Performed By: Leading U.S. civilian and military scientists, engineers and administrators; and the TECHPLAN Corporation of Marlton, New Jersey. The Deputy for International Programs in the Office of the Assistant Secretary of the Air Force (Acquisition) administers the program.

(U) Related Activities: Supports
- (U) US Mutual Weapons Development Data Exchange Program
- (U) Information Exchange Projects
- (U) The Technology Cooperative Program (United Kingdom/Canada/Australia/New Zealand)
- (U) U.S. Air Force Senior National Representative activities
- (U) NATO Conference of National Armaments Directors
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: This program, as the title indicates, deals entirely with International Cooperative Research, Development, Test and Evaluation (RDT&E). See above for detailed explanation.

MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES

Department/Agency: Air Force

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 of all such projects accomplished in FY 88 and FY 89 and planned in FY 90 and FY 91.

SECTION I - Projects Accomplished or Underway

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
Refurbish Complex 40 MODS 1_/*	35119F	Martin Marietta	Cape Canaveral AFS, FL		45,000	70,000	70,000
Alter Integrate-Transfer Launch (ITL) Facilities 1_/	35119F	Martin Marietta	Cape Canaveral AFS, FL	11,000	7,100		
PLF Processing Annex, ITL Expansion 1_/	35119F	Martin Marietta	Cape Canaveral AFS, FL		10,000		
Medium Launch Vechicle (Atlas II) Program 1_/	35119F	General Dynamics	Cape Canaveral AFS, FL	1,500	9,100	4,500	
Titan (IV) Facilities 1_/	34111F	Stearns-Roger	Vandenberg AFB, CA		6,600	12,000	13,000
Solid Rocket Motor Upgrade 1_/	35119F	Martin Marietta	Edwards AFB, CA	13,000			
Addition to Electronic Research Laboratory 1_/*	Various	MIT Lincoln Lab	Hanscom AFB, MA Bldg 1312L	50	395	3,532	
Addition to Electronic Research Laboratory 1_/	63250F	MIT Lincoln Lab	Hanscom AFB, MA Bldg 1312L	50	243	2,240	
Addition to Electronic Research Laboratory 1_/*	63250F	MIT Lincoln Lab	Hanscom AFB, MA Bldg 1302C		150	459	

SECTION I - Projects Accomplished or Underway (Cont'd)

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
Near Field Anechoic Chamber 1_/*	63424F	MIT Lincoln Lab	Hanscom AFB, MA	121	893		
Contractor R&D ATF Dem/Val Facility 1_/	63230F	Various	Edwards AFB, CA	9,800			

Part 1. Utilization of Section 2353, Title 10 Authority

SECTION II - Projects Planned or Projected

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
Contractor Provided Facilities for Solid Rocket Motor Upgrade 1_/	35119F	Martin Marietta	Vandenberg AFB, CA			4,000	
Hazardous Processing Facility 2_/	33110F	GE	Cape Canaveral AFS, FL				9,600
MDT Upgrades, Integrate-Transfer Launch (ITL) Facilities 1_/*	35119F	Martin Marietta	Cape Canaveral AFS, FL			25,000	
PLF Cleaning (VIB Modification) 2_/	35119F	Martin Marietta	Cape Canaveral AFS, FL			3,000	
Solid Rocket Motor Upgrade 1_/*	35119F	Martin Marietta	Cape Canaveral AFS, FL			18,000	
Addition to Chemical Stock Facility 1_/*	63250F	MIT Lincoln Lab	Hanscom AFB, MA Bldg 1302M			881	
Dynamic Coherent Measurement Complex (DYCOMS) 1_/	65809F	EG&G	White Sands Missile Range				4,300
Modification to Contractor Hazardous Fuel Storage Fac 2_/	Various		Cape Canaveral AFS, FL			1,750	

Part 2. Utilization of RDT&E Appropriation for Facilities at Government-Owned/Government-Operated Installations

DOD Manual 7110-1-M provides that RDT&E appropriations 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. Facilities which are consumed in R&D test and evaluation, prototype facilities/equipment, and temporary facilities are also financed as part of the R&D appropriation involved since their intended utility expires when a test is completed. (Note: Contractor-operated facilities are included in Part 1.) The table below provides a summary listing of all such projects for the the installation of equipment, where the cost of installation is more than $200,000, accomplished in FY 88 and FY 89, and planned in FY 90 and FY 91.

