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DEPARTMENT OF THE AIR FORCE

SUPPORTING DATA FOR FISCAL YEAR 1990/91 BIENNIAL BUDGET ESTIMATES

SUBMITTED TO CONGRESS JANUARY 1989

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DESCRIPTIVE SUMMARIES

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

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11. ~~A NOTE OF TWO-DIMENSIONAL LANDMARK-BASED OBJECT RECOGNITION/ON LANDMARK-BASED SHAPE ANALYSIS,~~ THE PASM PARALLEL PROCESSING SYSTEM: HARDWARE DESIGN AND INTELLIGENT OPERATING SYSTEM CONCEPTS, EXPERT SYSTEMS FOR THE SCHEDULING OF IMAGE PROCESSING TASKS ON A PARALLEL PROCESSING SYSTEM

ACKNOWLEDGEMENTS

I am deeply grateful to my thesis advisor Howard Jay Siegel, who has guided my work and my research in many ways. I am especially grateful for the confidence he placed in my handling of the PASM Parallel Processing Laboratory, even though I won't build the reconfigurable shared bus. I would like to extend my thanks to the other members of my advisory committee, David G. Meyer, Edward J. Delp, and Piyush Mehrotra for their guidance and efforts.

Special thanks go to Jim Kuehn who was always available to discuss ideas and designs, and who made sure that I would not forget that hardware and software must go hand in hand.

The design and construction of the PASM prototype would not have been possible save for the many people that helped me with that task. They are Aram Azadpour, Larry Bruner, Matt Davey, Nat Davis, Eric Demaree, Rod Graft, Andreas Gronefeld, Chuck Harrington, Steve Heinrich, Bill Hsu, Titus Kaufmann, Mike Krebs, Jim Kuehn, Phil Lampe, Kevin Lee, Mike McSherry, Daoud Nassimi, Wayne Nation, Ralf Nentwig, Tom Niswonger, Jim Ott, Pierre Pero, Ralf Schmitt, Stan Schwieterman, Stan Seibert, Pete Spreen, Vonzant Stoughton, Harry Vlahos, Carl Walker, Tom Wiseman, and Constantino Yap.

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DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF
THE DEPARTMENT OF THE AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM
FY 1990/FY 1991 BIENNIAL BUDGET ESTIMATES
JANUARY 1989

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 Years 1990/91 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 1990/91 RDT&E Program. A Test and Evaluation section is provided for major weapon systems. The formats and contents of this document are in accordance with the guidelines and requirements of the Congressional Committees insofar as possible.

(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 849-853 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 Years 1990/91 Descriptive Summaries entitled "Facilities Exhibits" (pages 862-898) contains information on major improvements to, and construction of, government owned facilities funded by RDT&E.

2. (U) Comparison of Fiscal Years 1988, 1989, 1990 and 1991 Data. A direct comparison of Fiscal Years 1988, 1989, 1990, and 1991 data shown in this document with corresponding data in the Descriptive Summaries dated February 1988 will reveal differences. Many of the differences are attributable to the following factors:

a. (U) Fiscal Year 1989 funding changes as a result of Congressional action on the appropriation and/or proposed RDT&E Reprogramming Actions.

b. (U) Fiscal Year 1988 funding changes between 1 October 1987 and 30 September 1988 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.

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

PROGRAM ELEMENT		REMARKS
BUDGET ACTIVITY 1: TECHNOLOGY BASE		
0601103F	University Research Initiatives	New program element for efforts previously funded under 0601103D.
BUDGET ACTIVITY 2: ADVANCED TECHNOLOGY DEVELOPMENT		
0603112F	Advanced Materials for Weapons Systems	New program element for two projects previously contained in PE 0603211F.
BUDGET ACTIVITY 3: STRATEGIC PROGRAMS		
0603428F	Space Surveillance Technology	New program element proposed for FY 1990/91 for efforts previously funded in 0603741D.
BUDGET ACTIVITY 4: TACTICAL PROGRAMS:		
0207134F	F-15E Squadrons	New program element for efforts previously contained in 0207130F.
0207163F	Advanced Medium Range Air-to-Air Missile	New program (AMRAAM Pre-planned Product Improvement (P3I)) proposed for FY 1990/91.
0207319F	Standoff Land Attack Missile	New program element proposed for 1990/91.
0207590F	SEEK EAGLE	Consolidated program element for certification and testing efforts.
0208006F	Mission Planning System	New program element proposed for FY 1990/91.
0208021F	Electronic Combat Support	New program element for efforts contained in 0604241F (FY88) and 0604270F (FY89).
0305887F	Electronic Combat Intelligence Support	New program element for efforts contained in 0604270F.

0603617F Command, Control and Communications Applications	New program element for four projects previously contained in PE 0603789F.
0604239F Advanced Tactical Fighter (ATF) FSD	New program element proposed for FY 1990/91.
0604244F SRAM II	New program element proposed for efforts previously contained in PE 0603364F.
0604245F Short Range Attack Missile - Tactical (SRAM-T)	New program element proposed for FY 1990/91.
0604246F Close Air Support Alternatives	New program proposed for FY 1990/91.
0604727F Joint Standoff Weapons	New program element for efforts previously contained in OSD PE 0604702D.

BUDGET ACTIVITY 5:
INTELLIGENCE & COMMUNICATIONS:

None.

BUDGET ACTIVITY 6:
DEFENSE-WIDE MISSION SUPPORT:

0604243F Manpower, Personnel and Training Development	New program element proposed for FY 1990/91.
0604408F Advanced Launch System	New program element proposed for FY 1990/91 for efforts started under SDI.
0901218F Civilian Compensation	New program element for efforts previously funded by O&M 3400.

4. (U) Classification.

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

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TABLE OF CONTENTS
BUDGET ACTIVITY, PROGRAM ELEMENT SEQUENCE

Note: Table of Contents in Program Element sequence starts on page xii.

ELEMENT CODE	TITLE	PAGE
#1 - TECHNOLOGY BASE		
0601101F	In-House Laboratory Independent Research	1
0601102F	Defense Research Sciences	3
0601103F	University Research Initiatives	22
0602101F	Geophysics	24
0602102F	Materials	33
0602201F	Aerospace Flight Dynamics	41
0602202F	Human Systems Technology	48
0602203F	Aerospace Propulsion	60
0602204F	Aerospace Avionics	66
0602205F	Personnel, Training & Simulation	78
0602206F	Civil Engineering & Environment Quality	88
0602302F	Rocket Propulsion	91
0602601F	Advanced Weapons	98
0602602F	Conventional Munitions	104
0602702F	Command/Control/Communication	110
#2 - ADVANCED TECHNOLOGY DEVELOPMENT		
0603106F	Logistics Systems Technology	118
0603109F	Integrated Electronic Warfare System (INEWS) Integrated Communications-Navigation-Identification Avionics (ICNIA)	122
0603112F	Advanced Materials for Weapon Systems	129

ELEMENT CODE	TITLE	PAGE
0603202F	Aerospace Propulsion Subsystem Integration	134
0603203F	Advanced Avionics for Aerospace Vehicles	137
0603205F	Aersopace Vehicle Technology	144
0603211F	Aerospace Structures	150
0603216F	Aerospace Propulsion and Power Technology	153
0603227F	Personnel, Training and Simulation Technology	159
0603231F	Crew System and Personnel Protection Tech	165
0603245F	Advanced Fighter TechnologyIntegration	173
0603250F	Lincoln Laboratory	179
0603253F	Advanced Avionics Integration	182
0603269F	National Aerospace Plane Technology	187
0603270F	Electronic Warfare Technology	191
0603302F	Space and Missile Rocket Propulsion	202
0603363F	Hypervelocity Missile	206
0603401F	Advanced Spacecraft Technology	209
0603410F	Space System Environment Interactions Tech	215
0603601F	Conventional Weapons	219
0603605F	Advanced Weapons Technology	227
0603707F	Weather Systems	237
0603723F	Civil/Environmental Engr Tech	239
0603726F	C3I Subsystem Integration	243
0603728F	Advanced Computer Technology	247
0603789F	C3I Technology Development	252

ELEMENT CODE	TITLE	PAGE
#3 - STRATEGIC PROGRAMS		
0603311F	Advanced Strategic Missile Systems	258
0603367F	Relocatable Target Capability Program	261
0603428F	Space Surveillance Technology	263
0604240F	B-2 Advanced Technology Bomber	265
0604244F	Short Range Attack Missile (SRAM II)	269
0604312F	Intercontinental Ballistic Missile (ICBM) Modernization	273
0604361F	Air Launched Cruise Missile (ALCM)	281
0604711F	Systems Surviability - Nuclear Affects	283
0101120F	Advanced Cruise Missile	286
0101142F	KC-135 Squadrons	291
0101213F	Minuteman Squadrons	293
0101312F	Post Attack Command and Control System	296
0101313F	War Planning Automated Data Processing (ADP) - Strategic Air Command (SAC)	298
0102310F	Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System	302
0102325F	Joint Surveillance System	321
0102411F	Surveillance Radar Stations/Sites	324
0102412F	Distant Early Warning (DEW) Radar Stations	327
0102417F	Over-the-Horizon Radar	329
0102423F	Ballistic Missile Early Warning System (BMEWS)	332
0102424F	Spacetrack	335
0102431F	Defense Support Program	341
0102432F	Sea Launched Ballistic Missile (SLBM) Radar Warning Systems	345

ELEMENT CODE	TITLE	PAGE
0102433F	Integration/Operation Nuclear Detonations (NUDETS) Detection System	347
0303131F	Minimum Essential Emergency Communications Network	350
0303152F	World Wide Military Command Control System (WWMCCS) Information System (WIS)	355
0303154F	WIS Joint Program Management Office (JPMO)	357
0303601F	Milstar Satellite Communications System (Air Force Terminals)	361
0303603F	Milstar Satellite Communications System (Space and Mission Control)	365
#4 - TACTICAL PROGRAMS		
0603230F	Advanced Tactical Fighter (ATF)	369
0603260F	Intelligence Advanced Development	382
0603307F	Air Base Operability Advanced Development	387
0603320F	Low Cost Seeker	390
0603617F	Comand Control and Communication Applications	392
0603742F	Combat Identification Technology	397
0604201F	Aircraft Avionics Equipment Development	400
0604212F	Aircraft Equipment Development	408
0604218F	Engine Model Derivative Program	410
0604222F	Nuclear Weapons Support	412
0604223F	Alternate Fighter Engine	414
0604231F	C-17 Program	417
0604233F	Tanker Transport Training System	421
0604236F	Infrared Search and Track System	423
0604237F	Variable Stability In-Flight Simulator Test Aircraft (VISTA)	425

ELEMENT CODE	TITLE	PAGE
0604239F	Advanced Tactical Fighter (ATF) Full Scale Development (FSD)	428
0604242F	Advanced Tactical Aircraft	431
0604243F	Short Range Attack Missile - Tactical (SRAM-T)	434
0604246F	Close Air Support Alternatives (CAS)	437
0604247F	Modular Automatic Test Equipment	439
0604249F	Night Precision Attack	444
0604250F	Integrated Electronic Warfare/Communications Navigation Identification Development	447
0604268F	Aircraft Engine Component Improvement Program	458
0604270F	Electronic Warfare Development	461
0604315F	Advanced Short Range Air-to-Air Missile	487
0604321F	Joint Tactical Fusion Program	489
0604327F	Hardened Target Munitions	492
0604601F	Chemical/Biological Defense Equipment	494
0604602F	Armament Ordnance Development	497
0604604F	Submunitions	505
0604607F	Wide-Area Anti-Armor Munition	507
0604617F	Air Base Operability	511
0604703F	Aeromedical Systems Development	516
0604704F	Common Support Equipment Development	518
0604706F	Life Support System	522
0604707F	Other Operational Equipment	527
0604725F	Combat Identification Systems	533
0604727F	Joint Standoff Weapons (JSOW) System	544
0604733F	Surface Defense Suppression	547

ELEMENT CODE	TITLE	PAGE
0604740F	Computer Resources Management Technology	550
0604750F	Intelligence Equipment	558
0604754F	Joint Tactical Information Dist System	561
0604756F	Side Looking Airborne Radar	566
0604770F	Joint Surveillance Target Attack Radar System (JSTARS)	568
0604779F	Joint Interoperability Tactical Command and Control	572
0207129F	F-111 Squadrons	574
0207133F	F-16 Squadrons	578
0207134F	F-15E Squadrons	583
0207136F	F-4G Wild Weasel Squadrons	587
0207162F	Tactical Air-to-Ground Missiles	592
0207163F	Adv Medium Range Air-to-Air Missile (Procmt)	594
0207168F	F-111 Self Protection Systems	597
0207215F	TR-1 Squadrons	600
0207217F	Tactical Air Reconnaissance System (TARS)	603
0207247F	Air Force TENCAP	613
0207316F	TACIT RAINBOW	615
0207319F	Standoff Land Attack Missile (SLAM)	619
0207411F	Overseas Air Weapon Control System	621
0207412F	Tactical Air Control System	623
0207417F	Airborne Warning and Control System	625
0207423F	Advanced Communication System	629
0207431F	Tactical Air Intelligence System Activities	634
0207590F	SEEK EAGLE	636

ELEMENT CODE	TITLE	PAGE
0208006F	Mission Planning Systems	639
0208010F	Joint Tactical Communication Program (Tri-Tac)	641
0208021F	Electronic Combat Support	643
0303605F	Satellite Communications Terminals	646
0305887F	Electronic Combat Intelligence Support	650
0401840F	Military Airlift Command (MAC) Command and Control System	652
0502610F	A-7 Squadrons (Air National Guard)	654
1110011F	Special Operations - Force Enhancements	662
#5 - INTELLIGENCE AND COMMUNICATIONS		
0301357F	Nuclear Detonations (NUDETS) Detection System	681
0303110F	Defense Satellite Communication System	684
0303126F	Long-Haul Communications	688
0303144F	Electromagnetic Compatability Analysis Center	693
0303401F	Communciations Security	695
0305114F	Traffic Control/Approach/Landing System	697
0305164F	NAVSTAR Global Positioning Systems (GPS) (User Equipment)	707
0305165F	NAVSTAR GPS (Space/Ground Segments)	712
#6 - DEFENSE-WIDE MISSION SUPPORT		
0603402F	Space Test Program	716
0603438F	Satellite System Surviability	724
0604211F	Advanced Aerial Targets Development	729
0604227F	Flight Simulator Development	731
0604243F	Manpower, Personnel & Training Development	749
0604408F	Advanced Launch System	751

ELEMENT CODE	TITLE	PAGE
0604609F	Reliability and Maintainability Technology Insertion Program (RAMTIP)	755
0604707F	Weather Systems	758
0604735F	Range Improvement	761
0604747F	Electromagnetic Radiation Test Facility	777
0604755F	Improved Capability for DT&E	781
0605101F	Project AIR FORCE	794
0605306F	RANCH HAND II Epidemiology Study	796
0605708F	Navigation/Radar/Sled-Track Test Support	798
0605807F	Test and Evaluation Support	802
0605808F	Advanced Systems Engineering/Planning	807
0605809F	Dynamic Coherent Measurement System (DYCOMS)	810
0605863F	RDT&E Aircraft Support	811
0605894F	Real Property Maintenance - RDT&E	816
0605896F	Base Operation Support (BOS) - RDT&E	820
0305110F	Satellite Control Facility	822
0305119F	Space Boosters	825
0305130F	Consolidated Space Operations Center (CSOC)	830
0305160F	Defense Meteorological Satellite Program (DMSP)	833
0305171F	Space Shuttle Operations	838
0701112F	Inventory Control Point Operations	841
0702207F	Depot Maintenance	843
0708011F	Industrial Preparedness	845
0708026F	Productivity, Reliability, and Maintainability (PRAM)	854
0901218F	Civilian Compensation Program	857
1001004F	International Activities	859

TABLE OF CONTENTS
PROGRAM ELEMENT SEQUENCE

ELEMENT CODE	TITLE	PAGE
0101120F	Advanced Cruise Missile	286
0101142F	KC-135 Squadrons	291
0101213F	Minuteman Squadrons	293
0101312F	Post Attack Command and Control System	296
0101313F	War Planning Automated Data Processing (ADP) - Strategic Air Command (SAC)	298
0102310F	Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System	302
0102325F	Joint Surveillance System	321
0102411F	Surveillance Radar Stations/Sites	324
0102412F	Distant Early Warning (DEW) Radar Stations	327
0102417F	Over-the-Horizon Radar	329
0102423F	Ballistic Missile Early Warning System (BMEWS)	332
0102424F	Spacetrack	335
0102431F	Defense Support Program	341
0102432F	Sea Launched Ballistic Missile (SLBM) Radar Warning Systems	345
0102433F	Integration/Operation Nuclear Detonations (NUDETS) Detection System	347
0207129F	F-111 Squadrons	574
0207133F	F-16 Squadrons	578
0207134F	F-15E Squadrons	583
0207136F	F-4G Wild Weasel Squadrons	587
0207162F	Tactical Air-to-Ground Missiles	592

ELEMENT CODE	TITLE	PAGE
0207163F	Adv Medium Range Air-to-Air Missile (Procmt)	594
0207168F	F-111 Self Protection Systems	597
0207215F	TR-1 Squadrons	600
0207217F	Tactical Air Reconnaissance System (TARS)	603
0207247F	Air Force TENCAP	613
0207316F	TACIT RAINBOW	615
0207319F	Standoff Land Attack Missile (SLAM)	619
0207411F	Overseas Air Weapon Control System	621
0207412F	Tactical Air Control System	623
0207417F	Airborne Warning and Control System	625
0207423F	Advanced Communication System	629
0207431F	Tactical Air Intelligence System Activities	634
0207590F	SEEK EAGLE	636
0208006F	Mission Planning Systems	639
0208010F	Joint Tactical Communication Program (Tri-Tac)	641
0208021F	Electronic Combat Support	643
0301357F	Nuclear Detonations (NUDETS) Detection System	681
0303110F	Defense Satellite Communication System	684
0303126F	Long-Haul Communications	688
0303131F	Minimum Essential Emergency Communications Network	350
0303144F	Electromagnetic Compatability Analysis Center	693
0303152F	World Wide Military Command Control System (WWMCCS) Information System (WIS)	355

ELEMENT CODE	TITLE	PAGE
0303154F	WIS Joint Program Management Office (JPMO)	357
0303401F	Communciations Security	695
0303601F	Milstar Satellite Communications System (Air Force Terminals)	361
303603F	Milstar Satellite Communications System (Space and Mission Control)	365
0303605F	Satellite Communications Terminals	646
0305110F	Satellite Control Facility	822
0305114F	Traffic Control/Approach/Landing System	697
0305119F	Space Boosters	825
0305130F	Consolidated Space Operations Center (CSOC)	830
0305160F	Defense Meteorological Satellite Program (DMSP)	833
0305164F	NAVSTAR Global Positioning Systems (GPS) (User Equipment)	707
0305165F	NAVSTAR GPS (Space/Ground Segments)	712
0305171F	Space Shuttle Operations	838
0305887F	Electronic Combat Intelligence Support	650
0401840F	Military Airlift Command (MAC) Command and Control System	652
0502610F	A-7 Squadrons (Air National Guard)	654
0601101F	In-House Laboratory Independent Research	1
0601102F	Defense Research Sciences	3
0601103F	University Research Initiatives	22

ELEMENT CODE	TITLE	PAGE
0602101F	Geophysics	24
0602102F	Materials	33
0602201F	Aerospace Flight Dynamics	41
0602202F	Human Systems Technology	48
0602203F	Aerospace Propulsion	60
0602204F	Aerospace Avionics	66
0602205F	Personnel, Training & Simulation	78
0602206F	Civil Engineering & Environment Quality	88
0602302F	Rocket Propulsion	91
0602601F	Advanced Weapons	98
0602602F	Conventional Munitions	104
0602702F	Command/Control/Communication	110
0603106F	Logistics Systems Technology	118
0603109F	Integrated Electronic Warfare System (INEWS) Integrated Communications-Navigation-Identification Avionics (ICNIA)	122
0603112F	Advanced Materials for Weapon Systems	129
0603202F	Aerospace Propulsion Subsystem Integration	134
0603203F	Advanced Avionics for Aerospace Vehicles	137
0603205F	Aerospace Vehicle Technology	144
0603211F	Aerospace Structures	150
0603216F	Aerospace Propulsion and Power Technology	153
0603227F	Personnel, Training and Simulation Technology	159
0603230F	Advanced Tactical Fighter (ATF)	369

ELEMENT CODE	TITLE	PAGE
0603231F	Crew System and Personnel Protection Tech	165
0603245F	Advanced Fighter TechnologyIntegration	173
0603250F	Lincoln Laboratory	179
0603253F	Advanced Avionics Integration	182
0603260F	Intelligence Advanced Development	382
0603269F	National Aerospace Plane Technology	187
0603270F	Electronic Warfare Technology	191
0603302F	Space and Missile Rocket Propulsion	202
0603307F	Air Base Operability Advanced Development	387
0603311F	Advanced Strategic Missile Systems	258
0603320F	Low Cost Seeker	390
0603363F	Hypervelocity Missile	206
0603367F	Relocatable Target Capability Program	261
0603401F	Advanced Spacecraft Technology	209
0603402F	Space Test Program	716
0603410F	Space System Environment Interactions Tech	215
0603428F	Space Surveillance Technology	263
0603438F	Satellite System Surviability	724
0603601F	Conventional Weapons	219
0603605F	Advanced Weapons Technology	227
0603617F	Comand Control and Communication Applications	392
0603707F	Weather Systems	237
0603723F	Civil/Environmental Engr Tech	239

ELEMENT CODE	TITLE	PAGE
0603726F	C3I Subsystem Integration	243
0603728F	Advanced Computer Technology	247
0603742F	Combat Identification Technology	397
0603789F	C3I Technology Development	252
0604201F	Aircraft Avionics Equipment Development	400
0604211F	Advanced Aerial Targets Development	729
0604212F	Aircraft Equipment Development	408
0604218F	Engine Model Derivative Program	410
0604222F	Nuclear Weapons Support	412
0604223F	Alternate Fighter Engine	414
0604227F	Flight Simulator Development	731
0604231F	C-17 Program	417
0604233F	Tanker Transport Training System	421
0604236F	Infrared Search and Track System	423
0604237F	Variable Stability In-Flight Simulator Test Aircraft (VISTA)	425
0604239F	Advanced Tactical Fighter (ATF) Full Scale Development (FSD)	428
0604240F	B-2 Advanced Technology Bomber	265
0604242F	Advanced Tactical Aircraft	431
0604243F	Manpower, Personnel & Training Development	749
0604244F	Short Range Attack Missile (SRAM II)	269
0604245F	Short Range Attack Missile - Tactical (SRAM-T)	434
0604246F	Close Air Support Alternatives (CAS)	437

ELEMENT CODE	TITLE	PAGE
0604247F	Modular Automatic Test Equipment	439
0604249F	Night Precision Attack	444
0604250F	Integrated Electronic Warfare/Communications Navigation Identification Development	447
0604268F	Aircraft Engine Component Improvement Program	458
0604270F	Electronic Warfare Development	461
0604312F	Intercontinental Ballistic Missile (ICBM) Modernization	273
0604315F	Advanced Short Range Air-to-Air Missile	487
0604321F	Joint Tactical Fusion Program	489
0604327F	Hardened Target Munitions	492
0604361F	Air Launched Cruise Missile (ALCM)	281
0604408F	Advanced Launch System	751
0604601F	Chemical/Biological Defense Equipment	494
0604602F	Armament Ordnance Development	497
0604604F	Submunitions	505
0604607F	Wide-Area Anti-Armor Munition	507
0604609F	Reliability and Maintainability Technology Insertion Program (RAMTIP)	755
0604617F	Air Base Operability	511
0604703F	Aeromedical Systems Development	516
0604704F	Common Support Equipment Development	518
0604706F	Life Support System	522
0604707F	Weather Systems	758
0604708F	Other Operational Equipment	527

ELEMENT CODE	TITLE	PAGE
0604711F	Systems Surviability - Nuclear Affects	283
0604725F	Combat Identification Systems	533
0604727F	Joint Standoff Weapons (JSOW) System	544
0604733F	Surface Defense Suppression	547
0604735F	Range Improvement	761
0604740F	Computer Resources Management Technology	550
0604747F	Electromagnetic Radiation Test Facility	777
0604750F	Intelligence Equipment	558
0604754F	Joint Tactical Information Dist System	561
0604755F	Improved Capability for DT&E	781
0604756F	Side Looking Airborne Radar	566
0604770F	Joint Surveillance Target Attack Radar System (JSTARS)	568
0604779F	Joint Interoperability Tactical Command and Control	572
0605101F	Project AIR FORCE	794
0605306F	RANCH HAND II Epidemiology Study	796
0605708F	Navigation/Radar/Sled-Track Test Support	798
0605807F	Test and Evaluation Support.	802
0605808F	Advanced Systems Engineering/Planning	807
0605809F	Dynamic Coherent Measurement System (DYCOMS)	810
0605863F	RDT&E Aircraft Support	811
0605894F	Real Property Maintenance - RDT&E	816
0605896F	Base Operation Support (BOS) - RDT&E	820

ELEMENT CODE	TITLE	PAGE
0701112F	Inventory Control Point Operations	841
0702207F	Depot Maintenance	843
0708011F	Industrial Preparedness	845
0708026F	Productivity, Reliability, and Maintainability (PRAM)	854
0901218F	Civilian Compensation Program	857
1001004F	International Activities	859
1110011F	Special Operations - Force Enhancements	662

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
In-House Laboratory Independent Research	14,966	7,000	7,657	8,114	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program provides discretionary funds to Air Force Laboratory Directors to use in pursuing promising high technical risk, high potential pay-off opportunities which arise during the budget year. This program permits Air Force Laboratories to maintain an aggressive research program critical to their role as leaders in national research. The Air Force manages this program in strict compliance 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 meet annually with the Assistant Secretary of the Air Force for Acquisition to report their achievements and the status of their projects. Distribution of funds is based on these after-the-fact reviews.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:

- (U) Experimentally determined the superconducting and structural effects of a variety of radiation (proton flux, high energy x-ray, laser at 10.6 microns) dosages on two of the best characterized of the "high temperature" superconducting compounds.
- (U) Investigated the application of artificial intelligence techniques to infrared threat warning systems; provides expert interpretation and discrimination of data acquired by infrared sensor arrays.
- (U) Designed and successfully flew an extreme ultraviolet detection system to monitor in detail the energetics associated with solar disturbances; purpose, predict the solar events which may disrupt vital defense systems.
- (U) Experimentally identified chemical reactions in flames containing halon admixtures; purpose, oftain knowledge required to replace halons as fire suppressants.
- (U) Discovered a new medication for dealing with severe motion sickness effects in humans; preliminary results confirm the drug to be the most effective ever tested in suppressing motion sickness.
- (U) Established the feasibility for developing a satellite radar (36 gigahertz) system to provide weather forecasts in data-denied mission areas by measuring cloud base altitudes and other weather parameters (winds, water, etc).

Program Element: #0601101F Budget Activity: #1 - Technology Base
PE Title: In-House Laboratory Independent Research

- (U) Constructed the hardware required to grow single crystals of gallium arsenide on board the space shuttle in order to assess the crystalline quality achievable in the space environment; awaiting a spring 1989 shuttle flight.
- (U) Established human tolerance to using a ten-foot diameter, 1 to 2 G (gravity) centrifuge to mitigate the medical and physiologic deconditioning of crew members during space station assignments or long-duration space missions.

(U) FY 1989 Planned Program:
- (U) The Air Force Assistant Secretary for Acquisition approved distribution of the budget.
- (U) Several of the efforts begun in FY 1988 will be completed during FY 1989.
- (U) Work has begun on new efforts selected by the Laboratory Directors.
- (U) In-house performance is being stressed.

(U) FY 1990 Planned Program:
- (U) Distribution of the FY 1990 budget will be made in September, 1989.
- (U) A portion of the work begun in FY 1989 will continue.
- (U) New efforts will be selected by the Laboratory Directors.
- (U) Extramural contracting will be virtually eliminated.

(U) FY 1991 Planned Program:
- (U) Same management approach as used in FY 1990.

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

(U) Work Performed By: This is totally a laboratory-directed research program in which all Air Force Laboratories participate, performing work in-house and, in the past, awarding contracts to universities and industrial research laboratories. During FY 1988, significant research contributions were made by: Los Alamos National Laboratory, Los Alamos, New Mexico; Martin Marietta Corp., Orlando, Florida; M.I.T., Cambridge; Massachusetts; Johns Hopkins University, Baltimore, Maryland; TRW, Los Angeles, California.

(U) Related Activities:
- (U) Program results transition to Air Force Laboratory development activities for continuing funding.
- (U) Similar programs: Army, 0601101A; Navy, 0601152N.
- (U) Oversight responsibility resides in the Office of the Deputy Director, Defense Research & Engineering.
- (U) There is no unnecessary duplication of effort.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2301 Physics	20,641	20,532	20,335	20,683	Continuing	TBD
2302 Structures	11,121	11,741	11,627	11,827	Continuing	TBD
2303 Chemistry	23,648	25,266	25,021	25,451	Continuing	TBD
2304 Mathematics	21,599	21,661	21,451	21,821	Continuing	TBD
2305 Electronics	21,598	21,252	21,046	21,408	Continuing	TBD
2306 Materials	23,601	24,202	23,967	24,380	Continuing	TBD
2307 Fluid Mechanics	14,800	15,438	15,289	15,553	Continuing	TBD
2308 Energy Conversion	9,951	9,990	9,894	10,064	Continuing	TBD
2309 Terrestrial Sciences	1,863	1,770	1,753	1,784	Continuing	TBD
2310 Atmospheric Sciences	10,792	10,592	10,489	10,670	Continuing	TBD
2311 Astronomy & Astrophysics	6,965	7,134	7,065	7,187	Continuing	TBD
2312 Biological & Medical Sciences	9,689	10,702	10,598	10,780	Continuing	TBD
2313 Human Resources	8,933	9,108	9,020	9,175	Continuing	TBD
Total	185,201	189,388	187,555	190,783	Continuing	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 new research initiatives for FY 1989 include:

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

multifunctional wafer level union; nonlinear interactive flow control and 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 6.2 Air Force Programs. During FY 1988 over 1,000 awards were made to 350 institutions in the amount of $147 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 1988 Accomplishments:
- (U) Millimeter wave circuit testing capability developed using easily automated, noninvasive, electro-optical techniques.
- (U) Effective new means for generating high power millimeter waves demonstrated using scattered plasma waves generated by opposing electron beams.
- (U) Laser photochemical processing research for circuit repair and real time circuit configuring, sponsored under this PE, was commercialized by several small U.S. companies.
- (U) Devised noninvasive optical techniques which permit high resolution, spatial measurement of vector electric fields in plasmas.

(U) FY 1989 Planned Program:
- (U) Started wafer level union initiative combining sensors, electronic, optical, and mechanical devices on single wafers ("chips"). Will permit combination of target detection, transmit, receive, and signal processing functions on a single wafer.
- (U) "Half-collisions" initiative to study breaking of molecular bonds and particle dynamics using lasers.
- (U) Channeling radiation initiative to produce intense, coherent x-ray and gamma-ray radiation.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

- (U) Study techniques for trapping and cooling atoms, ions, and large molecules, using laser techniques, for high performance clocks. Understanding the unusual properties of these slow entities could lead to dramatic new applications.

(U) FY 1990 Planned Program:
- (U) Emphasize x-ray optics in areas of high resolution, element selective, soft x-ray microscopic and holographic imaging.
- (U) 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) Initiative in electro-optical techniques for millimeter wave integrated circuits will combine laser processing, optical control and testing of millimeter wave devices, and nonlinear optical techniques.

(U) FY 1991 Planned Program:
- (U) Initial demonstrations of very short wavelength free electron lasers for weapon, industrial, and medical applications.
- (U) Transition of optical device processing, and wafer scale integration knowledge to millimeter wave/digital integrated circuit applications for use in imaging radar systems.
- (U) Emphasize particle acceleration and very high power microwave devices using advanced beam, plasma interaction concepts.

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

(U) Work Performed By: The following Air Force (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: 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).

(U) Other Appropriation Funds: Not applicable.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

(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 1988 Accomplishments:
- (U) New model for predicting blast response in rock validated by experiment and will be used for predicting survivability of strategic structures.
- (U) Developed an adaptive control algorithm to account for non-linear dynamic behavior of structures. Use of the algorithm was demonstrated on a 30 mm cannon, improving its accuracy by a factor of two.
- (U) Probabilistic (stochastic) approach for studying fatigue crack growth supports improved aerospace structure life prediction.

(U) FY 1989 Planned Program:
- (U) Start mesomechanics programs to establish microstructural basis for mechanics analysis of structural materials.
- (U) Investigate effect of combined thermal and structural loads on cooled non-metallic and metallic structures for hypersonic systems.
- (U) Evaluate pavement system failure modes and new materials.
- (U) Investigate combined structure-control-fluids interactions for highly maneuverable vehicles.

(U) FY 1990 Planned Program:
- (U) Investigate constitutive mechanics for soil response to blast and impulsive loading.
- (U) Begin computational thermoelasticity program to provide numerical simulations of hypersonic structural response.

(U) FY 1991 Planned Program:
- (U) Investigate parallel computation techniques for structural optimization.

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

(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

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

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 1988 Accomplishments:
- (U) New basis for high energy density directed energy weapons through advances in laser pulse design for molecular motion control.
- (U) Improved combustion efficiency for aircraft fuel by modulation of combustion system parameters.
- (U) New ultrastructured materials for high temperature superconductors, atomic oxygen resistant polymers, and armor/antiarmor ceramic-metal composites.

(U) FY 1989 Planned Program:
- (U) New initiative to examine the ultraviolet (UV) radiation mechanisms which produce UV signatures in rocket exhausts.
- (U) Ultrastructure materials approaches will be applied to new classes of nonlinear optical materials.

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

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

- (U) Investigate chemical laser systems operating at near ultraviolet frequencies.

(U) FY 1991 Planned Program:
- (U) Emphasis on evaluating the phenomenon of spontaneous ionization of gases surrounding satellites.
- (U) New program to control molecular architecture of polymers for artificial neural network applications.

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

(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; MIT; 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.

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 1988 Accomplishments:
- (U) Developed new methods for parallel solution of large sparse linear programs applicable to scheduling and allocation problems facing the Military Airlift Command.
- (U) Initiated multidisciplinary program in neural architectures with potential for faster, fault tolerant signal processing.
- (U) Started initiative in nonlinear sciences with applications

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

to nonlinear optics and aerodynamics.
- (U) For non-destructive evaluation applications, developed new methods and produced computer codes for deriving material properties and detecting structural defects from scattered electromagnetic radiation.

(U) FY 1989 Planned Program:
- (U) Research on the interactive feedback control of fluid flow and combustion processes to improve real-time performance characteristics of missiles and aircraft.
- (U) An initiative in parallel optimization will focus on research efforts to use parallel processors to solve large scale optimization problems which are beyond current capabilities.

(U) FY 1990 Planned Program:
- (U) Signals to symbols initiative 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) A new initiative in design optimization 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) A new initiative in theoretical materials modeling will extend advances in the mathematical calculation of exotic material properties.
- (U) An initiative in discrete mathematics 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) Program to Completion: This is a continuing program.

(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: MIT; University of Illinois, Urbana IL; University of Maryland, College Park MD; University of North Carolina, Chapel Hill NC; and University of Wisconsin, Madison WI.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

(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 1988 Accomplishments:
- (U) Developed surface emitting laser diode for optical communication between microchips.
- (U) Established intelligent artificial neural-net based system which can interpret spoken sounds from facial movements for optical voice recognition.
- (U) Demonstrated optical microscope exhibiting superresolution.
- (U) Predicted and obtained highest efficiency tunneling electron device.

(U) FY 1989 Planned Program:
- (U) Research on ultrahigh frequency oscillator based on electron tunneling through quantum wells which could lead to increased capabilities in communication and surveillance applications.
- (U) Enhancement of the Air Force advanced thermionic research initiative to strengthen expertise in microwave tube R&D.
- (U) Develop more accurate models for conformal patch array antennas.
- (U) Research on pseudomorphic electron device structures in the millimeter wave domain.
- (U) Apply neural network approaches to specific image recognition problems.

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

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

- (U) Search for alternatives to mercury cadmium telluride for far infrared detection systems.

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

(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: City College-CUNY, New York NY; 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, processing and manufacturing sciences, electronic materials, optical films and substrates.

(U) FY 1988 Accomplishments:
- (U) Modeled bonding at metal-ceramic interfaces used in protecting jet turbine fans.
- (U) New non-toxic growth of gallium arsenide developed.
- (U) Established importance of interdiffusion between fiber and matrix in metal matrix composites.
- (U) Extended transformation toughening in model ceramic materials.
- (U) Established novel high temperature superconductor processed with ozone.

(U) FY 1989 Planned Program:
- (U) Model at the atomic level the macroscopic mechanical properties of structural materials to predict material properties without costly experimentation.
- (U) Investigate mechanisms for improving toughness in non-metallic structural materials.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

- (U) Conduct research to improve the oxidation resistance of carbon-carbon materials.
- (U) Investigate the mechanical properties of cementitious materials.
- (U) Increased effort on high temperature superconductivity.

(U) FY 1990 Planned Program:
- (U) Fatigue and fracture studies of recently developed novel, advanced aerospace materials.
- (U) Increased effort on ceramic matrix composites.
- (U) Continue advanced semiconductor processing research.

(U) FY 1991 Planned Program:
- (U) Wide bandgap semiconductors for solar blind ultraviolet (UV) detection.
- (U) Conduct research on thin magnetic films on semiconductors for ultrahigh density non-volatile data storage.
- (U) Interface phenomena and interface control in structural materials.

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

(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: MIT; National Academy of Sciences, Washington DC; 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.

7. (U) Project 2307, Fluid Mechanics: Provides basic understanding for improved aerodynamics including drag reduction, high 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.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

(U) FY 1988 Accomplishments:
- (U) A computer code for predicting three-dimensional aerodynamics of full aircraft configurations has been transitioned to industry for future aircraft and missile systems design.
- (U) A new oxygen fluorescence technique allows accurate three-dimensional velocity measurements in supersonic flows.

(U) FY 1989 Planned Program:
- (U) Control techniques will be investigated for stabilizing rotating stall and surge in gas turbines.
- (U) A new initiative in interactive flow control will explore new concepts for feedback control of turbulent flows for application in aircraft and missile drag reduction, enhanced mixing in propulsion systems and flow control in lasers.
- (U) Computational fluid dynamics research will focus on hypersonic flows with real gas kinetics.

(U) FY 1990 Planned Program:
- (U) A new program based on direct numerical simulation will focus on improved turbulence models.

(U) FY 1991 Planned Program:
- (U) Major emphasis will be on developing methods for exploring massive computational parallelism for computational fluid dynamics.

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

(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: MIT; Princeton University, Princeton NJ; Stanford University, Stanford CA; USC; 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.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

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 1988 Accomplishments:
- (U) A new method which has the potential for predicting acoustic instability of rockets has been validated by laboratory experiments.
- (U) An improved exhaust plume prediction model was used to demonstrate redesign of a rocket nozzle to reduce backflow by nearly fifty percent.

(U) FY 1989 Planned Program:
- (U) Investigate techniques to overcome mixing inhibition in supersonic combustion propulsion systems.
- (U) Start a new program in interactive flow control to provide enhanced mixing and combustion efficiency in propulsion systems.

(U) FY 1990 Planned Program:
- (U) Emphasize research in plasma-based space propulsion including stabilization and pulsed-plasma phenomena.

(U) FY 1991 Planned Program:
- (U) Emphasize research on fluid flow/chemical kinetics research to understand and control combustion instability.

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

(U) Work Performed By: The following AF Laboratories are conducting research under this project: the AF Astronautics 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; MIT; 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.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

- (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 geodesy is required to determine the exact position of targets with respect to missile launch sites. Research in gravity is required to determine its effect on missile guidance systems. Research in seismology is required to determine the effect of earthquakes, nuclear explosions, and other noise on the accuracy of missile guidance systems before launch, and also on other Air Force systems and facilities. Seismology research also supports efforts to improve our nuclear test ban treaty monitoring capability.

(U) FY 1988 Accomplishments:
- (U) Experiments have revealed possible deviations from the Newtonian laws of gravity which may have practical consequences for targeting of strategic missiles.

(U) FY 1989 Planned Program:
- (U) Study stresses and earth motion in tectonically active regions using Global Positioning Satellite location techniques.
- (U) Study crustal motion associated with Defense Nuclear Agency nuclear simulation tests.
- (U) Pursue non-Newtonian components of gravity and high altitude gravity measurements.

(U) FY 1990 Planned Program:
- (U) Concentrate on teleseismic signal definition and seismic source signatures for nuclear test ban treaty discrimination.
- (U) Develop technique to more accurately define Earth surface positions in regions inaccessible to placement of Global Positioning System receivers.

(U) FY 1991 Planned Program:
- (U) Clarify and quantify role of short-range gravitational forces. Understanding these forces is important for strategic missile system targeting accuracy.

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

(U) Work Performed By: The AF Geophysics Laboratory, Hanscom AFB MA is conducting research under this project. The three

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

universities or contractors for this project are: Southern Methodist University, Dallas TX; University of Federal Armed Forces, Munich, Germany; and University of Hawaii, Honolulu HI.

(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/IR environment, ionospheric dynamics, and meteorology.

(U) FY 1988 Accomplishments:
- (U) Discovered new ways to model terrain effects on local weather with potential application to battlefield situations.
- (U) Developed advanced optical remote sensing system for monitoring the earth's atmosphere above 50 kilometers .
- (U) Improved understanding of the detailed evolution of isolated showers using dual polarization radar.

(U) FY 1989 Planned Program:
- (U) New initiatives for space-borne remote sensing of atomic oxygen to provide localized predictive capability of weather environment for battlefield support.
- (U) Enhanced research for specifying electron density profiles in the upper stratosphere.

(U) FY 1990 Planned Program:
- (U) Emphasis on modeling of the neutral and ionized environment to improve understanding of geomagnetic disturbances in upper atmosphere.
- (U) Enhanced research on modeling of fine-scale atmospheric structure recently observed with newly fielded clear-air wind profiler radars and Doppler radars.

(U) FY 1991 Planned Program:
- (U) Intensive investigation of weather environment on local scale under the National Stormscale Operational and

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

Research Meteorology program.
- (U) New initiative to understand and predict the coupled processes of lightning phenomena in the atmosphere.

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

(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: MIT; Colorado State University, Fort Collins CO; Johns Hopkins University, Laurel MD; 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 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 radiation and charged atomic particles can endanger mission and degrade the performance of military spacecraft. The project supports the Air Weather Service by improving observation and forecast techniques that are needed to support military operations. It also supports studies of celestial and stellar radiation background contributing to the knowledge of how that infrared radiation will affect Air Force surveillance, discrimination and tracking activities for future systems.

(U) FY 1988 Accomplishments:
- (U) Developed a small reflecting solar coronagraph capable of measuring coronal transients and mass ejections. Data will lead to predictions of coronal emissions and solar wind changes that impact Air Force systems.
- (U) Launched a rocket experiment which emitted the most powerful, man-made electron beam ever injected into space. It will be used to study particle beam propagation in space and serve as base of knowledge for future AF directed energy applications.
- (U) Determined the global pattern of auroral ion precipitation as a function of the level of geomagnetic activity and as a function of the orientation of the interplanetary magnetic

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

field and the solar wind speed. Such work will improve the ability to monitor and predict the near Earth-space environment and its affects on Air Force space and ground based communication and surveillance systems.
- (U) Derived new analytical representations of the empirical convection electric field models which can be adjusted for magnetic activity and the polarity of the interplanetary magnetic field. These models are being developed for operational use by the Air Weather Service.

(U) FY 1989 Planned Program:
- (U) Determine radiation dosage produced by galactic and solar cosmic rays for AF and DOD space orbits.
- (U) Determine particle and energy transport mechanisms between boundaries of solar, interplanetary and ionospheric regions.
- (U) Investigate interplanetary shocks to determine whether they can predict relationships between solar radio emissions and coronal mass ejections.

(U) FY 1990 Planned Program:
- (U) Generate, from satellite data, first dynamic models of earth's radiation belt, essential to select AF and DOD satellite orbits, and to establish connection between energetic particle dosage and on board microelectronics performance.
- (U) Acquire critical data and develop sensors to take advantage of the next solar maximum which will occur in 1991.
- (U) Study feasibility of altering energetic particle populations in earth's radiation belts by chemical releases.

(U) FY 1991 Planned Program:
- (U) Take advantage of the 1991 solar activity maximum with increased observational and analytical efforts.
- (U) Emphasize understanding of generation of solar storms and their impact on AF operations in space.
- (U) Continue efforts in infrared astronomy, to define spectral, spatial, and temporal emissions from both faint and bright space objects.

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

(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: Yale University, New Haven CT; University of Wyoming, Laramie WY; Johns Hopkins University, Laurel MD; Smithsonian Institution, Cambridge MA; and University of Arizona, Tucson AZ.

U) Related Activities:
- (U) Program Element #0602101F, Geophysics.
- (U) Program Element #0602702F, Command Control Communication.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

- (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 1988 Accomplishments:
- (U) 3-aminotyrosine found to inhibit one of the major routes through which radiation and toxic chemicals attack the body.
- (U) Progress in understanding the brain's circuits which govern arousal and stress response. Goal is to improve aircrew performance under stressful situations.
- (U) Increased understanding of how neurons transmit information advanced by research on mechanisms governing the release of neurotransmitters.