SECTION I - Projects Accomplished or Underway

Facility/Equipment	RDT&E Program Element	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
Equipment Installation Projects Follow						
Modernize Component Research Air Facility 1_/	62203F	Wright-Patterson AFB, OH Bldgs 18B, 18C and 18E		528		
Low Observables R&D 1_/	63003F	Wright-Patterson AFB, OH Bldg 254	1,250			
Sensitive Compartmented Information Facility (SCIF) 1_/	20006F	Hanscom AFB, MA Bldg 1614	126			
Upgrade Arc Heater 1_/	64755F	AEDC, Arnold AFB, TN		549		
Test Facility Plant Automation 1_/	65807F	AEDC, Arnold AFB, TN			140	34
Freejet Test Cell C2 1_/*	Classified	AEDC, Arnold AFB, TN		800	450	600
T3 Modification 1_/*	Classified	AEDC, Arnold AFB, TN		495	463	1,836
Flex Nozzle Equip Tunnel 4T 1_/*	65807F	AEDC, Arnold AFB, TN		848		
Upgrade Air Conditioning System 1_/	65896F	Edwards AFB, CA, Bldg 145		599		

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Part 2. Utilization of RDT&E Appropriation for Facilities at Government-Owned/Government-Operated Installations

SECTION I - Projects Accomplished or Underway

Facility/Equipment	RDT&E Program Element	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
Equipment Installation Projects (Cont'd)						
Tempest Shielded Room 1_/	Classified	Edwards AFB, Ca	206			
Contractor R&D ATF Dem/Val Facility 1_/	63230F	Edwards AFB, CA	9,800			
Chemical Analysis Equipment 1_/	62102F	Wright-Patterson AFB, OH Bldg 20450		400		
CRAY X-MP/4XX Computer System 1_/*	62201F, 62202F 62203F, 62204F	Wright-Patterson AFB, OH Bldg 20676	293		400	
Computer-Aided Engineering (CAE) Support 1_/	65807F	Wright-Patterson AFB, OH Bldgs 20005, 30206 and 30207		100	450	
Prototype/Test Facilities Follow						
Small ICBM Program 1_/*	64312F	Various	9,000	900		
Peacekeeper Rail Garrison Basing 1_/*	64312F	Various	3,400	36,600	41,800	7,500
Atmospheric Compensation Facility 1_/	63605F	Kirtland AFB, NM		100	2,000	1,300
Temporary Construction Projects Follow						
C-17A Airdrop Test Complex 1_/	64231F	Edwards AFB, CA		4,300		
SRAM II Integration 1_/	63364F/64226F	Edwards AFB, CA		1,848		

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Part 2. Utilization of RDT&E Appropriation for Facilities at Government-Owned/Government-Operated Installations

SECTION II - Projects Planned or Projected

Facility/Equipment	RDT&E Program Element	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
Equipment Installation Projects Follow						
Reentry Systems Launch Program 1_/*	64312F	Various			1,500	
Foundry Processing Equipment 1_/		Wright-Patterson AFB, OH Bldg 20655				2,500
Turbine Research Laboratory 1_/*	62203F	Wright-Patterson AFB, OH Bldg 71B, J-Bay			413	
Anechoic Chamber Research Lab 1_/*	21002F	Wright-Patterson AFB, OH Bldg 4A			1,000	
Warfare Hot Bench Development System 1_/*	62204F	Wright-Patterson AFB, OH Bldg 620				500
Clean Room Support Area 1_/*	62204F	Wright-Patterson AFB, OH Bldg 620			500	
Combustion Air Heaters & Exhaust System 1_/	62204F	Wright-Patterson AFB, OH Bldg 490				750
Environmental Control System for Clean Rooms 1_/*	62204F	Wright-Patterson AFB, OH Bldg 620			450	450
Metal Organic Molecular Beam Epitaxial System 1_/	62204F	Wright-Patterson AFB, OH Bldg 620			495	495
RASPL Relocation 1_/*	62204F	Wright-Patterson AFB, OH Bldg 620				400

Part 2. Utilization of RDT&E Appropriation for Facilities at Government-Owned/Government-Operated Installations

SECTION II - Projects Planned or Projected

Facility/Equipment	RDT&E Program Element	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
Equipment Installation Projects (Cont'd)						
Upgrade Ballistic Range Capability 1_/	Various/Classified	AEDC, Arnold AFB, TN			1,235	540
High Temperature Lab Equipment 1_/*	RBA/TBD	AEDC, Arnold AFB, TN				1,000
R-Cells Instr & Control Equipment 1_/*	65807F	AEDC, Arnold AFB, TN			120	220
Freejet Test Cell C-1 1_/*	63269F	AEDC, Arnold AFB, TN				1,000
Improve Drier Reactivation 2_/	65807F	AEDC, Arnold AFB, TN			509	737
Test Unit Support System 2_/	65807/64755 Various	AEDC, Arnold AFB, TN			213	
Visual Simulation Display 1_/	64755F	Edwards AFB, CA			680	420
Temporary Construction Projects Follow						
Airborne Imagery Transmitter (ABIT) 1_/*	63727F	Wright-Patterson AFB, OH Bldg 620				300

1_/ Previously listed in RDT&E Congressional Exhibit
2_/ Initial listing
* Cost, Scope and/or Year Change

MAJOR IMPROVEMENTS TO AND CONSTRUCTIION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E

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 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 88 and FY 89, and estimated amounts planned for FY 90 and FY 91. All minor construction projects must result in a complete and usable facility. In no event two or more minor construction projects or minor and major construction projects to be contrived to form a usable facility.

	Total Obligation Authority (Thousands of Dollars)			
	1988	1989	1990	1991
Summary of Minor Construction Funded by RDT&E, Air Force	13,953	15,942	17,168	9,348

Summary of Major Improvements to and Construction of Government-owned Facilities

Subtotal Part 1	35,521	79,481	145,362	96,900
Subtotal Part 2	24,075	48,067	52,818	20,582
Subtotal Part 3	13,953	15,942	17,168	9,348
Grand Total	73,549	143,490	215,348	126,830

1 COMPONENT	FY 1990 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
		23 Aug 89

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
Hazardous Processing Facility for DSCS/IABS CCAFS, Cape Canaveral, FL	Hazardous Processing Facility

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
33110F			$9,600

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Hazardous Processing Facility	LS			(1,600)
SITE/Architectural/Structural.....	LS			(1,700)
Mechanical.....	LS			(5,700)
Electrical.....	LS			(2,200)
TOTAL.....	LS			9,600.

10 DESCRIPTION OF PROPOSED CONSTRUCTION

Prepare site work/roadways/retaining walls; miscellaneous demolition; construct blast resist wall; construct doors/gaskets and hardware; interior uplift of existing high bay; refurb office area; construct encapsulation/airlock areas; construct fueling areas; build HVAC System; Install scrubber and containment system; install breathing air system; install 5 ton bridge cranes; controls; install new fire suppression system and water deluge system; construct fuel/oxidizer aspiration system; have capability for nitrogen purge, vacuum, krypton venting; install communications and cable; install fire alarm, CCTV, controls, and gas detect systems; power distributions; install lighting systems; UPS capability; and lightning protection.

PROJECT: Hazardous Processing Facility for DSCS/IABS Program.

REQUIREMENT: The basic requirement is to launch 10 Defense Satellite Communication System (DSCS) satellite using the Atlas II launch vehicle instead of from the Space Shuttle. This requires the processing and fueling of the spacecraft at an off pad facility properly configured to accept this hazardous operation. The operation is under contract to General Electric and the government is providing an existing facility which General Electric will modify/upgrade to enable them to satisfy their contractual requirements since no existing facilities can be used without modifications to satisfy the new requirements.

CURRENT SITUATION: No existing facility identified that can support requirements or schedule.

IMPACT IF NOT PROVIDED: Delay of DSCS/Atlas II launches. (First launch May 1991)

(AFSC) AIR FORCE	FY 1990 MILIT.	UNCLASSIFIED	PROJECT DATA	2 DATE 6 Sep 89

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
CAPE CANAVERAL AFS, FLORIDA	VIB MODIFICATION, PAYLOAD FAIRING CLEANING FACILITY

5 PROGRAM ELEMENT	6 CATEGORY CODE	7. PROJECT NUMBER	8 PROJECT COST ($000)
35119 F			$3,000

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
ADDITION TO VIB BLDG: PAYLOAD FAIRING CLEANING FACILITY				$3,000

10 DESCRIPTION OF PROPOSED CONSTRUCTION

Modify/construct facilities necessary for Contractor Class 100,000 cleaning of Titan IV payload fairing sectors to prepare fairing for shipment to launch pad (Space Launch Complex 40 or Space Launch Complex 41) at Cape Canaveral AFS, Florida. Modifications include civil work for roadway access, relocation of parking areas, Structural and electrical modifications to existing VIB bldg.

PROJECT: Modify VIB to provide payload fairing cleaning facility.