(U) FY 1989 Planned Program:
- (U) Start research on environmental fate and impact of chemicals used in AF operations to ultimately reduce pollution and costs of complying with regulations.
- (U) Continuing research on biological effects of radiation and toxic chemicals.
- (U) Start research on brain blood flow in high-g maneuvers.
- (U) Continue research on mechanisms of neural regulation.

(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, environment, 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) Program to Completion: This is a continuing program.

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

(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: UCLA; University of Illinois, Urbana IL; University of Massachusetts, Amherst MA; University of Wisconsin, Madison WI; and Oregon State University, Corvallis OR.

(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, 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 1988 Accomplishments:
- (U) Sensory-motor test developed to predict individual's aptitude for undergraduate pilot training.
- (U) Neural network theory applied to devise computer programs to recognize radar images.

(U) FY 1989 Planned Program:
- (U) Neurophysiological data from animals and psychophysical data from humans will be used to test theories of how vision and hearing work to improve transmission of data from equipment displays to human operators.
- (U) Continuing research in cognition will include mental functions such as attention, perception, learning and

Program Element: #0601102F Budget Activity: 1-Technology Base
PE Title: Defense Research Sciences

memory, organization of knowledge, reasoning and problem-solving.

(U) FY 1990 Planned Program:
- (U) 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 and on cognitive functions.

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

(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, United Kingdom, England.

(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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0601103F Budget Activity: 1-Technology Base
PE Title: University Research Initiative

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3396 University Research Initiative	0	0	24,882	24,878	Continuing	N/A
Total	0*	0*	24,882	24,878	Continuing	N/A

* For FY 1988 and 1989 funded under PE #0601103D in the amount of $26,388,000 and $25,122,000 respectively.

B. (U) BRIEF DESCRIPTION OF ELEMENT: The University Research Initiative (URI) is designed to stimulate defense related research at universities and to develop the engineer and scientist resource pool needed to conduct research in disciplines important to national defense. This is accomplished through the support of research programs, graduate students and faculty members, and by providing equipment. In FY 1988 and 1989, the URI program was funded under Program Element #0601103D and funds were in turn dispersed to the services. In FY 1990, the URI Program is in the Air Force budget. In FY 1990 and 1991, research will be supported in the following areas: structural, electronic, and optical materials; the Earth's ionosphere; human performance; toxicology; mathematical modelling; computational algorithms; combustion and propulsion processes; and flight vehicle fluid dynamics.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 3396, University Research Initiative:

(U) FY 1988 Accomplishments: Work performed and reported under PE #0601103D.

(U) FY 1989 Planned Program: Work performed and reported under PE #0601103D.

(U) FY 1990 Planned Program:
- (U) Structural dynamics and structural materials (metallic and non-metallic) for flight vehicle and civil engineering applications.
- (U) Fluid dynamics to enhance control and performance of aircraft.
- (U) Combustion and propulsion processes for air-breathing vehicles and for space systems.
- (U) Study of the Earth's ionospheric-magnetospheric system and effects upon spacecraft; and development of the basic knowledge needed to predict solar cycles which affect that system.
- (U) Material studies of thin films for semiconductor and

Program Element: #0601103F Budget Activity: 1-Technology Base
PE Title: University Research Initiative

optical applications and of polymers for advanced electrical and structural applications.

- (U) Life science studies on factors affecting alertness, fatigue, stress, visual and auditory perception, and spatial orientation.
- (U) Studies on harmful effects of chemicals involved in Air Force operations on humans and environment and development of protective measures to reduce environmental contamination.
- (U) Mathematical modelling: to deal with complex problems associated with fluid turbulence in flight and combustion environments, optics, and mechanical vibration; to take advantage of advances in parallel processing hardware; and to conduct research in discrete methods to solve problems such as scheduling, routing, allocation, etc.
- (U) Generation and control of a variety of extreme ultraviolet (XUV) and x-ray sources.
- (U) The student and faculty fellowship programs funded under PE #0601103D in FY 89 will be continued under this program element.

(U) FY 1991 Planned Program: URI efforts started in FY 1990 will continue.

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

(U) Work Performed By: For FY 1988 and 1989 this work was performed and reported under PE #0601103D.

(U) Related Activities:

- (U) Program Element #0601103A, University Research Initiative.
- (U) Program Element #0601103N, University Research Initiative.
- (U) All three Services participate in the URI program and each Service stimulates interactions between its URI researchers and its in-house Laboratories. This interaction encourages the university community to gain direct insight into the particular technical challenges facing each of the Services. The program is not duplicative, for it fulfills vital research needs of each Service and stimulates the development of the human resources each Service requires to support its research programs.

(U) Other Appropriations Funds ($ in Thousands): Not applicable.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06GL Laboratory Operations	24470	22667	23315	23480	Continuing	TBD
3054 Infrared Target and Background Signatures	2342	1967	2043	2016	Continuing	TBD
4643 Ionospheric Specification	2593	2191	2264	2234	Continuing	TBD
6670 Atmospheric Science and Technology	1112	1040	1196	1180	Continuing	TBD
7600 Terrestrial Geophysics	701	604	639	630	Continuing	TBD
7601 Space Effects on Air Force Systems	3639	3773	4072	4432	Continuing	TBD
7659 Aerospace Systems Technology	662	570	592	584	Continuing	TBD
7670 Optical/Infrared Properties of the Environment	2183	1833	1904	1878	Continuing	TBD
TOTAL	37702	34645	36025	36434	Continuing	TBD

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Military Construction Funds (PE 0702806F)	0	0	5700	0	5700

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program develops the scientific groundwork for performance and operations of Air Force weapons systems in the geophysical environment. The focus is on better exploitation of the geophysical environment to yield support to developers and users of 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 Air Force Geophysics Laboratory, Hanscom AFB MA and its operations at four locations stateside. It provides 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.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

2. (U) Project 3054, Infrared Target and Background Signatures. Infrared 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 environment that will exist normally or after nuclear explosions so that infrared surveillance systems can always detect targets. Data from rockets, aircraft, balloons, and Shuttle measurement platforms, are compared with theoretical and laboratory data. Results are integrated into computer models to assist infrared systems designers, developers, and operators to detect targets.

(U) FY 1988 Accomplishments:
- (U) Supported compartmented programs with instruments on the AFGL flying infrared laboratory and advanced sensors.
- (U) Demonstrated new technology to discriminate targets from backgrounds.

(U) FY 1989 Planned Program:
- (U) Design high resolution, new technology infrared sensors for use in enhancing spatial and spectral resolution of surveillance systems for stealth targets and transient signal targets in clutter.
- (U) Design shuttle ejector infrared instruments and plan experiments to expand knowledge of infrared environment in space for establishing design specifications.

(U) FY 1990 Planned Program:
- (U) Begin evaluation of high resolution infrared sensor by exploiting a supersensitive photomultiplier in conjunction with an interferometer to detect spectral transients.
- (U) Continue field measurement program using C-135 flying laboratory for measuring the infrared signatures of aircraft, backgrounds, and natural and man made objects and providing calibrated data bases to program offices.

(U) FY 1991 Planned Program:
- (U) Using a high altitude balloon for a platform, launch the Strategic Atmospheric Window experiment to gather earthlimb infrared measurements and demonstrate flight instrument for support of infrared atmospheric model.
- (U) Complete and deliver infrared clutter models for auroral and atmospheric radiance to Space Division as basis for advanced surveillance systems development.

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

(U) Work Performed By: Air Force Geophysics Laboratory (AFGL) Hanscom AFB MA; Visidyne, Burlington MA; Irvine Sensors, Costa Mesa CA; SSG, Waltham MA; Aerodyne Research, Billerica MA; Utah State University, Logan UT.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

(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 nor the DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

3. (U) Projects 4643, Ionospheric Specification. Increasingly Air Force systems operate in the ionosphere. 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 DMSP.

(U) FY 1988 Accomplishments:
- (U) Studied survivability of high frequency radio signals during periods of high solar activity.
- (U) Performed chamber experiments to simulate ionospheric mirrors to enhance communications and surveillance programs.
- (U) Devised a method of predicting radio and radar outages caused by ionospheric scintillation at high latitudes.

(U) FY 1989 Planned Program:
- (U) Develop technique for oblique remote sensing of electron density profiles over data denied areas to support over-the-horizon radars.
- (U) Analyze data and assess use of ionized gasses to reduce missile and aircraft engine radar cross sections.
- (U) Begin 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 disturbed radar cross sections of reentry vehicles and to test radio plasma blackout reduction for vehicles like NASP.
- (U) Complete theory and feasibility study of artificially stimulating the ionosphere for command, control, and communications enhancement.

(U) FY 1991 Planned Program:
- (U) Field test reentry vehicle signature chemical modification techniques.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

- (U) Conduct field studies of space based ionospheric enhancement based on FY 1990 efforts.

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

(U) Work performed By: AFGL, Hanscom AFB MA; Northwest Research Assoc, San Diego CA; University of Lowell, Lowell MA; Boston College, Chestnut Hill MA; University of Michigan, Ann Arbor MI; Photometrics, Burlington MA.

(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 nor the DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

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 in smaller scale models and supporting measurements which will provide required detail. The Air Force requires new techniques to satisfy requirements for its ever-expanding mission in support of emerging communications, surveillance, and acquisition systems technologies which the atmosphere impacts.

(U) FY 1988 Accomplishments:
- (U) Completed rainrate duration model critical for extremely high frequency communications.
- (U) Started Advanced Meteorological Processing System (AMPS) and cloud analysis program to develop forecast techniques by consolidating and integrating the many data displays to be available to the forecaster.
- (U) Completed and validated cloud simulation model and delivered atmospheric dispersion model to Air Weather Service.

(U) FY 1989 Planned Program:
- (U) Continue the AMPS cloud analysis work using available satellite, radar, and conventional weather data.
- (U) Start program to identify and forecast regions of potential induced lightning from missile and shuttle launches for use by launch control offices.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

(U) FY 1990 Planned Program:
- (U) Begin forecast technique using microwave depolarization data to quantify induced lightning potential.
- (U) Continue efforts on multi-frequency sensors for cloud mapping from satellites.

(U) FY 1991 Planned Program:
- (U) Deliver expert Weather Forecast System application models to Air Weather Service--work initiated in FY 1989.
- (U) Continue satellite cloud and precipitation technique development and transition cloud algorithm.

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

(U) Work Performed By: AFGL, Hanscom AFB MA; AER, Cambridge MA; CDC, Minneapolis MN; STX, Lanham MD; University of Lowell, Lowell MA; University of Wisconsin, Madison WI.

(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 nor the DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

5. (U) Project 7600, Terrestrial Geophysics: This project, the only DOD gravity and geodesy research program, advances technology in the areas of the earth's geometry, motion, gravity, and seismology to support Air Force strategic and tactical systems. Missile launch region and space gravity models are improved by satellite-to-satellite tracking and experimental refinement of the laws of gravity. The application of superconducting technology to inertial instrumentation in order to lessen future requirements for presurveyed gravity corrections is under study. Seismo-acoustic techniques are being evaluated for detection and tracking of low-flying, low observable aircraft and missiles.

(U) FY 1988 Accomplishments:
- (U) Conducted seismo-acoustic studies to determine the impact of lowering SAC low level overflights from 400 to 200 feet.
- (U) Evaluated performance of Six-axis Superconducting Accelerometer for possible use as autonomous inertial navigation system.
- (U) Determined that passive seismo-acoustic detection of stealth aircraft works.

(U) FY 1989 Planned Program:
- (U) Complete design of Superconducting Tensor Gravity Gradiometer (STGG) for inertial navigation applications.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

- (U) Complete plan for experimental field array for seismo-acoustic detection of stealth aircraft.

(U) FY 1990 Planned Program:
- (U) Assemble and bench test STGG.

(U) FY 1991 Planned Program:
- (U) Deliver superconducting inertial navigation system (INS) specifications to system developers.

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

(U) Work Performed By: AFGL, Hanscom AFB MA; University of Maryland, College Park MD; Boston College, Chestnut Hill MA.

(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 nor the DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

6. (U) Project 7601, Space Effects on Air Force Systems. This program measures, models, and forecasts the space radiation environment phenomena resulting from spacecraft interacting with the space environment 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 sensor systems applications, (3) predict space weather for satellite operations, C3I, and military man-in-space, and (4) exploit the space environment as a medium for strategic and tactical military operations.

(U) FY 1988 Accomplishments:
- (U) Launched ECHO-7 rocket to assess long distance propagation of high current electron beams in space.
- (U) Initiated development of state-of-the-art energetic particle, space, plasma, field and wave detectors.
- (U) Completed initial validation of shuttle rocket motor plume contamination model using the Maui Optical Site.
- (U) Transitioned solar flare prediction codes to MAC/AFGWC.

(U) FY 1989 Planned Program:
- (U) Deliver Space Radiation Effects Satellite sensors to the spacecraft integrator.
- (U) Transition dynamic magnetospheric models to AFSPACECOM, MAC and Air Weather Service.
- (U) Develop experimental reflecting solar telescope for submillimeter space debris detection.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

(U) FY 1990 Planned Program:
- (U) Start development of static and dynamic radiation models using data gathered from the launched Combined Release Radiation Effects Satellite (CRRES).
- (U) Complete study of high energy particle dynamics and transition results to space radiation models.

(U) FY 1991 Planned Program:
- (U) Initiate development of space radiation effects models using particle detector data from the CRRES as empirical data input.
- (U) Deliver satellite contamination code to Space Division.
- (U) Initiate validation of hypervelocity interactions model for vehicles such as NASP and RVs (reentry vehicles).

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

(U) Work Performed By: AFGL, Hanscom AFB MA; NRL, Washington DC; Boston College, Chestnut Hill MA: Amptek, Bedford MA; Spectral Sciences, Burlington MA; Fairchild Space Co, Germantown MD.

(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.
- (U) Program Element #0305160F, DMSP.
- (U) There is no unnecessary duplication of effort within the Air Force nor the DOD in the broad areas of geophysics.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

7. (U) Project 7659, Aerospace Systems Technology. This project is the only Department of Defense (DOD) high altitude balloon capability in the United States. It improves the usefulness of the spacecraft, balloon, and sounding rocket payload systems used as experiment carriers by Air Force Geophysics Laboratory and DOD. The work is focused on applying modern technology, particularly microelectronics, in developing experimental sensor platforms and efficient data management techniques.

(U) FY 1988 Accomplishments:
- (U) Conducted final testing of adapted laser disk recorder to gather high-rate pulse-code modulated telemetery data in support of scientific experiments.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

(U) FY 1989 Planned Program:
- (U) Complete testing of balloon navigation system for use by high altitude experiments needing precise balloon tracking.

(U) FY 1990 Planned Program:
- (U) Continue validation of balloon navigation system and use for experiments requiring precise tracking.
- (U) Investigate development of sensor pointing system for balloon, rocket, and satellite instrument platforms.

(U) FY 1991 Planned Program:
- (U) Continue development of sensor pointing system started in FY 1990 to improve payload/vehicle performance.

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

(U) Work Performed By: AFGL, Hanscom AFB MA; Wentworth Institute of Technology, Boston MA; Radex, Bedford MA; RDP, Waltham MA; New Mexico State University, Las Cruces NM; Mission Research Corp, Santa Barbara CA.

(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 nor the DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

8. (U) Project 7670, Optical/Infrared Properties of the Environment. This project develops: (1) lidar technology to measure atmospheric properties from space, (2) models and tools to predict the impact of the atmospheric environment on DOD 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 1988 Accomplishments:
- (U) Completed the atmospheric transmission code (LOWTRAN).
- (U) Demonstrated capability to measure statospheric water vapor with a balloon-borne raman lidar.
- (U) Completed and deployed a portable doppler lidar to measure wind speed and direction.

Program Element: #0602101F Budget Activity: #1 - Technology Base
PE Title: Geophysics

(U) FY 1989 Planned Program:
- (U) Develop self-sensing algorithms for infrared sensors to correct for atmospheric limitations on ranging and imaging for smart weapons.
- (U) Push lidar technology to develop an eyesafe lidar for wind sensing from space.

(U) FY 1990 Planned Program:
- (U) Complete path characterization for atmospheric transmission and input to Tactical Decision Aids.
- (U) Complete global aerosol background measurement studies for input to the Defense Meteorological Satellite Program.

(U) FY 1991 Planned Program:
- (U) Validate atmospheric path characterization models used as technology insertion to Tactical Decision Aids.
- (U) Prepare global aerosol specifications for satellite lidar systems designers.

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

(U) Work Performed By: AFGL, Hanscom AFB MA; Photometrics, Burlington MA; Schwartz Electro-Optics, Concord MA; Mission Research Corp, Nashua NH, Lightwave Electronics, Mountain View CA; Visidyne, Burlington MA.

(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 nor the DOD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06ML Laboratory Operations	16,574	20,089	20,339	20,590	Continuing	TBD
2417 Thermal Protection Materials and Structures	4,204	3,501	3,594	3,608	Continuing	TBD
2418 Metallic Structural Materials	14,901	14,223	16,138	16,201	Continuing	TBD
2419 Nonmetallic Structural Materials	5,697	6,104	4,933	4,952	Continuing	TBD
2420 Aerospace Propulsion Materials	3,775	4,154	3,682	3,696	Continuing	TBD
2421 Fluids, Lubricants and Elastomeric Materials	1,954	3,035	3,663	3,677	Continuing	TBD
2422 Protective Coatings and Materials	2,543	2,375	2,529	2,541	Continuing	TBD
2423 Electromagnetic Windows and Electronic Materials	4,079	4,590	4,435	4,452	Continuing	TBD
TOTAL	53,727	58,071	59,313	59,717	Continuing	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 for reducing costs and increasing performance, supportability, reliability, and survivability of current and future Air Force aerospace weapon systems and support equipment. It develops new and improved structural and non-structural materials, the processes for making them, appropriate repair techniques, and elements of a prospective unified computer system and data base that will reduce weapon production costs by half. Specific 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 be completed. These efforts are undertaken because Air Force needs cannot be satisfied solely by contractor funded research and development programs.

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 supporting personnel, travel, transportation, rents, communications, utilities, procurement of supplies and equipment, and contractor support services. Also includes salaries, travel, and equipment for personnel at the Aeronautical Systems Division who provide contracting support to the laboratory.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

2. (U) Project 2417, Thermal Protection Materials and Structures: Develops advanced structural and nonstructural materials, such as carbon-composites, and coating materials for protecting Air Force aerospace systems and components exposed to mechanical stresses under intense heat (2800°F-4000°F) in oxidizing and erosive environments. Also develops the processes for making these materials.

(U) FY 1988 Accomplishments:
- (U) Developed oxidation resistant stable fibers for use in the coated carbon fiber development for carbon-carbon composites.
- (U) Developed coating concepts for carbon-carbon composites to extend life to 2000 hours at 2800°F and 500 hours at 4000°F.

(U) FY 1989 Planned Program:
- (U) Initiate programs to develop full-life (2000 hours at 2800°F) and ultra-high temperature (500 hours at 4000°F) oxidation resistant carbon-carbon composites and the nondestructive evaluation techniques for these materials.

(U) FY 1990 Planned Program:
- (U) Begin evaluating life limiting thermal and mechanical parameters of the ultra-high temperature carbon-carbon composites and develop approaches to improve capability.
- (U) Begin developing low cost thermally stable, structurally efficient carbon-carbon composites for spacecraft.

(U) FY 1991 Planned Program:
- (U) Continue efforts on developing oxidation resistant carbon-carbon composites for military gas turbine engines and spacecraft systems, as well as nondestructive evaluation techniques and life limiting parameter evaluations of these materials.

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

(U) Work Performed By: Major contractors are General Electric Company, Cincinnati OH; Textron Inc/AVCO Corporation, Lowell MA; Aerojet Corporation, Sacramento CA; Nichols Research Corporation, Huntsville AL; and Minnesota Mining and Manufacturing Company, Minneapolis MN. 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 and Materials.
- (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: Not applicable.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

3. (U) Project 2418, Metallic Structural Materials: Develops advanced metallic materials for use in aerospace structural applications at cryogenic temperatures to 1800°F (a 600°F increase in capability). Also develops the process for making these materials, engineering properties of developed materials, repair technologies, advanced nondestructive inspection/evaluation technologies, and elements of a prospective unified computer system and data base that will reduce weapon production costs by half.

(U) FY 1988 Accomplishments:
- (U) Demonstrated nondestructive inspection tools for in-situ monitoring composite curing cycles which substantially decreases curing time.
- (U) Developed method to eliminate the casting factor for aluminum castings, which reduces the weight of cast parts.

(U) FY 1989 Planned Program:
- (U) Begin efforts to develop 900°F aluminum and 1800°F titanium alloys and metal matrix composites and to eliminate the casting factor from titanium alloy castings to reduce weight of cast parts and continue efforts in other areas.

(U) FY 1990 Planned Program:
- (U) Develop ultra lightweight magnesium alloys and metal matrix composites for structural applications and nuclear magnetic resonance inspection techniques for advanced turbine engine materials and continue efforts in other areas.

(U) FY 1991 Planned Program:
- (U) Complete development of 900°F aluminum and 1800°F titanium alloys and metal matrix composites and continue other efforts.

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

(U) Work Performed By: Major contractors are University of Dayton, Dayton OH; SYSTRAN Corporation, Dayton OH; General Electric Company, Cincinnati OH; United Technologies Corporation, West Palm Beach FL; and Universal Technology Corporation, 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 and Materials.
- (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: Not applicable.

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, with emphasis 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 1988 Accomplishments:
- (U) Developed lower cost, advanced thermoplastic composite processing techniques and advanced processing methods for fabricating molecular composites.

(U) FY 1989 Planned Program:
- (U) Begin assessing biotechnology techniques to create improved matrix materials for carbon fiber reinforced composites.
- (U) Complete developing advanced procedures and computer models to automatically cure thermoplastic composites.

(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 and fabricating molecular composite final forms.

(U) FY 1991 Planned Program:
- (U) Initiate development of advanced processing techniques to reduce weight and cost of molecular composite materials.
- (U) Continue other efforts.

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

(U) Work Performed By: The major contractors are University of Dayton, Dayton OH; Dow Chemical Company, Corning NY; General Dynamics Corporation, Fort Worth TX; Adtech Systems Research, Inc, Fairborn OH; United Technologies Corporation, West Palm Beach FL. 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 and Materials.
- (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: Not applicable.

Program Element: #0602102F Budget Activity: #1 - Technology Base
PE Title: Materials

5. (U) Project 2420, Aerospace Propulsion Materials: Develops new materials and manufacturing processes to provide lightweight, extremely high operating temperature, uncooled turbine engine components. Supports the DOD/NASA High Performance Turbine Engine initiative. Improves engine producibility, durability, thrust-to-weight capability, life cycle costs fuel use.

(U) FY 1988 Accomplishments:
- (U) Identified 4000°F capable ceramic matrix composites.
- (U) Developed improved toughness titanium aluminide materials for use in compressors.

(U) FY 1989 Planned Program:
- (U) Develop ultra high temperature ceramic composites and develop techniques to test them at temperatures above 3000°F.
- (U) Continue other efforts.

(U) FY 1990 Planned Program:
- (U) Initiate life prediction modeling efforts on ceramic matrix composites and high temperature titanium aluminide composites.
- (U) Continue other efforts.

(U) FY 1991 Planned Program:
- (U) Initiate development of environmental protection coatings for titanium aluminide materials and continue other efforts.

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

(U) Work Performed By: The major contractors are United Technologies Corporation, West Palm Beach FL; Southern Research Institute, Birmingham AL; General Motors Corporation, Indianapolis IN; General Electric Company, Cincinnati OH, and Allied Signal Garrett Engine Division, Phoenix AZ. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (U) Program Element #0602203F, Aerospace Propulsion.
- (U) Program Element #0603112F, Advanced Materials for Weapon Systems (FY 1990/1991).
- (U) Program Element #0603202F, Aerospace Propulsion Subsystem Integration.
- (U) Program Element #0603211F, Aerospace Structures and Materials.
- (U) Program Element #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: Not applicable.

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) Prior Accomplishments:
- (U) Developed 400°F fuel lubricant seal materials.
- (U) Transitioned 400°F gas turbine engine oil into service, replacing current 350°F-capable MIL-H-7808 oil.
- (U) Initiated development of very high temperature gas turbine engine oils.

(U) FY 1989 Planned Program:
- (U) Complete development of 350°F conductive explosion-suppression foam for aircraft fuel cells and -65 to 275°F fire resistant hydraulic fluid.
- (U) Initiate 700°F liquid lubricant base fluid and additive technology research and associated model development.

(U) FY 1990 Planned Program:
- (U) Transition a halocarbon based 350°F/8000psi nonflammable hydraulic fluid to the product divison.
- (U) Identify and synthesize candidate 700°F liquid lubricant base stocks.

(U) FY 1991 Planned Program:
- (U) Formulate candidate 700°F engine oils.
- (U) Initiate 600-700°F nonflammable hydraulic fluid development.
- (U) Continue developing compatible 700°F liquid lubricant seals.

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

(U) Work Performed By: The major contractors are University of Dayton, Dayton OH; Ultrasystems, Inc., Irvine CA; Sperry Rand Corporation, Phoenix AZ; Signal Research Corporation, Des Plaines, IL; and Scot Foam Corporation, Eddystone PA. The Materials Laboratory, Wright-Patterson AFB OH, manages the work.

(U) Related Activities:
- (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 unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

Program Element: #0602102F Budget Activity: #1 - Technology 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 1988 Accomplishments:
- (U) Demonstrated solid state multiple wavelength filters for electro-optical systems and initiated development of super-lattice materials for laser hardening applications.

(U) FY 1989 Planned Program:
- (U) Complete development of nonlinear optical materials for new protective devices against agile/pulsed laser threats.
- (U) Complete development of advanced thermal flash protective coatings for aerospace systems.

(U) FY 1990 Planned Program:
- (U) Initiate development of prototype devices for agile laser threat protection.
- (U) Complete development of multi-threat survivable spacecraft coatings and multi-layer insulation blanket materials.

(U) FY 1991 Planned Program:
- (U) Begin developing biotechnology synthesis techniques to apply optical filters on large area optics.
- (U) Transition multiline narrow band rejection filters to component validation programs.

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

(U) Work Performed By: The major contractors are Science Applications International Corporation, Dayton OH; Rockwell International Corporation, Thousand Oaks CA; TRW, Inc., Redondo Beach CA; Celanese Corporation, Summit NJ; and Honeywell, Inc., Minneapolis MN. 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 #0603202F, Aerospace Propulsion Subsystem Integration.
- (U) Program Element #0603211F, Aerospace Structures and Materials.
- (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: Not applicable.

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 1988 Accomplishments:
- (U) Developed printed wiring boards having the same coefficient of thermal expansion as electronic piece parts, which greatly improves reliability of electronic subsystems.
- (U) Initiated effort to optimize metal-organic chemical vapor deposition of mercury cadmium telluride infrared detectors.

(U) FY 1989 Planned Program:
- (U) Determine applicability of superlattice and quantum well structured materials for long wave infrared detectors.
- (U) Complete assessment of electronic packaging materials requirement for high component density applications.

(U) FY 1990 Planned Program:
- (U) Initiate efforts to optimize superlattice infrared device.
- (U) Fabrication and high density, high speed electronic component packaging to remove high heat loads from the devices.

(U) FY 1991 Planned Program:
- (U) Complete feasibility demonstration of photo assisted and metal-organic gas molecular beam epitaxial processing techniques for infrared detectors.
- (U) Initiate effort to address producibility and reliability issues critical to packaging electronics.

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

(U) Work Performed By: The major contractors are University of Dayton, Dayton OH; Canadian Commercial Corporation, Ottawa Ontario Canada; Westinghouse, Pittsburgh PA; Rockwell International Corporation, Thousand Oaks CA; and AT&T Technologies, Inc., Murray Hill NJ. The Materials Laboratory, Wright-Patterson AFB OH, manages this work.

(U) Related Activities:
- (U) Program Element #0602204F, Aerospace Avionics.
- (U) Program Element #0708011F, Manufacturing Technology.
- (U) No unnecessary duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: A new FY 1990 contractual effort will be performed cooperatively with Canada under the Canada-US Defense Cost Sharing Program. This research effort will run for two years at a total cost of $350 thousand, evenly shared by the two countries.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06FF Laboratory Operations	34,077	33,230	34,030	34,869	Continuing	TBD
2401 Structures and Dynamics	9,466	9,092	8,405	8,380	Continuing	TBD
2402 Vehicle Equipment	6,552	6,418	6,052	6,157	Continuing	TBD
2403 Flight Control	9,466	9,448	9,245	9,578	Continuing	TBD
2404 Aeromechanics	9,101	8,914	8,237	8,380	Continuing	TBD
3038 Technology Integration and Assessment	1,820	1,783	1,681	1,710	Continuing	TBD
TOTAL	70,482	68,885	67,650	69,074	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technlogy 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. It 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, 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.

2. (U) Project 2401, Structures and Dynamics: This project creates more survivable aircraft structures, investigates new structural concepts, and exploits new materials and fabrication processes to increase the structural integrity 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 1988 Accomplishments:
- (U) Developed modular graphite heaters to successfully test large carbon-carbon structures to 2500°F.
- (U) Demonstrated actively cooled structures at high temperatures for National Aerospace Plane (NASP) panels and nose cones.
- (U) Applied laser holography to detect Advanced Medium Range Air-to-Air Missile (AMRAAM) fin structural defects and screen production fins. Analysis of defects led to redesign of the fin structure and improvement in the manufacturing process before production.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

(U) FY 1989 Planned Program:
- (U) Perform zero-gravity flight test on large space trusses that incorporate integral damping to increase pointing and tracking accuracy.
- (U) Develop methods for predicting the structural life of flight vehicles subjected to both load and temperature profiles.
- (U) Complete and transition to Advanced Development integral damping to reduce structural noise and vibration in combat aircraft aft equipment bays.
- (U) Initiate program to determine the structural benefits of integrating aircraft antennas, sensors, preprocessors, and electrical control cables in the aircraft skin.

(U) FY 1990 Planned Program:
- (U) Demonstrate large space structural test truss incorporating both active and passive damping techniques.
- (U) Design trade studies, development of structural concepts, and new manufacturing technologies for metallics and composites will allow improvements in the performance, reliability, and maintainability of aerospace structures to be demonstrated.
- (U) Complete survivability and vulnerability analysis of laser effects on aircraft structure.

(U) FY 1991 Planned Program:
- (U) Combine 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 structure, while increasing supportability.
- (U) Develop and demonstrate mechanical and electrical inspection and repair concepts of critical composite structures to increase the supportability of tactical aircraft.
- (U) Develop concepts of infrared signature control that allow vehicles to be thermally invisible from both ground and space.

(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, Witchita KS.

(U) Related Activities:
- (U) PE 0601101F, In-house Laboratory Independent Research.
- (U) PE 0602202F, Materials.
- (U) PE 0603211F, Aerospace Structures and Material.
- (U) No duplication of effort within the Department of Defense.

- (U) Other Appropriation Funds:

	FY 1988	FY 1989	FY 1990	FY 1991	To Complete	Total Cost
Military Construction Funds	0	10,100	10,500	0	Continuing	20,600

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

(U) International Cooperative Agreements: None.

3. (U) Project 2402, Vehicle Equipment: The goals of this project are to reduce the life cycle cost of subsystems and equipment, increase the probability of flight vehicle and crew member survival, and improve flight vehicle operational capabilities.

(U) FY 1988 Accomplishments:
- (U) Demonstrated electric brakes for aircraft that help eliminate brake fires by no longer requiring hydraulic fluid.
- (U) Fabricated a subscale injection molded frameless aircraft transparency demonstrating concept feasibility. 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 molded transparencies have 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) Ground test loop assembled and testing initiated for an integrated closed vapor cycle environmental control system (ECS) for aircraft. Closed loop ECS systems will save fuel and reduce maintenance requirements over current open loop systems.

(U) FY 1989 Planned Program:
- (U) Develop and evaluate prototype 350 mph aircraft tire.
- (U) Test chemical/biological agents contamination avoidance subsystem using live agents.
- (U) Assess the capabilities of advanced on-board inert gas generating systems for preventing aircraft combat fires.

(U) FY 1990 Planned Program:
- (U) Design, fabricate, and test a cryogenic cooler for use in smart bombs, air-to-air missiles, and air-to-ground missiles.
- (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 avionics.

(U) FY 1991 Planned Program:
- (U) Complete fabrication of full-scale injection molded frameless transparency and initiate testing.
- (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 University of Dayton, Dayton OH; Garrett Corp, Torrance CA; Canadian Commercial Corp, Ottawa, Ontario CN; 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) In-house Laboratory Independent Research (PE 0601101F).
- (U) Flight Vehicle Technology (PE 0603205F).
- (U) Aircraft Equipment Development (PE 0604212F).
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: A joint USAF/Canadian government project agreement to develop an integrated closed-loop environmental control system incorporating Chemical/Biological protection was signed in 1983. Funding is split 50/50.

4. (U) Project 2403, Flight Control: The objectives of this project are to develop technology to provide precision vehicle stability and trajectory control, obtain maximum performance for the vehicle throughout its flight envelope, and provide maximum safety and survivability.

(U) FY 1988 Accomplishments
- (U) Flight demonstrated on a C-130 a night/in-weather landing system that uses only on-board sensors, with no ground eminations, for post-attack airbase recovery.
- (U) Flight tested on an unmanned research vehicle the control software for a self-repairing flight control system, including successful flight with an aileron separated from the aircraft.
- (U) Assessed first three dimensional cockpit display to determine situational awareness benefit to aircrews.

(U) FY 1989 Planned Program:
- (U) Develop and test high pressure, low profile actuators which allow for thinner wings, but are capable of maintaining the performance required for future fighter aircraft.
- (U) Improve the performance of Ada compilers in order to meet flight critical control requirements and provide cost effective yet fault tolerant code for flight control. Flight demonstrate on an unmanned research vehicle.
- (U) Consolidate computational elements of electric, hydraulic, fuel, and environmental subsystems, resulting in fewer on-board computers.
- (U) Conduct baseline research into the feasibility of using a programmable heads-up display as the primary flight reference instrument, reducing the amount of space required on the panel and allowing the pilot to fly looking out of the cockpit. Testing will be conducted on a T-38 aircraft.

(U) FY 1990 Planned Program:
- (U) Develop decision aiding algorithms for air combat to establish target priorities, command steering, select weapons, and calculate weapons launch to increase exchange ratios.
- (U) Assess and develop flight control, air data, reference, and diagnostic sensors for future air and space vehicles.

Title: Aerospace Flight Dynamics Budget Activity: #1 - Technology Base
Program Element: #0602201F

- (U) Develop flying qualities design parameters and criteria, including pilot and control issues, vital to hypersonic missions of future military or NASP vehicles.

(U) FY 1991 Planned Program:
- (U) Develop analytical criteria for blending pilot control with automatic systems including pilot overriding of automatic systems, and transients following system disengagement.
- (U) Define and demonstrate a vehicle management system to incorporate highly complex functions such as tactical and strategic flight management; integrated fire and flight controls; integrated flight, propulsion, and thrust vectoring controls; and self-repairing flight controls.

(U) Work Performed By: This project is managed by the Flight Dynamics Laboratory, Wright-Patterson AFB OH. The top five contractors are General Dynamics, Ft Worth TX; CALSPAN Corp, Buffalo NY; McDonnell Douglas Corp, St Louis MO; Honeywell Inc, Minneapolis MN; Intermetrics Inc, Warminster PA.

(U) Related Activities:
- (U) PE 0601101F, In-house Laboratory Independent Research.
- (U) PE 0602202F, Materials.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603245F, Advanced Flight Technology Integration.
- (U) PE 0604237F, Variable Stability In-Flight Simulator Test Aircraft.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

5. (U) Project 2404, Aeromechanics: This project develops aeromechanics technology to obtain improved mission capability, increased survivability, and reduced cost of aircraft, missiles and space vehicles.

(U) FY 1988 Accomplishments:
- (U) Opened subsonic aerodynamic research laboratory, used to investigate high angle-of-attack aerodynamics and propulsion/airframe integration.
- (U) Conducted the first ever measurement of hypersonic boundary layer turbulence using laser velocemetry. This provides design tools for improving reentry vehicles.
- (U) Achieved through computational fluid dynamics the first ever numerical simulation of aerodynamic flow characteristics about a complex fighter aircraft, the F-16. Data base gaps for complex configurations can now be filled without the time and cost of additional wind tunnel testing.

(U) FY 1989 Planned Program:
- (U) Design and develop highly integrated inlet/nozzle concepts for Mach 4-6 flight vehicles.

Title: Aerospace Flight Dynamics Budget Activity: #1 - Technology Base
Program Element: #0602201F

- (U) Validate the drag reduction potential of hybrid laminar flow control. Expected benefits include a 15% drag reduction for long range transport aircraft.
- (U) Complete process to simulate real gas phenomena on high speed aircraft and demonstrate the effects on aeroheating, aerodynamics, stability, and control. This will allow increased performance and reduced risk on high altitude, high speed aircraft or reentry vehicles.

(U) FY 1990 Planned Program:
- (U) Develop an advanced computer model for the prediction of aircraft weapons separation aerodynamic and trajectory characteristics. This will reduce testing requirements, reduce development costs and risks, and improve the accuracy of future aircraft weapons systems.
- (U) Investigate effectiveness and induced secondary effects of using active cooling for leading edges and shock interference regions to develop design tools for hypersonic vehicles.
- (U) Investigate impact of emergency abort alternatives on the trajectories, separation dynamics, configuration, and propulsion concepts of high speed airbreathing systems to achieve efficient configurations.

(U) FY 1991 Planned Program:
- (U) Define, analyze, and test innovative hypersonic concepts that will cruise at endo-atmospheric conditions for the Mach number range of 6 to 12. Critical aeromechanic issues such as wave drag, airframe propulsion integration, cruise efficiency, aerodynamic heating, and weapon carriage and separation will be emphasized in order to develop efficient configurations.
- (U) Develop a rapid prediction method that provides an accurate aerodynamic analysis of supersonic and hypersonic missiles that fly at high angles-of-attack.
- (U) Develop inverse computational fluid dynamic methods that actually create design concepts to accomplish given missions rather than evaluate a specific design concept.

(U) Work Performed By: This 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; Accurex Corp, Mountain View CA; Grumman Aerospace, Bethpage NY; General Dynamics, Ft Worth TX.

(U) Related Activities:
- (U) PE 0601101F, In-house Laboratory Independent Research.
- (U) PE 0602202F, Materials.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603245F, Advanced Flight Technology Integration.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

Program Element: #0602201F Budget Activity: #1 - Technology Base
Title: Aerospace Flight Dynamics

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 systems concepts, operational requirements, and technology tradeoffs yields advanced vehicle design concepts and technology application opportunities.

(U) FY 1988 Accomplishments:
- (U) Initiated advanced systems technology investigations for a High Altitude, Long Endurance aircraft and investigated requirements for a Special Operations Forces (SOF) aircraft.
- (U) Transitioned concepts and identified required technologies for an Advanced Tactical Transport.

(U) FY 1989 Planned Program:
- (U) Idenfity requirements and concepts for a future lightweight, low cost fighter aircraft.
- (U) Define specific concepts for a SOF aircraft and conduct trade-off studies to determine mission effectiveness.

(U) FY 1990 Planned Program:
- (U) Develop software to incorporate advanced inlet and exhaust nozzles design into current laboratory concept studies.
- (U) Identify operational opportunities suitable for robotic air vehicle applications, determine design concepts and exploitable technologies, and evaluate 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 0602202F, Materials.
- (U) PE 0603205F, Flight Vehicle Technology.
- (U) PE 0603211F, Aerospace Structures and Material.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06MD Human Systems Division Laboratory Operations	24,411	26,561	26,643	26,966	Continuing	TBD
2729 Nuclear, Biological and Chemical (NBC) Defense	4,613	2,646	2,650	2,800	Continuing	TBD
6302 Occupational & Environmental Toxic Hazards in AF Operations	3,946	4,246	2,750	2,855	Continuing	TBD
6770 Biotechnology Studies in Advanced Systems	427	800	1,000	1,000	Continuing	TBD
6893 Manned Weapon Systems Effectiveness	1,947	1,417	1,400	1,480	Continuing	TBD
7184 Man-Machine Integration Technology	6,255	5,855	6,488	6,521	Continuing	TBD
7231 Safety & Aircrew Effectiveness in Mechanical Force Environments	3,782	2,807	2,800	3,190	Continuing	TBD
7755 Aerospace Medicine	806	806	800	850	Continuing	TBD
7757 Radiation Hazards in Aerospace Operations	3,563	3,999	3,750	3,992	Continuing	TBD
7930 Advanced Crew Technology	1,723	1,880	1,900	2,078	Continuing	TBD
Total	51,473	51,017	50,181	51,732	Continuing	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 Soviet 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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

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. 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 personnel at Aeronautical Systems Division to provide procurement support to the Human Systems Division.

2. (U) Project 2729, Nuclear, Biological & Chemical (NBC) Defense: This project provides the technology to address Air Force unique requirements to ensure continued effectiveness of air operations and aeromedical care in the event of a NBC attack. Project goals are to address Air Force unique requirements in seven functional areas: individual protection; collective protection; detection, identification and warning; contamination control; medical operations; operations analysis for Air Force NBC defense; and aircrew performance effects of drugs (developed by the Army or our allies). It is fully coordinated with the Army as the lead DoD agency for NBC defense via the Joint Service Agreement on Chemical/Biological Defense and the ASBREM.

(U) FY 1988 Accomplishments:
- (U) Measured effects of nerve agent pretreatment compound when administered in combination with repeated low doses of nerve agent to ensure there are no additive effects upon performance of flight tasks.
- (U) Developed methods to estimate casualties following chemical attack on the air base thereby optimizing the War Mobilization Plan for scheduled replacements.

(U) FY 1989 Planned Program:
- (U) Develop infrared voice communications for ground crew to eliminate conversation interference on the flightline while wearing the chemical protective mask.
- (U) Determine the residual effects on aircrew performance using animals to model exposure to nerve agent and its treatment.

(U) FY 1990 Planned Program:
- (U) Determine effects of chemical warfare pretreatment compounds and antidotes on heat load while wearing chemical protective equipment to better anticipate conditions leading to personnel heat stress.
- (U) Assess feasibility of using drugs and variation in heart rate as measures of nerve agent exposure.

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

(U) FY 1991 Planned Program:
- (U) Develop next generation of cooling vest for group cooling to permit continuous operations by ground crew in chemical protective suits for an entire work day.
- (U) Develop methods for decontaminating casualties during aeromedical evacuation of injured DoD personnel in combat.

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

(U) Work Performed By: United States Air Force School of Aerospace Medicine (USAFSAM), Brooks AFB, TX and the Harry G. Armstrong Aerospace Medical Research Laboratory (AAMRL), Wright-Patterson AFB, OH. The major contractors are Jaycor, San Diego, CA; Systems Research Laboratory, Dayton, OH; Applied Science, Valencia, PA; Niagara Scientific, Syracuse, NY; Univ. of Illinois, Champaign, 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 Technology.
- (U) PE #0603231F, Crew Systems and Personnel Protection Technology.
- (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: Not applicable.

3. (U) Project 6302, Occupational and Environmental Toxic Hazards in Air Force Operations: This project has the Air Force responsibilty 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 1988 Accomplishments:
- (U) Measured inhalation toxicity of new hydraulic fluid intended for use by the Advanced Tactical Fighter (ATF).
- (U) Characterized the exhaust products from beryllium-enriched fuels for use by secondary stages of rockets for the Strategic Defense Initiative.

(U) FY 1989 Planned Program:
- (U) Expand the development of mathematical predictors of human

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

toxicity from hazardous compounds resulting in improved estimates of safe levels of exposure to toxic substances.
- (U) Assess the toxicological impact of combustion by-products of new fuels and structural materials to be used in the next generation of aircraft such as the ATF and the F-117.

(U) FY 1990 Planned Program:
- (U) Evaluate hazards to the skin from the new hydraulic fluid intended for the ATF and the B-2.
- (U) Develop a model based upon physiological principles to assess the risk of illness such as cancer associated with exposure to hazardous materials.

(U) FY 1991 Planned Program:
- (U) Improve the mathematical models of the distribution and actions of toxic compounds in the body by incorporating a mechanism for predicting cancer following exposure.
- (U) Develop methods to predict the deleterious effects on man of exposure to combustion products from advanced composite materials used in the new generation of stealth aircraft.

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

(U) Work Performed By: AAMRL. The only contractor is Northrop Services, Inc., Research Triangle Park, NC.

(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: Not applicable.

4. (U) Project 6770, Biotechnology Studies in Advanced Systems: This project funds advice from national scientific and technical organizations, committees and tri-service groups to the 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 1988 Accomplishments:
- (U) Expansion of the postdoctoral scholars program to include two new positions: one in respiratory physiology, and the other in modeling of toxic substances.

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

(U) FY 1989 Planned Program:
- (U) Establish working groups on wrap-around visual displays and photoreceptor function during long term space flight.
- (U) Continue support of other technical advisory groups such as DoD Human Factors Engineering Technical Advisory Group.

(U) FY 1990 Planned Program:
- (U) Expand the postdoctoral program to a total of 8 positions.
- (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) Program to Completion: This is a continuing program.

(U) Work Performed 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: Not applicable.