REQUIREMENT: Recently revised criteria require fairings to be cleaned to clean class 100,000 standards prior to being placed around the payload. Martin Marietta Corporation is on contract to deliver launch vehicles including the payload fairings but has no facility available to clean the fairing to the required standard. This project to be executed by Martin Marietta will provide the necessary facility capability to allow them to meet the terms of their contract and satisfy Air Force standards. The present contract requires Martin Marietta to deliver and launch 13 vehicles through FY93.

CURRENT SITUATION: Existing facilities are not configured to support the cleaning of payload fairings to the new Class 100,000 clean requirement.

IMPACT IF NOT PROVIDED: Significant schedule delays in launching payloads supporting the highest national priority programs. The Titan IV program will not meet Air Staff directed launch schedules.

1 COMPONENT	FY 1990 MILITA	UNCLASSIFIED	OJECT DATA	2 DATE

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
CAPE CANAVERAL AIR FORCE STATION	MODIFICATION TO CONTRACTOR HAZARDOUS FUELS STORAGE FAC

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
VARIOUS	411-139		1,750

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
MODIFICATION TO CONTRACTOR HAZARDOUS FUELS STORAGE FAC	LS			1,750
MECHANICAL	LS			(900)
ELECTRICAL	LS			(690)
				1,590
CONTINGENCY (10%)				(159)
				1,749
ROUNDED				1,750

10 DESCRIPTION OF PROPOSED CONSTRUCTION

Modifications to existing deluge system, vent flappers, flow meter, underground values, vapor detection system, tone telemetry system, fire alarms system, and lighting system.

11. Requirement

PROJECT: Modify existing contractor hazardous fuels storage facility to allow safe storage for special fuel and oxidiser. The contractor, as part of his services, will be required to meet all and fire and safety standards unless waived by appropriate offices.

REQUIREMENT: An appropriate storage facility needs to be modified to permit safe storage of a special fuel. Storage levels of two and four years for oxidiser and fuel respectively are required to assure continued missile and space shuttle launches. Stockpile is required to safeguard United States interests in the event supplier or circumstances prevent delivery of fuels and oxidiser. Storage Facility will provide fuel for a variety of missions.

CURRENT SITUATION: New criteria associated with these fuels require changes to existing contractor facility. The existing contractor facility cannot be used. Regulations governing road and rail transportation of these materials have been tightened making the need for on-site storage more critical.

The government is the only user of these fuels, and continues to rely on sole-source supply for their availability.

IMPACT IF NOT PROVIDED: Lack of adequate reserve stockpile storage for these propellants could seriously curtail or stop missile, space and communications satellite programs that are vital to our national defense and continued space exploration.

1 COMPONENT	FY 1990-91 RTD&E FACILITIES PROJECT DATA	2. DATE
AIR FORCE		26 July 89

3 INSTALLATION AND LOCATION	4 PROJECT TITLE EQUIPMENT INSTALLATION
ARNOLD AIR FORCE BASE, TENNESSEE 37389	Improve Drier Reactivation, V

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65807F	311-115	ANZY 880336	$1,246

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
IMPROVE DRIER REACTIVATION, V				
Equipment Installation	LS			1246
Valves & Piping	LS			(893)
Heater Systems	LS			(78)
Electrical & Controls	LS			(221)
Filters	LS			(54)
				1246
Cost of Purchased Equipment (non-add)	LS			(873)
Total Equipment Installation & Equip. Cost	LS			(2119)
Other Non-Add Costs:				
Design	LS			(211)

10 DESCRIPTION OF PROPOSED INSTALLATION

PROJECT: Modify two existing reactivation circuits, install two new reactivation circuits, and install all new process air filters for the V-Plant Driers 15 through 18. These driers provide process air to the von Karman Facility Wind Tunnels.

REQUIREMENT: Additional capability is needed to reduce the time required for reactivating the dessicant beds in von Karman Facility Driers 15 through 18 after they have become saturated with moisture from the process air. This capability will reduce the turn around time between tests, allow greater utilization of tunnel hardware and manpower, and allow more test data to be taken for a given period of time. Improved filtering of the process air to the von Karman Facility wind tunnels will reduce surface erosion of test models (improved heat transfer, pressure and aerodynamic data) and the schlieren windows (improved photographic data coverage of pressure wave profiles around the model).