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 perceptual capacities 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 1988 Accomplishments:
- (U) Demonstrated in field tests of visual deception techniques that aircraft survivability was improved by causing attacking aircrew to attack decoys.
- (U) Demonstrated the feasibility of an optically based passive terrain-avoidance system not requiring radar emissions, permitting unobserved penetration of enemy territory.

(U) FY 1989 Planned Program:
- (U) Develop a special telescope to allow observation from orbital altitude of terrestrial objects to determine human pointing, tracking and visual performance in space.
- (U) Develop a method to effectively simulate and predict enemy

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

responses during various combat scenarios.

(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 to penetrating air base defenses as posed by manned systems such as the B-2.

(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.

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

(U) Work Performed By: AAMRL. The major 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 Technology.
- (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 and DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

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 perceptual, cognitive, and response characteristics of human operators is gathered and analyzed within mission specific scenarios to provide design data for system control and display development. Standardized man-in-the-loop simulation methods are developed to measure the changes in weapon effectiveness as a result of changes in man-machine coupling.

(U) FY 1988 Accomplishments:
- (U) Designed B-1B bomber defensive operator display system currently being used by Strategic Air Command aircrews.
- (U) Developed a prototype human engineering workstation using Artificial Intelligence to optimize tests on aircrew performance involving such factors as mental fatigue.

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

(U) FY 1989 Planned Program:
- (U) Complete an image-generating terminal for simulating air-to-air combat in a 3-dimensional viewing field.
- (U) Complete a brassboard helmet-mounted display system with a wide field-of-view for transition to the Super Cockpit initiative.

(U) FY 1990 Planned Program:
- (U) Design the display requirements for the first ejection-compatible tactical night vision system...improve night combat effectiveness.

- (U) Evaluate the design of a strategic crew station intended to enhance information displays to the 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) Program to Completion: This is a continuing program.

(U) Work Performed By: AAMRL. The major contractors are Systems Research Lab., Dayton, OH; 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 Technology.
- (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 and DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

7. (U) Project 7231, Safety and Aircrew Effectiveness in Mechanical Force Environments: Efforts within this project determine human response to a variety of mechanical forces: noise, impact and sustained acceleration, and vibration. This information is needed for the development of safe, effective escape/ejection systems, acceleration protection equipment, and

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

restraint devices for aircrews. This project also develops data for operator-centered communications, communications jamming, and noise exposure criteria, as well as concepts for operator control of robotic systems using telepresence techniques.

(U) FY 1988 Accomplishments:
- (U) Demonstrated 2-dimensional audio display technology for overcoming spatial disorientation during flight, as well as target finding in the cockpit for future fighter aircraft.
- (U) Analyzed the structural loads of the proposed systems for emergency escape of personnel from the Space Shuttle.

(U) FY 1989 Planned Program:
- (U) Start development of remote, closed-loop control of mobile robots by human operators, to link human judgement, adaptability and dexterity in real-time to robots.
- (U) Continue work on monitoring of physiologic state of aircrew during stressful phases of flight to reduce the likelihood of aircraft mishaps.

(U) FY 1990 Planned Program:
- (U) Quantify the critical features of audio communications in human information processing and decision making.
- (U) Develop a model to predict the effectiveness of various countermeasures on voice communications.

(U) FY 1991 Planned Program:
- (U) Develop countermeasures against voice communication for deception and jamming.
- (U) Complete a mathematical model of noise levels from the takeoff ground roll profile of current inventory aircraft.

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

(U) Work Performed 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 Proptection Technology.
- (U) PE #0604703F, Aeromedical/Chemical Defense Systems Development.
- (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.

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

- (U) No unnecessary duplication of effort within USAF or DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

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 these diseases on aircrew performance; (3) conduct research in maintaining and possibly enhancing aircrew performance.

(U) FY 1988 Accomplishments:
- (U) Completed development and installation of a medical imaging system permitting state-of-the-art heart disease diagnosis of grounded aircrew under flight evaluation.
- (U) Measured the degree of compatibility of night vision goggles with all three US chemical defense masks.

(U) FY 1989 Planned Program:
- (U) Determine if fighter aircrew can use contact lenses during flight for enhancing aerial combat capability, since eye glasses do not remain in place during high-G maneuvers.
- (U) Determine if changes in visual acuity of aircrew over their flying career are similar to those of other groups and if aircrew selection criteria for vision should be revised.

(U) FY 1990 Planned Program:
- (U) Use Artificial Intelligence in the search of repositories of medical data for more rapid and accurate diagnoses.
- (U) Evaluate effects of cholesterol-lowering drugs and blood-pressure medication on aircrew performance during flight to determine if flyers on these drugs may continue flying.

(U) FY 1991 Planned Program:
- (U) Validate the cardiac risk evaluation system to determine the likelihood of aircrew members suffering heart disease.
- (U) Complete evaluations on the natural history of cardiac disease as part of a large and well-controlled study done collaboratively with the Army on Class of '56 West Point graduates.

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

(U) Work Performed By: USAFSAM. The major contractors are Frontier Engrg., Inc., Stillwater, AL and Transform Index Technologies, Inc., San Antonio, TX.

(U) Related Activities:
- (U) PE #0603231F, Crew Systems and Personnel Protection Technology.

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

- (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 and DoD.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

9. (U) Project 7757, Radiation Hazards in Aerospace Operations: This project assesses biological effects, develops countermeasures and quantifies acute and delayed biological effects of: lasers; nuclear flash; and radiofrequency, ionizing, and particulate radiation on USAF personnel. It performs personnel hazard assessments, defines safe separation distances, develops protective devices, and develops the means to predict air and ground crew ability to safely perform in laser, radiofrequency or nuclear radiation environments.

(U) FY 1988 Accomplishments:
- (U) Obtained preliminary validation of radar pulse propagation studies for estimating effects in man using animal models to predict safe levels of exposure to HPM.
- (U) Determined that laser-induced glare interference with the F-16 heads-up display adversely impacts aircrew performance.

(U) FY 1989 Planned Program:
- (U) Expand studies on the bioeffects of HPM to better define the safe limits of exposure around our many radar sites.
- (U) Study the effects of ionizing radiation on the air base in coordination with the Armed Forces Radiobiology Research Institute to predict effects of the use of nuclear weapons.

(U) FY 1990 Planned Program:
- (U) Measure performance decrements in man following exposure to low intensity laser radiation.
- (U) Develop a theory of acoustic wave injury following exposure to high power short pulse radiofrequency radiation.

(U) FY 1991 Planned Program:
- (U) Determine the likelihood of brain tumor occurrence in rats following exposure to ionizing radiation to correlate with new findings in the long-term animal study.
- (U) Set transmittance standards for laser protective helmet visors intended for night operations.

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

(U) Work Performed By: USAFSAM. The major contractors are SRI International, Atlanta, GA; Radiation Monitoring Devices, Inc., Watertown, MA; Technology, Inc., San Antonio, TX; Southwest

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

Research Inst., San Antonio, TX; Applied Electromagnetics, Inc., Marietta, GA.

(U) RELATED ACTIVITIES:
- (U) PE #0603231F, Crew Systems and Personnel Protection Technology.
- (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: Not applicable.

10. (U) Project 7930, Advanced Crew Technology: This project develops design criteria and prototypes for improved protection of aircrews confronted by very high onset sustained acceleration (G) forces, spatial disorientation, thermal extremes, and oxygen deprivation. Additional tasks involve the development and evaluation of aeromedical evacuation equipment; and the evaluation, cockpit integration, and man rating of aircrew life support equipment.

(U) FY 1988 Accomplishments:
- (U) Developed spatial disorientation trainer to help aircrew maintain their orientation during aerial maneuvers.
- (U) Developed predictions for occurrence of the bends following rapid decompression of aircraft to find ways to reduce the likelihood of injury associated with high altitude flight.

(U) FY 1989 Planned Program:
- (U) Determine the appropriate onset time and rate of inflation for anti-G suits in response to very rapid onset G-forces.
- (U) Develop a combined anti-G valve and breathing regulator to reduce cockpit space required by life support equipment, and improve assisted positive pressure breathing systems.

(U) FY 1990 Planned Program:
- (U) Develop a system to transport at altitudes over 1000 ft a patient suffering from decompression sickness.
- (U) Develop inflight countermeasures against spatial disorientation such as 3-dimensional sound cues to reduce accidents during complex aerial maneuvers.

(U) FY 1991 Planned Program:
- (U) Develop an in-flight clinical laboratory to perform standard laboratory tests such as blood hematocrit and blood-in-urine on patients during evacuation by air.
- (U) Develop an improved oxygen generator using molecular sieve technology in combination with high pressure pumps for producing liquid oxygen during flight for fighter aircraft.

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

UNCLASSIFIED

Program Element: #0602202F Budget Activity: 1-Technology Base
PE Title: Human Systems Technology

(U) Work Performed By: USAFSAM. The major contractors are Technology, Inc., 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 Technology.
- (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: Not applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0602203F Budget Activity: #1 - Technology Base
Title: Aerospace Propulsion

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
06PP Laboratory Operations	20,747	21,616	22,055	22,320	Continuing	TBD
3012 Ramjet Technology	5,711	5,401	5,830	6,045	Continuing	TBD
3048 Fuels, Lubrication and Fire Protection	6,470	6,575	6,732	6,811	Continuing	TBD
3066 Turbine Engine Technology	21,060	24,039	23,604	23,659	Continuing	TBD
3145 Aerospace Power Technology	6,670	6,542	6,700	6,900	Continuing	TBD
TOTAL	60,658	64,173	64,921	65,735	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element contains the entire Air Force Exploratory Development program in airbreathing propulsion and aerospace power technology for current and future aerospace vehicles and weapon systems. The prime areas of focus are turbine engine technology, ramjet technology, fuels, lubrication and fire protection technology, and advanced power technology. Technology advances in components such as turbine engine fans, compressors, combustors, turbines, and lubrication systems, when integrated, could provide a 60% increase in engine thrust-to-weight ratio and a 25-30% reduction in specific fuel consumption by 1995. Advanced airbreathing propulsion concepts like ramjets could reduce by 50% the time to target for future air-to-ground missiles and provide high Mach propulsion for manned aircraft. Advanced fuels efforts support all weapon systems providing double the heat sink capability over current fuels. Improved hydraulic power and electrical secondary power systems will be required to produce twice the energy with half the weight.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06PP Laboratory Operations: Provides management and operational support for the Aero Propulsion Laboratory, Wright-Patterson Air Force Base OH. Includes pay and benefits for civilian scientists, engineers, and supporting personnel, travel, transportation, rents, communications, utilities, and procurement of supplies and equipment.

(U) Other Appropriation Funds:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Military Construction Funds Cost	0	0	5,300	0	0	5,300

2. (U) Project 3012, Ramjet Technology: Develops advanced propulsion concepts in ducted ramjets, solid fueled ramjets and air turborockets

Program Element: #0602203F Budget Activity: #1 - Technology Base
Title: Aerospace Propulsion

for missiles; turboramjets and air turborockets for aircraft and aerospace vehicles; and supersonic combustion ramjets for hypersonic aircraft and missiles.

(U) FY 1988 Accomplishments:
- (U) Developed a boron fuel for a solid fueled ramjet that could double the range of future air-to-ground missiles.
- (U) Demonstrated a low-cost ramjet inlet up to Mach 4 conditions, confirming a 15-20% weight savings for ducted ramjets.

(U) FY 1989 Planned Program:
- (U) Continue component development for turboramjet and air turborocket (ATR) leading to advanced development in FY 1992.
- (U) Initiate boron solid fueled ramjet rig test to evaluate engine performance, leading to advanced development in FY 1993.
- (U) Determine effects of design parameters on performance of scramjet inlets and combustors over Mach 3 to 22.

(U) FY 1990 Planned Program:
- (U) Demonstrate a turboramjet ramburner scaled to a turbine engine gas generator, a critical step for transitioning to a Mach 4-6 demonstration.
- (U) Design advanced ramburner using new endothermic fuels, materials and aerothermodynamics.
- (U) Continue the boron solid fueled ramjet rig test initiated in FY 1989.

(U) FY 1991 Planned Program:
- (U) Rig test ATR components through a joint effort with NASA.
- (U) Integrate and test turboramjet components in preparation for a Mach 4-6 advanced development demonstration.
- (U) Test hydrocarbon fueled scramjet components for high speed missiles.

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

(U) Work Performed By: Work is managed by laboratory personnel at the Aero Propulsion 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.

(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 standing committees such as the Joint Army-Navy-NASA-Air Force (JANNAF) Interagency Propulsion Committee.

Program Element: #0602203F Budget Activity: #1 - Technology Base
Title: Aerospace Propulsion

- (U) This is a well coordinated initiative and there is no duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

3. (U) Project 3048, Fuels, Lubrication and Fire Protection: Develops improved Air Force fuels, understanding of fuel/system capabilities, lubricants, lubrication techniques and system components, and fire protection technology. Deemphasizing fire protection in the future.

(U) FY 1988 Accomplishments:
- (U) Demonstrated a corrosion resistant bearing material which will reduce DOD bearing replacement costs by $20M/year and could triple bearing mean-time-between-failure (MTBF) rates.
- (U) Demonstrated an advanced permeable membrane for an On-Board Inert Gas Generator System (OBIGGS) to provide more effective fire protection for aircraft fuel tanks.

(U) FY 1989 Planned Program:
- (U) Demonstrate and transition a 400°F (+75°F capability) liquid lubricant for use in supersonic fighter engines.
- (U) Define fuel heat sink and thermal stability needs for candidate high Mach vehicles, essential data for future designs.

(U) FY 1990 Planned Program:
- (U) Complete development of ceramic, solid lubricated bearings for expendable engines (e.g., cruise missile engines).
- (U) Apply newly developed characterization and computational techniques to the molecular structure of fuel components to predict fuel endothermic and physical behavior.

(U) FY 1991 Planned Program:
- (U) Complete development of solid lubricated ball bearings for manrated engines. Goals are 600°F and 500 hours life.
- (U) Produce candidate thermally stable hydrocarbon fuels for high Mach application and determine heat sink capability.
- (U) Demonstrate second generation endothermic fuel concept and transition to fuel system advanced development effort.

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

(U) Work Performed By: Work is performed both in-house and with contracts managed by Aero Propulsion Laboratory personnel. The five 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.

Program Element: #0602203F Budget Activity: #1 Technology Base
Title: Aerospace Propulsion

(U) Related Activities:
- (U) Technology output from this program is 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 Integrated High Performance Turbine Engine Technology (IHPTET) program.
- (U) This is a well coordinated initiative and there is no duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

4. (U) Project 3066, Turbine Engine Technology: Develops turbine engine technology to increase performance, operational reliability, and mission flexibility while reducing fuel consumption. Primarily supports the IHPTET program, aimed at doubling propulsion capability by the year 2000 by incorporating improved aerothermodynamics, new materials, and lighter weight innovative engine structures.

(U) FY 1988 Accomplishments:
- (U) Demonstrated a 4% increase in compressor efficiency using swept aerodynamics that could provide up to 2% improvement in overall specific fuel consumption.
- (U) Fabricated and demonstrated metal-matrix composite compressor spacer ring that is 70% lighter in weight. This will revolutionize future compressor system designs.
- (U) Demonstrated a composite, hollow fan blade which is a 10% weight reduction and a 5% improvement in fan performance.

(U) FY 1989 Planned Program:
- (U) Design new brush seals which reduce internal leakage flow by an order of magnitude. This increases compressor efficiency by 1% and reduces specific fuel consumption by 0.5%.
- (U) Demonstrate new materials with high cooling effectiveness for turbine airfoil applications that allow several hundred degrees increase in turbine temperature to use for thrust.
- (U) Evaluate advanced high temperature titanium-aluminide turbine blades which if successful will provide a 5% reduction in turbine blade weight over current production blading.

(U) FY 1990 Planned Program:
- (U) Demonstrate 3-stage metal-matrix composite integral blade and ring compressor rotor that reduces weight 70% over conventional blade and disk designs.
- (U) Rig test a high stability, compact, high temperature rise combustor that is 25% smaller and requires minimal cooling at near stoichiometric temperature operation.

Program Element: #0602203F Budget Activity: #1 - Technology Base
Title: Aerospace Propulsion

(U) FY 1991 Planned Program:
- (U) Demonstrate a high stage-loaded enhanced flow compressor design which will greatly expand the engine flight envelope at high Mach number flight.
- (U) Evaluate structural rod support designs that reduce the weight of the overall engine frame and bearing support system by 10%.

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

(U) Work Performed By: Work is performed both in-house and with contracts managed by Aero Propulsion Laboratory personnel. The five major contractors for this project are: General Electric, Evendale OH; United Technologies, East Hartford CT, West Palm Beach FL, and San Jose CA; Garrett Corp, Los Angeles CA and Phoenix AZ; Boeing Aerospace Co, Seattle WA; and Allison Turbine Engine, Indianapolis IN.

(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 100 percent committed to the support of the DOD/NASA Integrated High Performance Turbine Engine Technology (IHPTET) initiative. The IHPTET initiative is also funded by PE's 0602102F, 0603202F, 0603211F, 0603216F, 0602209A, 0603201A, 0602122N, 0602234N, and 0603210N.
- (U) This is a well coordinated initiative and there is no duplication of effort within Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

5. (U) Project 3145, Aerospace Power Technology: Develops solar power cells, fuel cells, batteries, hydraulics, and power generation, conversion and transmission technologies, as well as thermal management technology for aerospace vehicles and satellites.

(U) FY 1988 Accomplishments:
- (U) Developed a 20.5% efficient Gallium Arsenide on Germanium solar cell that doubles power density over current silicon based solar cells.
- (U) Validated Metal Oxide Semiconductor Controlled Thyristor power switch with operating temperature of 200 degrees centigrade and switching capability 90% faster than current transistors.
- (U) Designed a 50 watt-hour per pound sodium-sulfur battery (for satellite energy storage) that is 75% lighter than current battery systems, allowing increased power levels and payload with reduced launch cost.

Program Element: #0602203F Budget Activity: #1 - Technology Base
Title: Aerospace Propulsion

(U) FY 1989 Planned Program:
- (U) Demonstrate solid state quad-fault tolerant electrical power system for aircraft that provides a factor of three improvement in fault tolerance and 100% improvement in reliability.
- (U) Establish criteria to triple the survivability level of current solar cells.
- (U) Design, fabricate and rig test an advanced combustor for Aircraft Auxiliary Power Unit (APU).

(U) FY 1990 Planned Program:
- (U) Integrate proven APU components with the advanced combustor. Design a ground test unit that will be rig tested.
- (U) Validate a radiation hardened and high efficiency cascade solar cell that is three times current survivability.
- (U) Complete sodium sulfur satellite battery reliability tests. The battery can be used in all new satellites and space systems.

(U) FY 1991 Planned Program:
- (U) Demonstrate APU system performance of 400 horsepower per cubic foot (80% improvement) and operational envelope to 50,000 feet altitude (100% improvement).
- (U) Complete maintenance free aircraft battery and certify for flight test. The battery eliminates a serious flight line hazard.

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

(U) Work Performed By: Work is performed both in-house and with contracts managed by Aero Propulsion Laboratory personnel. The major contractors for this project are: General Electric, Schnectody NY; Boeing Aerospace, Seattle WA; Eagle-Picher Ind, Joplin MO; Research Triangle Institute NC; and Loral EOS Inc, Pasadena CA.

(U) Related Activities:
- (U) Coordination is accomplished through the Interagency Power Group, an Air Force, Army, Navy, NASA and Department of Energy coordination 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 duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06AA Air Force Avionics Laboratory Operations	32,073	33,755	35,024	36,425	Continuing	TBD
2000 Active Electronic Countermeasures	2,840	3,145	3,464	3,687	Continuing	TBD
2001 Electro-Optical Technology	1,910	2,115	2,330	2,480	Continuing	TBD
2002 Microwave Technology	4,800	5,315	5,855	6,232	Continuing	TBD
2003 Avionics System Design Technology	4,700	3,654	4,025	4,285	Continuing	TBD
2004 Reconnaissance/Strike Electro-Optical Sensors	2,028	1,526	1,681	1,789	Continuing	TBD
6095 Inertial Reference and Guidance Technology	1,470	1,627	1,793	1,909	Continuing	TBD
6096 Microelectronics Technology	3,100	3,432	3,781	4,025	Continuing	TBD
7622 Reconnaissance/Strike RF Sensors	2,862	2,615	2,881	3,067	Continuing	TBD
7629 Fire Control Avionics	2,980	3,126	3,440	3,662	Continuing	TBD
7633 Passive Electronic Countermeasures	2,605	2,884	3,177	3,382	Continuing	TBD
7662 Avionics Data Transmission and Reception	825	915	1,006	1,071	Continuing	TBD
Total	62,193	64,109	68,457	72,014	Continuing	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.

00066

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 1988 Accomplishments:
- (U) Demonstrated a wideband linear solid state phased array antenna for jammers using integrated circuit amplifiers.

(U) FY 1989 Planned Program:
- (U) Evaluate jamming systems using digital radio frequency memories to verify jamming effectiveness against coherent radar threats.
- (U) Evaluate 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) Program to Completion: This is a continuing program.

(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 1988 Accomplishments:
- (U) Coherently combined seven carbon dioxide waveguide lasers to demonstrate 100 watt output to extend laser radar range.

(U) FY 1989 Planned Program:
- (U) Increase the quantum efficiency of doped silicon infrared detectors in the 8-12 micron spectrum.
- (U) Develop a 2-5 micron tunable laser source for future infrared smart countermeasure systems.

(U) FY 1990 Planned Program:
- (U) Develop uncooled infrared detectors (8-12 Microns) to be used in active or passive systems.
- (U) Develop efficient photo luminescent materials for 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.
- (U) Develop optical networks for correlators, image processing, and signal analysis compatible with GaAs type materials.

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

(U) Work Performed By: The Electronic Laboratory, Wright-Patterson AFB, OH, manages this project. The contractors include: AT&T, Holmdell, NJ; 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) There is no unnecessary cuplication 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: #C602204F 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 1988 Accomplishments:
- (U) Developed a 20-40 GHz Traveling Wave Tube (TWT) producing 100 watts continuous wave (CW) power for electronic combat.

(U) FY 1989 Planned Program:
- (U) Demonstrate sensors for non destructive inspection of TWTs.
- (U) Develop simultaneous transmit/receive multifrequency (7-11 GHz) phased array elements for advanced radar waveforms.

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

(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 06037065, Micro/Millimeter Wave 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: Not applicable.

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 1988 Accomplishments:
- (U) Completed an interactive Ada workstation to double programmer productivity.
- (U) Demonstrated artificial neural and distributed expert systems for adaptive RF emitter identification.

(U) FY 1989 Planned Program:
- (U) Develop packaging, cooling, and interconnect design for an advanced airborne parallel processor.
- (U) Apply neural network drive reinforcement learning systems to adaptive robotics control.
- (U) Expand 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 reusabile real-time software.

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

(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 1988 Accomplishments:
- (U) Demonstrated ultra-high resolution passive infrared imaging capability for high altitude reconnaissance applications.
- (U) Collected imagery with Tri-Service laser radar for more accurate and longer range air-to-ground targeting.

(U) FY 1989 Planned Program:
- (U) Develop target detection concepts using unexploited observables to detect and classify targets protected by camouflage, concealment, and deception (CCD) techniques.
- (U) Update the tactical decision aid model with new high value targets.

(U) FY 1990 Planned Program:
- (U) Develop advanced counter-countermeasure techniques for new forward looking infrared (FLIR) systems and laser radars.
- (U) Develop performance models to design next generation FLIRs.

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

(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 1988 Accomplishments:
- (U) Designed an integrated antenna for CNI/EW between 200 and 2000 MHz.
- (U) Completed hypervelocity vehicle CNI technology roadmap to define a family of advanced applications.

(U) FY 1989 Planned Program:
- (U) Evaluate artificial intelligence for improved navigation sensor management.
- (U) Develop automatic fix taking management techniques to reduce crew workload.
- (U) Demonstrate new Kalman filter design to reduce navigation system procurement costs.
- (U) Research ultra-high reliability inertial components to help 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) FY 1991 Planned Program:
- (U) Demonstrate resonant fiber optic gyros.
- (U) Demonstrate solid state accelerometers.
- (U) Develop breadboard superconducting inertial sensor for strategic weapons applications.

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

(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: Not applicable.

00072

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 1988 Accomplishments:
- (U) Used aluminum doped GaAs to demonstrate 6-bit monolithic quantizer to improve analog to digital converter signal resolution and speed.
- (U) Demonstrated the world's fastest propagation delay heterojunction field effect transistor.

(U) FY 1989 Planned Program:
- (U) Demonstrate subnanosecond GaAs integrated logic.
- (U) Develop Indium Phosphide (InP) hybrid bipolar technology for high frequency application.
- (U) Implement 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) 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) Program to Completion: This is a continuing program.

(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: Not applicable.

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 1988 Accomplishments:
- (U) Analyzed image smearing problem for F-15 SAR targeting capability. Provided solution to F-15 program.

(U) FY 1989 Planned Program:
- (U) Fabricate 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/techniques for use with Nasa Space Shuttle bistatic radar experiment.
- (U) Investigate Ultra High Resolution SAR to establish key technologies for air-to-ground target detection

(U) FY 1991 Planned Program:
- (U) Demonstrate bistatic SAR space illumination techniques for passive ground target detection.
- (U) Develop raid assessment modeling techniques for difficult to detect airborne targets.

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

(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 1988 Accomplishments:
- (U) Demonstrated automatic target cueing using radar to improve air-to-ground targeting and attack of concealed targets.
- (U) Designed multi-sensor fire control to enhance targeting and strike capabilities against reduced signature air targets.

(U) FY 1989 Planned Program:
- (U) Develop automatic target cueing techniques for infrared sensors to identify and attack concealed ground targets.
- (U) Incorporate neural network and parallel processing techniques into multi-sensor fusion algorithms to meet increased throughput requirements and reduce pilot workload.
- (U) Investigate concepts for targeting and fire control to be used on covert aircraft.

(U) FY 1990 Planned Program:
- (U) Demonstrate automatic target cueing for forward looking infrared systems and laser radars.
- (U) Demonstrate covert targeting algorithms.

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

(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: Not applicable.

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 1988 Accomplishments:
- (U) Random Agile Deinterleaver algorithm proven effective in sorting agile radar signals.

(U) FY 1989 Planned Program:
- (U) Demonstrate an acoustooptical tunable filter for laser warning in the far infrared.
- (U) Develop 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) Program to Completion: This is a continuing program.

(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 1988 Accomplishments:
- (U) Designed adaptive signal masking waveform to provide LPI operation and resistance to jamming.
- (U) Designed ultraviolet system for short range LPI communication.

(U) FY 1989 Planned Program:
- (U) Develop a CNI roadmap outlining the technology developments needed for aerospace communication in the post 2000 era.
- (U) Assemble and test 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) 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) Program to Completion: This is a continuing program.

(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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06HT Laboratory Support	10,150	10,207	11,785	11,874	Continuing	TBD
1121 Technical Training Development	1,912	1,950	1,860	1,853	Continuing	TBD
1123 Flying Training Development	2,849	2,793	2,070	2,070	Continuing	TBD
1192 Advanced Simulation for Pilot Training	5,220	5,456	4,866	4,825	Continuing	TBD
1710 Logistics and Maintenance Technology	3,950	3,640	2,991	2,988	Continuing	TBD
3017 Command and Control Training	1,151	1,395	1,090	1,064	Continuing	TBD
6114 Flight Simulator Technology	1,286	1,215	830	814	Continuing	TBD
7719 Force Acquisition & Distribution Systems	3,298	3,370	2,746	2,743	Continuing	TBD
7734 Force Management Systems	1,019	827	780	757	Continuing	TBD
Total	30,835	30,853	29,018	28,990	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Increases operational readiness by developing technologies to enable more effective classification, assignment, training, and retention of personnel, and to minimize the manpower and equipment necessary to conduct maintenance.

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 Program Element (PE).

2. (U) Project 1121, Technical Training Development: Improves the quality and cost effectiveness of technical 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 1988 Accomplishments:
- (U) Developed an expert system which provides real-time guidance to students during equipment operation training.

00078

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

(U) FY 1988 Accomplishments:
- (U) Developed an expert system which provides real-time guidance to students during equipment operation training.
- (U) Developed software to partially automate creation of training systems incorporating artificial intelligence.

(U) FY 1989 Planned Program:
- (U) Determine parameters for deciding when computer-based job aids are more cost effective than additional training.
- (U) Determine the most effective instructional sequencing and delivery strategies for computer-based training for maintenance and space operations.

(U) FY 1990 Planned Program:
- (U) Begin experiments on the effectiveness of different instructional approaches in intelligent training systems.
- (U) Determine the value and use of case-based reasoning and qualitative reasoning in AF technical training.
- (U) Continue development of software tools to enable training developers to create intelligent computer-based training courses without the assistance of computer programmers.
- (U) Determine the feasibility of using neural networks to construct individualized student models in order to enhance the performance of intelligent tutoring systems.
- (U) Begin investigations regarding machine learning and knowledge-based instructional planning.

(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 experiments on the effectiveness of computer-based training for various AF applications.

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

(U) Work Performed By: AF Human Resources Laboratory, Training Systems Division, Brooks AFB, TX. Prime contractors are: FMC Corp, Santa Clara, CA; MEI Associates, Lexington, MA; Harris Corp, Melbourne, FL; and Universal Energy Systems, Dayton, OH.

(U) Related Activities:
- (U) PE 0603227F, Personnel, Training, and Simulation Technology.
- (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) PE 0602727A, Non-System Training Devices Technology.

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

- (U) The AF has formal agreements with the Army and the Navy to share development of computer-based training technologies.
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 1123, Flying Training Development: Develops new methods and techniques for aircrew training. Investigates the entire spectrum of aircrew training required for a weapon system to determine the best ways of designing, delivering and assessing ground based and aircraft training.

(U) FY 1988 Accomplishments:
- (U) Determined that low cost, artificially enhanced digital imagery could effectively simulate synthetic aperture radar and satisfy operational B-1 simulator training requirements.
- (U) Determined that successive reductions in the instantaneous field-of-view available in C-130 flight simulators resulted in corresponding reductions in pilot performance during low altitude manuevering in the simulator.

(U) FY 1989 Planned Program:
- (U) Begin development of a modular threat simulation system to support the development and evaluation of integrated full-mission electronic combat training
- (U) Determine flight simulator critical visual cues for low-level flight and performance effects of trade-offs in scene brightness, resolution, and contrast.
- (U) Identify critical factors in cockpit resource management and develop training to improve related aircrew skills.
- (U) Conduct experiments on sensor scene fidelity to specify simulation requirements for ground radar resolution and infrared displays.

(U) FY 1990 Planned Program:
- (U) Demonstrate a stand alone aircrew performance measurement system, capable of acquiring data from flight simulators, as well as Air Combat Maneuvering Instrumentation Ranges.
- (U) Complete development of an artificial intelligence model of pilot knowledge structures, to evaluate air combat decision-making strategies and develop improved training methods.
- (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) Determine the effectiveness of augment cuing (e.g. adding color or detail to an object in order to increase detectability) for training and other applications.

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

- (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 combat training and mission rehearsal.
- (U) Begin development of an expert system for training tactical air combat pilots in decision making.

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

(U) Work Performed By: AF Human Resources Laboratory, Operations Training Division, Williams AFB, AZ. The prime contractors are: University of Dayton, Dayton, OH; Singer Company, Binghamton, NY; and Logicon, San Diego, CA.

(U) Related Activities:
- (U) PE 0603227F, Personnel, Training, and Simulation Technology
- (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) PE 0602785A, Manpower, Personnel, and Training 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 with the Operations Training Division at Williams AFB, AZ.
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

3. (U) Project 1192, Advanced Simulation for Pilot Training: Provides engineering support for Projects 1123 and 6114 and on-site contractor maintenance and modification of the R&D flight simulation equipment and software, including computer image generation systems, dome and helmet-mounted visual displays, data base development systems, and simulator control computers.

4. (U) Project 1710, Logistics and Maintenance Technology: Develops new technologies to improve the logistics support of Air Force combat and peacetime operations. Develops improved models for logistics planning and assessment to provide realistic computation of wartime logistics requirements and capabilities. Develops methods to identify tradeoffs in personnel, job aids, and support equipment to minimize the manpower and equipment neccessary to conduct aircraft maintenance in a dispersed location. Develops software tools to enable weapon systems designers to design in improved reliability, maintainability, supportability, and man-machine interfaces.

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

(U) FY 1988 Accomplishments:
- (U) Compiled listing of flightline maintenance tasks which can be completed, partially completed, or not performed by personnel wearing chemical/biological warfare protective clothing and the associated physiological demands for performance of those tasks.

(U) FY 1989 Planned Program:
- (U) Begin development of improved, computer-based reliability and maintainability design evaluation measures and criteria for use by and program directors and engineers during weapon system development.
- (U) Develop user-friendly computer techniques to enable rapid development and use of capability assessment models.
- (U) Begin development of methods to identify critical maintenance tasks to be performed in emergency situations (both combat and domestic) and the training requirements associated with those contingencies.

(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 while system is still in early design stages.
- (U) Continue development of improved simulation models to enable enhanced analysis of Air Force-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) Program to Completion: This is a continuing program.

(U) Work Performed By: AF Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB, OH. The prime contractors are: Applied Sciences Assoc., Valencia, PA; Institute for Defense Analyses, Mc Clean, VA; and Systems Exploration Inc., San Diego, CA.

(U) Related Activities:
- (U) PE 0602202F, Human Systems Technology
- (U) PE 0603106F, Logistics Systems Technology
- (U) PE 0603227F, Personnel, Training, and Simulation Technology

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

- (U) PE 0602716A, Human Factors Engineering Technology Dev
- (U) PE 0602234N, Mission Support Technology: Human Factors Technology Area
- (U) No unnecessary duplication 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 job performance and training requirements, and develops new training and evaluation methods for decision making and command and control team performance. Emphasis is on training to enable optimal use of complex command and control information systems.

(U) FY 1988 Accomplishments:
- (U) Conducted field demonstration of an automated tool to analyze command and control training requirements that promises to significantly reduce the cost and manpower required to develop new command and control training system.

(U) FY 1989 Planned Program:
- (U) Develop and evaluate preliminary models to allow systems designers to predict the impacts of automation on previously manual command and control systems.
- (U) Develop a proof-of-concept rapid training system for Headquarters Pacific Air Force battlestaff augmentees.

(U) FY 1990 Planned Program:
- (U) Continue development of models to define and replicate high performance decision making skills of tactical battlestaffs.
- (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 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) Program to Completion: This is a continuing program.

(U) Work Performed By: AF Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB, OH. The major contractors are: BBN Laboratories, Cambridge, MA and Logicon Inc., San Diego, CA.

(U) Related Activities:
- (U) PE 0602702F, Command, Control, and Communication

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

- (U) PE 0603789F, C3I Technology Development
- (U) PE 0603227F, Personnel, Training, and Simulation Technology
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area.
- (U) PE 0602785A, Manpower, Personnel, and Training Technology
- (U) PE 0602727A, Non-System Training Devices Technology
- (U) The AF Human Resources Laboratory has formal agreements with the Rome Air Development Center, Griffis AFB, NY, to share command and control systems research products.
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

6. (U) Project 6114, Flight Simulator Technology: Develops flight simulator component hardware technologies for future aircrew training systems, to reduce the cost of aircrew training systems and to provide new capabilities for realistic combat training.

(U) FY 1988 Accomplishments:
- (U) Demonstrated the feasibility of using low cost image generation architecture to simulate real-beam radar.
- (U) Completed development of a low-cost ground-mapping digital radar generator for flight simulators.

(U) FY 1989 Planned Program:
- (U) Begin tri-Service effort with the Naval Training Systems Center and the Army Research Institute to develop local and long distance communications networking standards for linking aircraft, tank, and helicopter simulators.
- (U) Demonstrate the feasibility to rehost high fidelity simulation and support software from large minicomputers to inexpensive microprocessor systems, significantly reducing the cost for flight simulators.

(U) FY 1990 Planned Program:
- (U) Continue development of the tri-Service simulator networking standards.
- (U) Begin development of design and utilization guidelines for part-task trainers for the Major Air Commands.

(U) FY 1991 Planned Program:
- (U) Develop design guidelines for electronic warfare trainers.
- (U) Demonstrate long-distance interactive operation between the Operations Training Division at Williams AFB, AZ; Naval Training Systems Center, Orlando, FL; and Fort Rucker, AL.
- (U) Begin development of technologies supporting rapid database development necessary for simulator mission rehearsal.

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

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

(U) Work Performed By: AF Human Resources Laboratory, Operations Training Division, Williams AFB, AZ. The contractors are: University of Dayton, Dayton, OH; Singer Company, Binghamton, NY; and Systems Exploration Inc., San Diego, CA.

(U) Related Activities:
- (U) PE 0603227F, Personnel, Training, and Simulation Technology
- (U) PE 0603231F, Crew Systems Technology
- (U) PE 0604227F, Flight Simulator Development
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area
- (U) PE 0603733N, Training Devices Technology
- (U) PE 0602727A, Non-System Training Devices Technology
- (U) PE 0603003A, Aviation Advanced Technology
- (U) The AF has formal agreements with the Army for simulator visual display and computer image generation technology.
- (U) The Navy has a liaison office with the Operations Training Division at Williams AFB, AZ.
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

7. (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 1988 Accomplishments:
- (U) Developed and demonstrated a model to determine the value or cost of replacement of experienced enlisted personnel.
- (U) Developed computer model to predict impact on technical training requirements from combining AF specialties.
- (U) Developed an enlisted classification model which optimizes the match between jobs and individual skills/aptitudes.

(U) FY 1989 Planned Program:
- (U) Determine the ability of the various job performance measures to reliably capture the performance of technicians and examine the interrelationships among the measures.
- (U) Continue development of measures to predict suitability for fighter, bomber, tanker, or transport aircraft training.
- (U) Determine 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 Air Force jobs to improve training effectiveness and efficiency.

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

- (U) Develop methods to predict personality, motivational, and leadership qualities, for officer selection/classification.
- (U) Begin development of a transferability of skills 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 supportability and maintainability of future weapon systems.
- (U) Begin development of a Total Force Impact Model to specify supportable manpower, personnel, and training constraints for use in early weapon system planning documents and provide design criteria to weapon system developers.

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

(U) Work Performed By: AF Human Resources Laboratory, Training Systems Division, Brooks AFB, TX. The contractors are: Psychometrics Inc., Woodland Hills, CA; Data Metrics Research Inc., Waban, MA; University of Illinois, Champaign, IL; and IIT Research Institute, Chicago, IL.

(U) Related Activities:
- (U) PE 0603227F, Personnel, Training, and Simulation Technology
- (U) PE 0604243F, Manpower, Personnel, and Training Development
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area
- (U) PE 0603707N, Manpower and Personnel Systems Development
- (U) PE 0602785A, Manpower, Personnel, and Training Technology
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None

8. (U) Project 7734, Force Management Systems: Develops models, strategies and techniques to maintain a quality career force sufficient to meet mission requirements; improve training effectiveness and reduce related costs through better design of overall training programs; improve evaluation of job performance, career motivation, job satisfaction, and individual/unit productivity; and reduce premature separation from service and attrition from training.

(U) FY 1988 Accomplishments:
- (U) Developed metrics to enable cost and training effectiveness comparisons of additional training at the technical school, field training detachments, or through on-the-job training.

Program Element: #0602205F Budget Activity: #1 - Technology Base
PE Title: Personnel, Training, and Simulation

(U) FY 1989 Planned Program:
- (U) Begin experiments to refine and validate methods, tools, and models for training content identification.
- (U) Demonstrate and evaluate alternative methods for automating the instructional systems development process.
- (U) Continue development of methods to create alternate training designs for AF specialties by projecting outcomes of various personnel utilization and training options.

(U) FY 1990 Planned Program:
- (U) Continue development of methods to simulate current and alternative AF enlisted specialty structures, estimating training resource capacity and estimation of training costs.
- (U) Develop methods to use job performance for training content validity assessment

(U) FY 1991 Planned Program:
- (U) Continue experiments to refine and validate methods, tools, and models for training planning/decision making.
- (U) Determine the feasibility of integrating job performance information with training planning/decision technologies.
- (U) Continue development of methodologies for identifying areas of over- and under-training based on job performance.

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

(U) Work Performed By: AF Human Resources Laboratory, Manpower and Personnel Division, Brooks AFB, TX. Prime contractor is Universal Energy Sys, Dayton, OH.

(U) Related Activities:
- (U) PE 0601102F, Defense Research Sciences
- (U) PE 0602202F, Human Systems Technology
- (U) PE 0603227F, Personnel, Training, and Simulation Technology
- (U) PE 0604243F, Manpower, Personnel, and Training Development
- (U) PE 0602233N, Mission Support Technology: Personnel, Training and Simulation Technology Area
- (U) PE 0603707N, Manpower and Personnel Systems Development
- (U) PE 0602785A, Manpower, Personnel, and Training Technology
- (U) PE 0603007A, Human Factors, Personnel and Training Adv Tech
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1900 Environmental Quality Technology	2,797	2,999	2,663	2,589	Continuing	TBD
2673 Civil Engineering Technology	3,715	3,817	3,388	3,296	Continuing	TBD
Total	6,512	6,816	6,051	5,885	Continuing	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 program is achieved by exploratory development in the areas of: defensive construction of air base facilities, utilities, and operating surfaces against conventional and chemical/biological attacks; battle damage assessment, repair, and maintenance of air base facilities, utilities and operating surfaces; air base and aircraft crash rescue and fire suppression; control, detection, and disposal of pollutants and wastes generated during Air Force operations; and waste reduction/remedial actions for Air Force site clean-up.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 cleanup technologies. Research is conducted to reduce the cost and increase the effectiveness of technologies that protect the environment. New fuels and chemicals are monitored to anticipate and prevent environmental problems from occurring and to prevent delays in testing and fielding weapon systems.

(U) FY 1988 Accomplishments:
- (U) Characterized significant environmental interactions of toxic hydrazine fuels from rocket refueling operations.
- (U) Determined impact on air quality from analyzing photochemistry of chemicals released by jet engine operation.

(U) FY 1989 Planned Program:
- (U) Investigate the use of fuel additives to reduce particulate emission generated by jet engine maintenance tests--meet EPA standards for air quality.

Program Element: #0602206F Budget Activity: 1-Technology Base
PE Title: Civil Engineering & Environmental Quality

- (U) Design specifications for combustor that destroys contaminated rocket fuels and complies with EPA standards.

(U) FY 1990 Planned Program:
- (U) Evaluate ways to reduce hazardous waste generated by the actual firing of depleted uranium munitions.
- (U) Investigate aircraft paint stripping--reduce toxic waste.
- (U) Develop analytical procedures to identify the source of fuel spills to determine responsibility for clean up.

(U) FY 1991 Planned Program:
- (U) Investigate ways of disposing of hazardous waste resulting from the manufacture of rocket/missile propellants.
- (U) Analyze the environmental fate of new rocket propellants.
- (U) Investigate Nitrogen Oxide formation and control in aircraft engine ground tests--meet EPA standards.

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

(U) Work Performed By: AF Engineering and Services Lab, Tyndall AFB FL. Major contractors: U. of Calif., Berkeley CA; EG&G, Idaho Falls ID; 3M Corporation, St. Paul MN; Martin Marietta, Oakridge 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: None.

(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 areas of: survivabile air base strucutures, utilities, and operating surfaces against more accurate and powerful conventional and chemical/biological weapons; air base battle damage assessment and repair; 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 1988 Accomplishments:
- (U) Developed concept for environmentally safe, non-toxic fire suppressants to replace current toxic fire training agents--halon replacement/preserve earth's ozone layer.

Program Element: #0602206F Budget Activity: 1-Technology Base
PE Title: Civil Engineering & Environmental Quality

- (U) Determined response and failure modes of runway subsurfaces to improve construction for longer life runways.

(U) FY 1989 Planned Program:
- (U) Develop survivability assessment methodology for evaluating the merit of proposed air base structural designs.
- (U) Develop new dispensing concept for stand-off fire suppression for live ordnance and hazardous materials.

(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 criteria for an emergency air base power system that is reliable, deployable, and rapidly connectable.

(U) FY 1991 Planned Program:
- (U) Develop reliable high temperature resistant pavement design for short takeoff and landing aircraft.
- (U) Identify and evaluate alternate expedient repair materials to support post-attack runway/taxiway repair.
- (U) Develop concepts for use of new composite materials in air base protective structures.

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

(U) Work Performed By: AF Engineering and Services Lab, Tyndall AFB FL. 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 Technology.
- (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: None.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Estimate	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06RL Laboratory Operations	15,634	13,258	13,406	13,594	Continuing	TBD
2864 Interdisciplinary Space Technology	4,637	3,199	3,694	3,781	Continuing	TBD
3058 Space Propulsion Technology	8,034	6,545	7,561	7,740	Continuing	TBD
3059 Ballistic Missile Propulsion Technology	2,100	1,437	1,660	1,699	Continuing	TBD
3148 Air-Launched Missile Propulsion Technology	3,231	1,888	2,180	2,235	Continuing	TBD
5730 Multiple Applications Technology	7,531	7,997	9,239	9,456	Continuing	TBD
TOTAL	41,167	34,324	37,740	38,505	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This science and technology program exploits new concepts and techniques for rocket propulsion and interdisciplinary space technology. We provide propulsion technology to improve the performance, reliability, and cost of strategic and tactical missiles and space systems. We also provide technology to enhance the operation and performance of spacecraft subsystems. Work is accomplished in bench-scale tests to prove the feasibility of new technologies before starting larger scale demonstrations more closely approaching the form and shape useful in a system. Following the feasibility of demonstrations, we select some technologies for further demonstration in a motor, engine or system in Space and Missile Rocket Propulsion (PE 0603302F). The selection is based on potential payoff and relevance to AF needs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06RL - Laboratory Operations: This project supports the other projects in this program element and provides for management and operation of the Air Force Astronautics Laboratory, Edwards AFB CA. It provides for the pay and related costs of the civilian technical and support staff, supplies, equipment, maintenance of buildings, and other operating expenses.