CURRENT SITUATION: Each of two drier pairs is presently serviced by one hot-air circuit capable of reactivating the dessicant bed in only one of the driers at a time. Reactivation of the four driers when totally saturated takes approximately twenty-four hours. These systems have been in operation for thirty-five years, components and controls are outdated, operational efficiency reduced, and maintenance increased. The process air filter stations utilize oversize filter modules which cannot be removed from the driers once the existing reactivation circuits are modified. These modules currently have single-stage, 10-micron elements that will be replaced with 2-stage, 10 and 3-micron elements specially sized to go through an existing manway entry port.

00800

1. COMPONENT	FY 1990-91 RTD&E FACILITIES PROJECT DATA	2. DATE
AIR FORCE		26 July 89

3. INSTALLATION AND LOCATION
ARNOLD AIR FORCE BASE, TENNESSEE 37389-5000

4. PROJECT TITLE	5. PROJECT NUMBER
Equipment Installation-Improve Drier Reactivation, V	ANZY880336

IMPACT IF NOT PROVIDED: Long drier reactivation cycles will continue to hamper quick turn-around of von Karman Facility wind tunnel tests. Dust particle erosion of components in each tunnel test section will continue to effect quality of test data. Test schedules and overall AEDC capacity will be affected.

00801

1 COMPONENT	FY 1990-93 RDT&E FACILITIES PROJECT DATA	2 DATE
Air Force		14 AUG 89

3 INSTALLATION AND LOCATION	4 PROJECT TITLE EQUIPMENT INSTALLATION
Arnold AFB, Coffee County, TN 37389	Test Unit Support System (TUSS)

5. PROGRAM ELEMENT	6 CATEGORY CODE	7. PROJECT NUMBER	8 PROJECT COST ($000)
65807F	318614	ANZY900216	$793

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION				793
COST OF PURCHASED EQUIPMENT (NON-ADD)				(3614)
TOTAL INSTALLATION AND EQUIPMENT				(4407)
OTHER NON-ADD COST:				
Minor Construction*				(504)
Design				(178)
Checkout				(310)
Maintenance & Repair				(120)
Software				(300)
*Minor construction will not exceed $190K in any one year or in any one test area.				

10. DESCRIPTION OF PROPOSED INSTALLATION

PROJECT: The Test Unit Support System (TUSS) project is a 5-phase effort to automate operations and modernize three separate control rooms for three separate test units (Test Units T7, C1 and C2). This project procures and implements test area control systems to provide automatic control for selected test article and test facility functions. Each control room is a complete and usable, separate facility. New T7, C1 and C2 control rooms will be constructed and automatic control equipment will be installed and made operational

Phase I (FY89)	• Design the modifications to the existing T7 control room and control systems for compatibility with the new control equipment.
Phase II (FY90)	• Install the new test area control system in the new T7 control room and transfer all controls to the new equipment.
	• Design the modifications to C1 and C2 control room and control systems for compatibility with new control equipment.
Phase III (FY91)	• Construct new C1 control room.
Phase IV (FY92)	• Install the new test area control system in new C1 control room.
	• Construct new C2 control room.
Phase V (FY93)	• Install the new test area control system in new C2 control room.

REQUIREMENT: To provide safe, reliable and economical operational control of test article and facility systems during propulsion testing of jet engines including the ATFE.

CURRENT SITUATION: The existing test article and facility control systems were designed for extensive manual control prior to the advent of mini and micro computer systems. These systems require manual setup, monitoring, operation and logging during engine testing. This results in excessive time-consuming manual intervention in operations which consumes excessive amounts of electrical energy and jet fuel, and decreases useful engine life.

00802

1 COMPONENT	FY 1990-93 RDT&E FACILITIES PROJECT DATA	2 DATE
Air Force		14 AUG 89

3 INSTALLATION AND LOCATION
Arnold AFB, Coffee County, TN 37389

4 PROJECT TITLE	5 PROJECT NUMBER
Test Unit Support System (TUSS)	ANZY900216

IMPACT IF NOT PROVIDED: Without the implementation of this project, the test unit will continue to require excessive manpower and energy resources to accomplish test objectives. The Air Force initiative to upgrade and modernize the AEDC Turbine Engine Test Units will be delayed.

EQUIPMENT INSTALLATION	FY89	FY90	FY91	FY92	FY93
Electronic Equipment		213		290	290
DESIGN (NON-ADD)					
Systems Design	78		100		
NEW EQUIPMENT (NON-ADD)		1034		1290	1290
CHECKOUT (NON-ADD)		100		110	100
SOFTWARE (NON-ADD)		100		100	100
MINOR CONSTRUCTION (NON-ADD)		134	190	80	
MAINTENANCE & REPAIR (NON-ADD)		10		55	55

00803