2. (U) Project 2864 - Interdisciplinary Space Technology: This project integrates key propulsion and astronautics technologies to enable concepts for future Air Force space systems. We're developing technology to improve spacecraft performance, to enhance spacecraft operational logistics, and to advance spacecraft structural and design technologies.

Program Element: 0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion

(U) FY 1988 Accomplishments:
- (U) Demonstrated a collector for a liquid droplet radiator to reduce heat in a zero-gravity experiment.
- (U) Verified techniques to produce a high number of layers of insulation for multilayer insulation to provide long-term storage of cryogenic propellants in space.

(U) FY 1989 Planned Program:
- (U) Measure contamination of space sensors from fuel venting.
- (U) Demonstrate the feasibility of multilayer insulation technology for full size cryogenic tanks.
- (U) Pursue advanced heat-transfer technology to reduce the weight of spacecraft radiators by 90 percent.

(U) FY 1990 Planned Program:
- (U) Evaluate composite components with embedded sensors for interactive control of large space structures.
- (U) Determine structure and vibration control required to enable space based radar concepts under study.
- (U) Initiate verification of large space structure deployment analyses codes to define structural and propulsion requirements.

(U) FY 1991 Planned Program:
- (U) Complete experiments with structural components containing embedded sensors to verify the ability to control fragile space structures.
- (U) Complete demonstration, in a typical size tank, of the multiple layer insulation to increase the on-orbit storage time of cryogenic fluids to increase satellite life.
- (U) Fabricate an advanced thermodynamic vent system for extended storage of cryogenic fluids on orbit; combined with the multiple-layer insulation concept, we may double storage times.

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

(U) Work Performed By: Ball Aerospace, Boulder CO; Marquardt, Van Nuys CA; McDonnell Douglas, Huntington Beach CA; Photon Research Associates, Belmont MA; TRW, Redondo Beach CA.

(U) Related Activities:
- (U) PE 0603401F, Advanced Spacecraft Technology.
- (U) Related to some activities at NASA. Coordination accomplished through the NASA/AF Space Technology Interdependency Working Group at the working level. There is no duplication of effort within the AF, NASA, or Department of Defense.

(U) Other Appropriations Funds: Not Applicable.

Program Element: 0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 3058 - Space Propulsion Technology: This project advances technology for propulsion for satellite orbit transfer and maneuvering for survivability, single-stage-to-orbit launch vehicle propulsion concepts, exhaust plume signatures technology, and technology to reduce engine weight and cost.

(U) FY 1988 Accomplishments:
- (U) Terminated the XLR-134, low-thrust cryogenic-propellant engine, due to Congressional funding reductions.
- (U) Completed work on power conditioning circuits and key thruster elements for the arcjet (electric propulsion) thruster tests at 30 kilowatts.
- (U) Completed launch vehicle engine technology programs reducing the weight of engine components.

(U) FY 1989 Planned Program:
- (U) Demonstrate large, lightweight, low-cost titanium tanks for orbit transfer vehicle propulsion.
- (U) Integrate lightweight component technology for a new, ultra-lightweight orbit transfer engine.
- (U) Demonstrate arcjet thruster components and transition to an advanced technology demonstration of an engine for satellite propulsion.

(U) FY 1990 Planned Program:
- (U) Demonstrate an advanced altitude-compensating nozzle for single-stage-to-orbit launch vehicle.
- (U) Design a vaneless turbopump for advanced, high-performance engines for future launch vehicles.
- (U) Test a pulsed electrothermal thruster with three times the performance of chemical fuels.

(U) FY 1991 Planned Program:
- (U) Define technology for an integrated feed system combining an attitude control system with a pump-fed primary propulsion unit for increasing satellite orbit altitudes and station keeping.
- (U) Complete a demonstration of a dual mixture ratio propellant injector for an engine that will allow for high and low thrust levels to optimize engine performance and lower the launch vehicle dry weight, reducing total cost.
- (U) Complete measurements of low-signature plumes.

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

(U) Work Performed By: Aerojet Tech Systems Co, Sacramento CA; ARC, Gainesville VA; L'Garde, Chicago IL; Rockwell International, Canoga Park CA; Pratt & Whitney, West Palm Beach FL.

Program Element: 0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion

(U) Related Activities:
- (U) PE 0305171F, Upper Stages (Shuttle Operations).
- (U) Activities in this project are related to some efforts at NASA. Coordination is accomplished through the NASA/AF Space Technology Interdependency Group at the working level. Additional coordination is accomplished through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee at the working level. There is no duplication of effort within the AF, NASA, or Department of Defense.

(U) Other Appropriations Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

4. (U) Project 3059 - Ballistic Missile Propulsion Technology: This project develops technology to provide increased range or throw weight, increased reliability and maintainability, improved service life, and enhanced survivability for future systems. This project identifies manufacturing variables which affect the operational life, improves designs and reliability of future systems, and identifies new composite material combinations to reduce weight. Modifications to propellants will increase the service of future missiles, and continuing studies of current propellants will benefit existing missiles.

(U) FY 1988 Accomplishments:
- (U) Transitioned (to the Small ICBM and Minuteman programs) a new x-ray technique (computed tomography) to find and assess nozzle flaws.
- (U) Began a service-life prediction program for small, mobile ballistic missiles.

(U) FY 1989 Planned Program:
- (U) Verify non-destructive evaluation techniques to detect motor flaws that could cause an explosion.
- (U) Demonstrate high-energy, fast burning propellant to support a fast-launch, survivable ICBM concept.

(U) FY 1990 Planned Program:
- (U) Investigate how propellant processing variables affect safe motor operation with new high energy propellants.
- (U) Measure rocket plume radar cross sections that contribute to the overall cross section of missiles employing low-observable technology.
- (U) Evaluate fast-burn propulsion concepts for more survivable ballistic missiles.

(U) FY 1991 Planned Program:
- (U) Develop accept/reject criteria for non-destructive evaluation techniques, allowing a very high confidence in the ballistic missile motor performance.

Program Element: 0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion

- (U) Develop advanced image analysis to accurately define any defect in a composite nozzle for ballistic motors.
- (U) Investigate innovative propulsion concepts for ballistic missile penetration aids or reentry vehicles to allow mid-course trajectory changes.

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

(U) Work Performed By: Aerojet, Sacramento CA; Boeing, Renton WA; Hercules, Magna UT; Thiokol, Brigham City UT; UTC, San Jose CA.

(U) Related Activities:
- (U) PE 0603311F, Advanced Strategic Missile Systems.
- (U) Propulsion technology is coordinated through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee. There is no duplication of effort within the AF, NASA, or Department of Defense.

(U) Other Appropriations Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

5. (U) Project 3148 - Air Launched Missile Propulsion Technology: This project emphasizes technology to reduce rocket motor plume signature, reduce motor hazards, lower motor costs, and improve the reliability of motor components. Minimizing the rocket motor plume would enhance survival of fighter and attack aircraft. Minimum and reduced smoke propellants are being developed with lower hazards and improved performance. Methods to improve component reliability and lower cost will improve the cost effectiveness of future missiles. In addition, we'll explore innovative propulsion concepts to improve the probability of kill.

(U) FY 1988 Accomplishments:
- (U) Did not start four new efforts for air-launched missiles because Congress cut funds.
- (U) Explored concepts to provide propulsion options for weapons that will require very high velocity and high lateral maneuvering to survive terminal defenses.
- (U) Tested samples from composite cases and propellants used in composite case cumulative damage program to form the basis for predicting damage response in a motor.

(U) FY 1989 Planned Program:
- (U) Test motors in the cumulative damage program confirming predictions of damage response in composite cases.
- (U) Demonstrate a new, reduced-smoke propellant with more energy and less smoke than current propellants.

(U) FY 1990 Planned Program:
- (U) Investigate advanced propulsion concepts for future air-launched missiles.

Program Element: 0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion

- (U) Develop motor case insulation that protects solid rocket motors from accidental detonation.
- (U) Evaluate the effectiveness of reducing rocket motor signature to enhance missile/aircraft survivability.

(U) FY 1991 Planned Program:
- (U) Demonstrate high-energy, minimum smoke propellant that is not susceptible to accidental detonation.
- (U) Determine the aging characteristics of a reduced smoke propellant (new polymer ingredient) that lowers the visible motor plume signature.
- (U) Develop a low-cost tactical rocket motor that sharply reduces unit cost while maintaining performance.

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

(U) Work Performed By: Aerojet, Sacramento CA; ARC, Gainesville VA; Hercules, Magna UT; 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) Coordination is accomplished through the Joint Army-Navy-NASA-Air Force Interagency Propulsion and the AF/Navy Air-to-Air Missile Oversight Committee at the working and Program Executive Officer level. There is no duplication within the AF, NASA, or Department of Defense.

6. (U) Project 5730 - Multiple Applications Technology: This project develops technology to more than one area of propulsion and astronautics, including improving systems reliability by alleviating failures or low performance in systems. The technologies include better understanding of the effects of combustion on performance, introducing new propellant ingredients, determining factors limiting service life, and investigating the feasibility of advanced propulsion concepts. Includes revolutionary research in High Energy Density Materials (HEDM) to create materials in an excited energy state which could provide dramatic performance increases in propulsion.

(U) FY 1988 Accomplishments:
- (U) Identified seven HEDM propellant candidates for further research and characterization.
- (U) Provided better understanding of how deformations of composite cases affect performance and service life.
- (U) First successful encapsulation of a sensitive propellant ingredient leading to a less sensitive propellant.

(U) FY 1989 Planned Program:
- (U) Demonstrate a stabilizer for a new polymer to permit its use in missiles which can improve range by 10 percent.

Program Element: 0602302F Budget Activity: #1 - Technology Base
PE Title: Rocket Propulsion

- (U) Demonstrate a low-cost propellant processing technique that will reduce the cost of propellant by 50 percent.
- (U) Provide solution to the loss of head-end insulation in ICBM motors that could cause the loss of the motor.
- (U) Continue the effort in HEDM, researching the creation of new compounds and experimentally verifying promising compounds.

(U) FY 1990 Planned Program:
- (U) Begin studies of engineering applications for promising compounds created for propulsion in the HEDM effort.
- (U) Evaluate microencapsulation of incompatible ingredients for increasing solid propellant performance in test motors.
- (U) Begin development of a solid propellant that can be throttled for missile trajectory control.

(U) FY 1991 Planned Program:
- (U) Complete testing that improves the understanding of liquid engine combustion stability mechanisms for increased ability to design stable engines and avoid costly instability problems in engine testing.
- (U) Complete testing of microencapsulated ingredients, begun in FY 1990, and characterize the propellant shelf-life.
- (U) Develop the experimental process and equipment to verify prediction of complex gas flow in nozzle exit cones, that can degrade total engine performance.
- (U) Determine the electric properties of solid propellants and motor cases that affect the vulnerability of a motor to accidental ignition due to electrostatic discharge.

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

(U) Work Performed By: Aerojet, Sacramento CA; Hercules, Magna UT; Rockwell International, Canoga Park CA; Thiokol, Brigham City UT; UTC, San Jose CA.

(U) Related Activities:
- (U) PE 0602602F, Conventional Munitions.
- (U) PE 0602111N, Anti-Air/Anti-Surface Weapons.
- (U) PE 0602303A, Missile Technology.
- (U) PE 0305171F, Upper Stages (Shuttle Operations).
- (U) Coordination is accomplished through the Joint Army-Navy-NASA-Air Force Interagency Committee at the working level. There is no duplication within the AF, NASA, or Department of Defense.

(U) Other Appropriations Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06WL Lab Operations	20,351	18,907	18,532	19,042	Continuing	TBD
2007 Nuclear Safety	647	762	673	701	Continuing	TBD
2218 DEW Technology Assessment	1,249	1,800	1,657	1,757	Continuing	TBD
3326 Laser Applications	5,492	5,600	4,872	5,026	Continuing	TBD
5797 Advanced Weapons Concepts	6,121	5,800	5,585	5,863	Continuing	TBD
8809 Nuclear Survivability & Hardness Technology	1,539	1,623	1,561	1,640	Continuing	TBD
Total	35,407	34,492	32,880	34,029	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology effort advances the state of the art in directed energy weapons (DEWs) such as high energy lasers (HEL) and high power microwaves (HPM) and in nuclear survivability. DEWs are of great interest because they will allow long range, near-instantaneous-kill of many potential targets. This technical effort also supports studies to ensure that our nuclear weapons can be handled and operated safely. Management and support of the Air Force Weapons Laboratory at Kirtland Air Force Base, NM, is also 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 Air Force 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 1988 Accomplishments:
- (U) Completed initial nuclear safety analysis of small ICBM, B-52 with Advanced Cruise Missile (ACM).
- (U) Biannual operational nuclear safety reviews of Ground Launched Cruise Missile (GLCM), F-111, F-16C/D, B-1B, and Peacekeeper.

00098

Program Element: *0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

(U) FY 1989 Planned Program:
- (U) Conduct biannual operational nuclear safety reviews of B-52 with ACM, F-16, F-111, and PA-200 Tornado aircraft.
- (U) Conduct initial nuclear safety analysis of Short Range Attack Missile II.

(U) FY 1990 Planned Program:
- (U) Perform F-15E aircraft pre-operational study.
- (U) Perform Air Launched Cruise Missile (ALCM) and F-111A operational reviews.

(U) FY 1991 Planned Program:
- (U) Perform PA-200 Tornado and GLCM operational reviews.
- (U) Perform pre-operational safety study of the Small ICBM.

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

(U) Work Performed By: The Air Force 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
- (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.

(U) FY 1988 Accomplishments:
- (U) Completed cost tradeoffs for ground based laser (GBL) concepts and technology tradeoffs for neutral particle beam (NPB) devices.

(U) FY 1989 Planned Program:
- (U) Conduct large scale laser tests on susceptibility of satellite systems.
- (U) Optimize GBL system concepts.

(U) FY 1990 Planned Program:
- (U) Perform large scale and subsystem laser tests on satellites to verify lethality assessments.
- (U) Test satellites using repetitively pulsed lasers.
- (U) Perform a susceptibility analysis on US Peacekeeper missile.

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

- (U) Develop the methodology, expertise, and database on plasmas.

(U) FY 1991 Planned Program:
- (U) Begin satellite susceptibility tests for NPBs and HPMs.
- (U) Perform studies on the lethality of proposed HPM concepts and the survivability of AF systems to HPM.
- (U) Improve propagation codes for HPM, NPBs, and lasers.
- (U) Analyze semiconductor laser array applications to understand critical technology requirements.

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

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM manages this program. The major contractors performing this work are: Rockwell Power Services, Albuquerque, NM; Ball Systems Engineering Division, Albuquerque, NM; Science and Engineering Associates, Albuquerque, NM; SCEEE Space Services Corp, St Cloud, FL; and Martin Marietta Aerospace, Denver, CO.

(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, High Energy Laser & Directed Energy Components
- (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. This includes studying short wavelength chemical laser device concepts, developing fabrication technology for HEL optical components, analyzing and investigating advanced beam control/generation concepts, and investigating HEL phenomenology.

(U) FY 1988 Accomplishments:
- (U) Repetitively pulsed chemical oxygen iodine laser (COIL) device was demonstrated.
- (U) Developed ground-based space object imaging computer codes.
- (U) Developed passive speckle imaging field experiment plan with the multi-mirror telescope (MMT).

(U) FY 1989 Planned Program:
- (U) Demonstrate higher power, improved efficiency, repetitive COIL device for the GBL.
- (U) Demonstrate pulsed, photo-initiated visible chemical laser.
- (U) Develop advanced chemical generator for COIL.
- (U) Begin nonlinear optics phase conjugation to support advanced space object imaging.

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

- (U) Investigate passive speckle imaging of satellites with MMT.

(U) FY 1990 Planned Program:
- (U) Transition pulsed COIL to scale-up in PE 0603605F.
- (U) Begin scale-up of visible chemical laser.
- (U) Begin lab experiments for multiple aperture passive imaging to support advanced space object imaging.
- (U) Validate algorithm for active speckle imaging.
- (U) Develop concepts for design of sparse array imaging system.

(U) FY 1991 Planned Program:
- (U) Begin field experiments for passive speckle imaging used in advanced space object imaging.
- (U) Complete design concepts of a sparse array imaging system.
- (U) Evaluate 1.3 micrometer optical coatings.

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

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM manages this program. The top five contractors are: Rockwell Power Services, Albuquerque, NM; Spectra Technology, Inc, Bellvue, WA; University of Arizona, Tucson, AZ; Martin Marietta Aerospace, Denver, CO; and Applied Technology Associates, Albuquerque, NM.

(U) Related Activities:
- (U) PE 0602101N, Directed Energy Weapons
- (U) PE 0602307A, Laser Weapon Technology
- (U) PE 0603221C, Directed Energy Weapons
- (U) PE 0603224C, Survivability, Lethality, and Key Technologies
- (U) PE 0603314A, High Energy Laser & Directed Energy Components
- (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, and nuclear weapons concepts using innovative technologies. Primary areas of research are HPM, high energy plasmas such as compact toroids, high energy pulse power, nuclear power technology, and conceptual and feasibility studies of nuclear weapons requirements.

(U) FY 1988 Accomplishments:
- (U) Initiated HPM tests against an F-16 Flight Control System.
- (U) Demonstrated a 3 trillion watt plasma flow switch.
- (U) Developed a novel, high power, pulsed solid state HPM source.
- (U) Initiated earth penetrating weapon (EPW) and nuclear weapons

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

feasibility study for tactical air-to-surface missile (TASM).

(U) FY 1989 Planned Program:
- (U) Complete HPM tests against the F-16 Flight Control System.
- (U) Develop technology for a compact, pulsed power, HPM driver.
- (U) Investigate the HPM phenomenology effects of short versus long pulses and single versus multi- and repetitive pulses.
- (U) Investigate high energy, compact, plasma toroids.
- (U) Conduct compact reactor studies for space applications.

(U) FY 1990 Planned Program:
- (U) Conduct AF/Army HPM tests of munitions, fuzes, squibs, mines.
- (U) Investigate the lethality of fast, repetitive HPM pulses against command, control, and communication systems (C3).
- (U) Complete HPM effects of short versus long pulses.
- (U) Generate and focus multi-megajoule compact toroids.
- (U) Complete studies for EPW and TASM nuclear weapons.

(U) FY 1991 Planned Program:
- (U) Complete HPM effects of single versus multiple pulses.
- (U) Investigate enhanced lethality effects caused by special HPM pulse parameters including high frequency.
- (U) Demonstrate solid state phased array high power HPM source.
- (U) Accelerate and propagate compact plasma toroids.

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

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM manages this program. Contractor support is provided by Maxwell Laboratories, San Diego, CA; Rockwell Power Services, Albuquerque, NM; Mission Research Corporation, Albuquerque, NM; Science & Engineering Associates (SEA), Albuquerque, NM; and R&D Associates, Marina del Rey, CA.

(U) Related Activities:
- (U) PE 0602120A, Electronic Survivability & Fuzing Technology
- (U) PE 0602101E, Directed Energy Weapons
- (U) PE 0602202F, Human Systems Technology
- (U) PE 0602204F, Aerospace Avionics
- (U) PE 0603605F, Advanced Weapons Technology
- (U) PE 0603743F, Electronic Combat Technology
- (U) PE 0604222F, Nuclear Weapons
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: MILCON

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
7,400	-	-	-	0	7,400

(U) International Cooperative Agreements: None

Program Element: #0602601F Budget Activity: 1-Technology Base
PE Title: Advanced Weapons

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.

(U) FY 1988 Accomplishments:
- (U) Completed nuclear criteria for Advanced Tactical Fighter (ATF) and Peacekeeper/Rail Garrison.
- (U) Performed nuclear characterizations of satellite materials.
- (U) Conducted nuclear criteria studies on: advanced close air support and reconnaissance aircraft, Ground Wave Emergency Network, F-16, F-15, A-10, F-111, ATF, and satellites.

(U) FY 1989 Planned Program:
- (U) Nuclear criteria studies will include: update of KC-135 Tanker Single Integrated Operation Plan, National Aerospace Plane, and Advanced Time Sensitive Communications Systems.

(U) FY 1990 Planned Program:
- (U) Evaluate exposure of integrated optics to space radiation environments through space shuttle experiments.
- (U) Continue to develop nuclear hardness criteria for existing and new AF weapon systems.

(U) FY 1991 Planned Program:
- (U) Define integrated optic radiation effects.
- (U) Continue investigating alternate concepts for nuclear survivability and hardness for AF systems.

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

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM manages this program. The top five contractors are: Computer Science Corp, Albuquerque, NM; Kaman Sciences Corp, Dikewood Division, Albuquerque, NM; University of New Mexico, Albuquerque, NM; Weidlinger Associates, New York, NY; and Mission Research Corp, Santa Barbara, CA.

(U) Related Activities:
- (U) PE 0602715H, Defense Nuclear Agency
- (U) PE 0603311F, Advanced Strategic Missile Systems
- (U) PE 0604711F, Air Force Systems Survivability
- (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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06AL Air Force Armament Laboratory Operations	15,704	13,671	14,220	14,711	Continuing	TBD
2068 Advanced Guidance Technology	10,678	11,500	11,474	12,675	Continuing	TBD
2502 Ordnance Technology	8,367	8,400	8,220	8,325	Continuing	TBD
2543 Weapon Effectiveness Methodology	1,850	1,900	1,700	1,735	Continuing	TBD
2567 Aeromechanics Technology	7,910	8,292	8,845	7,820	Continuing	TBD
TOTAL	44,509	43,763	44,459	45,266	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the Air Force's primary technology base program for air-to-surface and air-to-air conventional weapons including advanced guidance, ordnance, weapon effectiveness, and aeromechanics technologies. This program serves as the basis for future advanced technology development of conventional weapons technology vital to Force survivability and the conventional deterrent posture of the United States. It also funds 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 for civilian salaries, transportation, rents, communications, reproduction services, supplies and equipment, and maintenance 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. The payoff from this project includes; all-weather delivery, increased accuracy, a "launch and leave" capability, increased number of kills per sortie, increased aircraft survivability, and improved reliability and affordability.

(U) FY 1988 Accomplishments:
- (U) Completed tower testing of a joint Air Force/Army millimeter wave/infrared (MMW/IR) dual mode seeker for defeat of ground mobile targets.

00104

Program Element: 0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

- (U) Initiated design of a joint Air Force/Navy non-cooperative vector scoring system for testing tactical missiles against airborne targets.
- (U) Completed captive flight testing and data reduction of imagery collected using a low speed tactical laser radar (LADAR) seeker for transition to PE 0603601F.
- (U) Successfully tested a Gallium Arsenide submunition guidance sensor for transition to PE 0603601F.

(U) FY 1989 Planned Program:
- (U) Initiate helicopter flight testing of the joint Air Force/ Army dual mode seeker.
- (U) Complete design of the joint Air Force/Navy non-cooperative vector scoring system for testing tactical missiles.
- (U) Initiate design of a radio frequency (RF) bistatic tactical missile seeker for covert defeat of air targets.
- (U) Initiate and complete the design of a tri-mode (passive IR/active RF/passive RF) seeker for multi-mode defeat of advanced air targets.

(U) FY 1990 Planned Program:
- (U) Complete helicopter flight testing of the joint Air Force/ Army dual mode seeker for transition to PE 0603601F.
- (U) Initiate ground and flight testing of the joint Air Force/ Navy non-cooperative vector scoring system.
- (U) Complete design and fabricate the RF bistatic seeker for covert defeat of advanced threats.
- (U) Fabricate and laboratory test the tri-mode seeker for enhanced effectiveness in defeat of airborne threats.
- (U) Initiate design of a fiber optic data recorder to support developmental testing of conventional weapons.
- (U) Initiate a technology assessment of diode pumped lasers for use in low cost solid state air-to-surface seekers.

(U) FY 1991 Planned Program:
- (U) Complete ground and flight testing of the joint Air Force/ Navy non-cooperative vector scoring system for transition to PE 0603601.
- (U) Conduct ground and flight testing of the RF bistatic seeker for transition to PE 0603601 in FY 1992.
- (U) Conduct Hardware-In-the-Loop (HIL) testing of the tri-mode seeker for transition to PE 0603601F in FY 1992.
- (U) Complete design and initiate fabrication of a fiber optic data recorder to support weapons testing.
- (U) Design and fabricate diode pumped lasers for use in low cost solid state air-to-surface seekers.

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

(U) Work Performed By: This program is managed by the Air Force Armament Laboratory, Eglin AFB, FL. The major contractors are:

Program Element: 0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

Hughes Corp., Santa Barbara, CA; Raytheon Corp., Bedford, MA; and LTV Aerospace, Dallas, TX.

(U) Related Activities:
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0603363F, Hypervelocity Missile (HVM)
- (U) PE 0602303A, Missile 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: Not Applicable.

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 high value buried and hardened targets, and improved submunition dispensing.

(U) FY 1988 Accomplishments:
- (U) Completed design and initiated evaluation of two plastic bonded insensitive high explosive (IHE) materials.
- (U) Initiated design of multi-dimensional heavy metal shaped charges (MDHMSC).
- (U) Initiated design of an aimable warhead fuze for defeat of advanced airborne threats.
- (U) Transitioned hard target warhead technology to PE 0603601F.

(U) FY 1989 Planned Program:
- (U) Complete evaluation of plastic bonded IHE materials for transition to PE 0603601F.
- (U) Complete design and initiate evaluation of MDHMSC terminal ballistics and fragment effects.
- (U) Complete design and initiate laboratory testing of a brassboard aimable warhead fuze for warheads which require warhead/target spatial information from the fuze sensor.
- (U) Initiate design and fabrication of enhanced blast fills for runway cratering bombs.

(U) FY 1990 Planned Program:
- (U) Complete evaluation of MDHMSC and initiate design of a heavy metal multi-fragment warhead.
- (U) Complete testing of the aimable warhead fuze for transition to PE 0603601F.
- (U) Initiate design of an anti-armor programmable fuze, active hard target fuze, and advanced threat fuze.
- (U) Complete design and fabrication of enhanced blast fills for runway cratering bombs.

Program Element: 0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

(U) FY 1991 Planned Program:
- (U) Complete design of heavy metal multi-fragment warhead for transition to PE 0603601F.
- (U) Continue design of the anti-armor programmable fuze, active hard target fuze, and advanced threat fuze.
- (U) Initiate testing of enhanced blast fills for runway cratering bombs.
- (U) Initiate railroad interdiction warhead study.

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

(U) Work Performed By: This program is managed by the Air Force Armament Laboratory, Eglin AFB, FL. The major contractors are: Hughes Corp., Santa Barbara, CA; Raytheon Corp., Bedford, MA; and General Electric Co., Schenectady, NY.

(U) Related Activities:
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0603363F, Hypervelocity Missile (HVM)
- (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 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. The payoff from this project includes improved technology planning and increased technology focus.

(U) FY 1988 Accomplishments:
- (U) Initiated a computer model to evaluate the lethality of smart submunitions against ground mobile targets.
- (U) Completed a computer model to evaluate the vulnerability of Soviet construction practices (with regard to building damage) to conventional weapons. Transitioned this model to AD/ENY, Eglin AFB.

(U) FY 1989 Planned Program:
- (U) Complete the initial computer model to evaluate the lethality of smart submunitions.
- (U) Initiate a computer model to evaluate the lethality of deep penetrating blast weapons against fixed hardened targets.

(U) FY 1990 Planned Program:
- (U) Update the computer model evaluating the lethality of smart submunitions for transition to AD/ENY, Eglin AFB.

Program Element: 0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

- (U) Continue development of a computer model to evaluate the lethality of deep penetrating blast weapons.
- (U) Initiate a computer model to evaluate the vulnerability of the Soviet Flanker aircraft to current air-to-air missiles.

(U) FY 1991 Planned Program:
- (U) Update the computer model evaluating the lethality of deep penetrating blast weapons based on current Warsaw Pact fixed hardened targets.
- (U) Complete the assessment of hypersonic weapon lethality and transition to AD/ENY, Eglin AFB.
- (U) Update the computer model evaluating the vulnerability of the Soviet Flanker aircraft to current air-to-air missiles.

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

(U) Work Performed By: This program is managed by the Air Force Armament Laboratory, Eglin AFB, FL. The prime contractor is LTV Aerospace, Dallas, TX.

(U) Related Activities:
- (U) PE 0603307F, Air Base Survivability
- (U) PE 0603601F, Conventional 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: Not Applicable.

5. (U) Project 2567, Aeromechanics Technology: This project develops advanced aeromechanics technologies for air-to-surface and air-to-air conventional weapons. The payoff from this project includes; improved aircraft performance, improved weapon carriage and release characteristics, increased aircraft survivability, and low cost manufacturing techniques.

(U) FY 1988 Accomplishments:
- (U) Completed design of Expert Missile Maintenance Aid (EMMA) systems for GBU-15 and AIM-7F guided missile test sets.
- (U) Fabricated a low cost tactical ring laser gyroscope for integration into inertial measurement unit (IMU).
- (U) Developed computational fluid dynamics (CFD) techniques for aerodynamic analysis of weapons carried during transonic and supersonic flight.
- (U) Designed organic composite components of an advanced air-to-surface dispenser airframe.
- (U) Initiated design of a dual spool fiber optic data link for an extended range tactical air-to-surface weapon.

(U) FY 1989 Planned Program:

Program Element: 0602602F Budget Activity: 1 - Technology Base
PE Title: Conventional Munitions

- (U) Fabricate and test EMMA systems for depot-level GBU-15 and AIM-7F guided missile test sets.
- (U) Integrate a low cost tactical ring laser gyroscope IMU for transition to the passive laser gyroscope program.
- (U) Develop CFD techniques for aerodynamic analysis of weapons released during supersonic and transonic flight.
- (U) Fabricate organic composite components of an advanced dispenser airframe.
- (U) Completed design and initated fabrication of a fiber optic data link for an extended range tactical weapon.

(U) FY 1990 Planned Program:
- (U) Initiate design of a programmable EMMA system to improve depot level maintenance of multiple guided missiles.
- (U) Design a passive laser gyroscope to provide tactical weapons with more effective midcourse guidance.
- (U) Develop CFD techniques for aerodynamic analysis of weapons carried and released during hypersonic flight.
- (U) Demonstrate organic composite components of an advanced dispenser airframe.
- (U) Complete fabrication and initiate testing a dual spool fiber optic data link for an extended range tactical air-to-surface weapon.

(U) FY 1991 Planned Program:
- (U) Complete design of a programmable EMMA system to improve depot level maintenance of multiple guided missiles.
- (U) Integrate the design of a passive laser gyroscope with a suitable IMU to provide more effective midcourse guidance.
- (U) Develop CFD techniques for aerodynamic analysis of submunitions carried and released during hypersonic flight.
- (U) Investigate low cost, high rate production technologies for organic composite weapon airframes.
- (U) Continue testing of a dual spool fiber optic data link for an extended range tactical air-to-surface weapon.

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

(U) Work Performed By: This program is managed by the Air Force Armament Laboratory, Eglin AFB, FL. The prime contractor is McDonnell Douglas Astronautics Co., St Louis, MO.

(U) Related Activities:
- (U) PE 0603601F, Conventional Weapons Technology
- (U) PE 0603363F, Hypervelocity Missile (HVM)
- (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.

FY1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06RA Laboratory Operations	40213	38419	39604	40055	Continuing	TBD
2338 Assurance Techniques for Electronics	5625	5583	5630	5700	Continuing	TBD
4506 Surveillance Technology	8289	9256	9260	9470	Continuing	TBD
4519 Communications Technology	4885	4499	4310	4410	Continuing	TBD
4594 Intelligence Technology	5210	5568	5725	5855	Continuing	TBD
4600 Electromagnetic Radiation, Devices and Components	7031	11525	10623	10860	Continuing	TBD
5581 Command & Control Technology	6974	7870	7860	8050	Continuing	TBD
Total	78227	82720	83012	84400	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is the primary source of new concepts, feasiblity 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 06RA, Laboratory Operations: This project supports and complements all other projects in this program element and provides for 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 for 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 effort focuses on new silicon and galluim 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 with improved operational readiness and supportability. Areas of emphasis include: techniques to design in reliability; artificial intelligence techniques for system maintenance; and computer aided design techniques to integrate reliability, maintainability, and testability.

(U) FY 1988 Accomplishments:
- (U) Established DOD program for the analysis of failed microcircuit components to improve circuit reliability.
- (U) Developed stress measurement devices for the A-10 and A-7 aircraft test program which reduced false alarms by 70%.

(U) FY 1989 Planned Program:
- (U) Develop test methodology for potential electromagnetic susceptible devices used in radio frequency systems.
- (U) Develop a credible reliability design and failure rate prediction model for printed circuit board connections.
- (U) Develop finite element analysis techniques to predict electronic component time to failure.

(U) FY 1990 Planned Program:
- (U) Transition 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 to Joint STARS Program.
- (U) Develop microcircuit time stress measurement device to record a circuit boards lifetime environmental history.

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

(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

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

- (U) PE 0603789F, C3I Technology Development
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: None.

(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, track 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 1988 Accomplishments:
- (U) Delivered L-Band space based radar modules: power increased by 35%; complexity of testing and module weight was reduced.
- (U) Completed specification for a clutter data collection subsystem to be used in a hybrid monostatic/bistatic radar.

(U) FY 1989 Planned Program:
- (U) Demonstrate adaptive nulling capabilities for space radar to counter high speed adaptive jammer threat.
- (U) Complete evaluation of multi-domain signal processing algorithm for radar systems to meet low observable threat.
- (U) Develop high power L-band transmit/receive modules for ground phased-array radar to improve detection capabilities in a dense jammer/clutter environment.

(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) FY 1991 Planned Program:
- (U) Test mainlobe nulling for electronic counter-countermeasures.
- (U) Develop multifunction real-time fusion to validate surveillance in a tactical threat environment.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

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

(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; G.E. Corp, 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: None.

(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 1988 Accomplishments:
- (U) Verified, using simulation, that adaptive antenna techniques could be used against multiple jammers.
- (U) Developed Acoustical Charge Transport (ACT) devices from basic concept into producible chips for high speed switching.

(U) FY 1989 Planned Program:
- (U) Complete design of an all optical component radio for transition to advanced technology development.
- (U) Complete phased array antenna design that replaces cables with fiber optics for satellite communication applications.
- (U) Demonstrate 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 modular modem processor and millimeter wave integrated circuit components for transition to mobile

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

satellite communications terminals.
- (U) Integrate distributed adaptive network technology into satellite ground terminals for secure, survivable communications.

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

(U) Work Performed By: RADC managed project. Major contractors: Electronic Decision Inc, Chatsworth, CA; Hughes A/C Co, Torrance, CA; Hazeltine Corp., Greenlawn, NY; Poly-Scientific Litton Systems, Blacksburg, VA.

(U) Related Activities:
- (U) PE 0603617F, C3 Applications
- (U) PE 0603726F, C3I Subsystem Integration
- (U) PE 0603789F, C3I Technology Development
- (U) PE 0303126F, Long Haul Communications
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: None

(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 effort improves recording and handling techniques for timely processing, storage and dissemination of extremely high data rate, large volume intelligence information. It provides for 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 multi spectral, multi-source imagery; and provides advanced techniques for charting and geodesy data processing.

(U) FY 1988 Accomplishments:
- (U) Developed and evaluated speech processing system to extract high quality voice from a high noise environment.
- (U) Demonstrated the feasibility of knowledge based software for monitoring foreign space launches.

(U) FY 1989 Planned Program:
- (U) Develop technique for exploiting airborne spectrometer data for countering denial and deception techniques.
- (U) Develop an Artificial Intelligence based automated imagery exploitation system for identifying ground targets.
- (U) Develop 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) 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) Program to Completion: This is a continuing program.

(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) The is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: None

(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 1988 Accomplishments:
- (U) Developed wideband optical transmitter to simplify and speed up electrical to optical conversion.
- (U) Transitioned splice technology for tactical fiber optical cable.

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

(U) FY 1989 Planned Program:
- (U) Complete design of radomes to reduce radar cross section of antennas.
- (U) Complete development of multi-band infrared camera for aircraft signature measurement using platinum silicide technology.
- (U) Develop digital optical coprocessor to increase speed for electronic intelligence applications.

(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) FY 1991 Planned Program:
- (U) Test the impact of 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) Program to Completion: This is a continuing program.

(U) Work Performed By: RADC managed project. Major contractors: Texas Instrument Inc, Dallas TX; Hazeltine Corp, NY; Hughes Aircraft Co., Torrance, CA; Eastman Kodak Co, Rochester NY; EGG&G Raticon, Sunnyvale, CA.

(U) Related Activities:
- (U) PE 0603726F, C3I Subsystem Integration
- (U) PE 0603789F, C3I Technology Development
- (U) PE 0303126F, Long Haul Communications
- (U) There is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: None

(U) International Agreement: 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 program 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

Program Element: #0602702F Budget Activity: #1 - Technology Base
PE Title: Command, Control and Communications

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.

(U) FY 1988 Accomplishments:
- (U) Demonstrated computer architecture for evaluation of large scale, real-time Artificial Intelligence based systems.
- (U) Determined performance parameters of a digital optical computer to reliably process very large amounts of information at speeds four times that of current computers.

(U) FY 1989 Planned Program:
- (U) Evaluate Knowledge Based Software Assistant models for distributed operating systems.
- (U) Complete designs for digital optical computers.

(U) FY 1990 Planned Program:
- (U) Modify the Software Life Cycle Support Environment, a 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) Program to Completion: This is a continuing program.

(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.

(U) Related Activities:
- (U) PE 0603617F, C3 Applications
- (U) PE 0603728F, Advanced Computer Technology
- (U) PE 0603789F, C3I Technology Development
- (U) The is no unnecessary duplication in the Air Force or DOD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Activities: None.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2745 Logistics for Combat Readiness Maintenance						
	258	3,175	75	100	Continuing	TBD
2940 Computer Technology for Systems Design and Maintenance						
	5,210	5,836	3,931	5,059	Continuing	TBD
2950 Integrated Maintenence Information System (IMIS)						
	2,848	5,951	5,610	8,310	Continuing	TBD
Total	8,316	14,862	9,616	13,469	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Primary development program for 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 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 (see FY 88, 89, and 90 project bullets).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2745, Logistics for Combat Readiness Maintenance: 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 1988 Accomplishments:
- (U) Transition of analysis software and a classified data base on actual combat maintenance to the DOD Survivability, Vulnerability Information Analysis Center.

(U) FY 1989 Planned Program:
- (U) As directed by the Office of the Secretary of Defense $3.1 Million transfers to PE #0603001A.
- (U) Test a computer model which predicts the impact of reduced numbers of maintenance specialties.

Program Element: #0603106F Budget Activity: #2 - Advanced Technology Development
PE Title: Logistics Systems Technology

(U) FY 1990 Planned Program:
- (U) Work on joint service application of the above mentioned computer maintenance model with the Army Research Inst.

(U) FY 1991 Planned Program:
- (U) Plan integrated test of above mentioned model with Project 2950, electronic flight line maintenance aids.

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

(U) Work Performed By: AF Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB OH.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0602205F, Personnel, Training and Simulation.
- (U) PE #0603007A, Human Factors, Personnel and Tng Adv Tech.
- (U) PE #0603205F, Aerospace Vehicle Technology.
- (U) No unnecessary duplication within the Air Force or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 2940, Computer Technology for Systems Design and Maintenance: Develops Computer-Aided Design (CAD) technologies to allow designers to consider reliability and maintainability (R&M) and logistics early in the design of weapons systems. Another effort, Integrated Design Systems (IDS), develops methods to electronically capture digitized contractor design and technical information data bases and use them for subsequent modification and reprocurement of parts.

(U) FY 1988 Accomplishments:
- (U) Transitioned software which allows USAF oversight of contractor weapon system trade-off studies.
- (U) Integrated CAD tools for R&M trade-offs into the design process for new Integrated Electronic Warfare System.

(U) FY 1989 Planned Program:
- (U) Evaluate methods for digitized capture and use of technical information data bases at Air Logistics Centers.
- (U) Joint project with Army to design R&M trade-off analysis for mechanical systems.

(U) FY 1990 Planned Program:
- (U) IDS program delayed due to OSD directed budget reduction.
- (U) Improve computer-aided maintainability design by modeling the dynamics of a maintenance technician's limbs.
- (U) Limited field test of integrated information modeling and management system at an Air Logistics Center.

- (U) Test CAD design software, specifications and standards for Air Force wide use as a design evaluation tool.

(U) FY 1991 Planned Program:
- (U) Improve computer-aided maintainability design by modeling multi-person team maintenance operations.
- (U) Demonstrate access to technical data bases by Air Logistics Centers, Air Force Logistics Command, and contractors.
- (U) Demonstrate design workstation for on-line trade-offs among R&M and supportability during system design.

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

(U) Work Performed By: AF Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB OH; AF Wright Aeronautical Laboratories, Wright-Patterson AFB OH; Rockwell International, Los Angeles CA; Systems Research Laboratories, Beavercreek OH; General Dynamics Corp, San Diego CA; and Boeing Computer Services, Seattle WA.

(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) No unnecessary duplication within the Air Force or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

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 1988 Accomplishments:
- (U) Joint service test of shop computerized maintenance aid system demonstrated 50% less troubleshooting time, 30% better fault identification, decreased false part removal.
- (U) Development of diagnostic techniques for integrating technician's maintenance aid with on-board test.
- (U) Draft specifications for standardized development of digital data based maintenance instructions to ATF.

Program Element: #0603106F Budget Activity: #2 - Advanced Technology Development
PE Title: Logistics Systems Technology

- (U) Program delayed due to OSD directed budget cuts.

(U) FY 1989 Planned Program:
- (U) This year's program includes a $2.0M OSD directed enhancement in maintenance diagnostics research and development.
- (U) Initial field tests of portable maintenance aiding and diagnostic technology on flight line using the F-16.
- (U) Joint test of diagnostics with the Navy F/A-18.
- (U) Test specification for generation, update and presentation of pageless digital technical orders for ATF and AFTOMS.
- (U) Initiate program to interconnect stand-alone portable technician maintenance aids to base maintenance and supply.
- (U) Transition draft specifications to weapons systems.

(U) FY 1990 Planned Program:
- (U) Complete joint service test with Navy on F/A-18.
- (U) Continue development of Joint Service specifications for pageless technical data.
- (U) Continue development of advanced display screens and components for flight line use.
- (U) Incorporate supply interface, reporting, and automated access to pilot debrief into base-wide IMIS prototype.

(U) FY 1991 Planned Program:
- (U) Provide functional specifications for flight line maintenance aiding system.
- (U) Continue development to aid flight line maintenance with artificial intelligence systems.
- (U) Continue development of IMIS functional demonstration prototype for base level field test.

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

(U) Work Performed By: AF Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB OH; Systems Research Laboratories, Beavercreek OH; General Dynamics Corp, San Diego CA; MCDonnell Aircraft Corp, St Louis MO.

(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 Maint. Diagnostics Sys.
- (U) PE #0603721N, Integrated Diagnostic Support.
- (U) No unnecessary duplication within the Air Force or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2273 Integrated Electronic Warfare System (INEWS)	36,452	1,100	1,500	3,500	0	79,846
2538 Integrated Communications, Navigation, Identification Avionics (ICNIA)	15,422	4,100	3,410	8,185	0	91,379
2734 VHSIC-based Subsystems	18,629	22,763	27,654	16,303	0	106,607
3003 Common Signal Processor	14,626	6,016	0	0	0	37,098
3062 Pave Sprinter	0	3,100	3,800	3,800	0	10,700
TOTAL	85,129	37,079	36,364	31,788	0	325,630

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 (A-12) and Army Light Helecopter, Experimental (LHX). Builds advanced development model (ADM) subsystems under management guidance of the ATF SPO and the Joint Integrated Avionics Working Group (JIAWG).

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10 MILLION IN BOTH FY 1990 AND FY 1991

1. (U) Project 2273: INEWS. Threat Warning and Countermeasures Suite for Low Observable Aircraft which can be fully integrated into Integrated Avionics Suite of AFT/ATA/LHX.

(U) FY 1988 Accomplishments:
- (U) Continued INEWS demonstration/validation phase
- (U) Completed initial flight demos of key sensors
- (U) Initiated development of INEWS sensor modules
- (U) Began design of INEWS ADM core configuration for ATF competitors

(U) FY 1989 Planned Program:
- (U) Transition INEWS Dem/Val and ADM development into Program Element 0604250F for pre-FSD construction of core INEWS module set.

(U) FY 1990 Planned Program:
- (U) SPO support and travel funding continues at a low level project terminates in this PE in 1991.

Program Element: #0603109F Budget Activity: #2 - Advanced Technology Development
PE Title: INEWS/ICNIA

(U) FY 1991 Planned Program:
- (U) Program Office support and travel funding continues at a low level; project transfers to PE0604250F in FY 91
- (U) Deliver INEWS system digital modal to the AF and Navy

(U) Work Performed By: In-house work by the ATF SPO, Wright-Patterson AFB, OH. 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) PE 0604250F, Integrated EW/CNI Development
- (U) PE 0603230P, Advanced Tactical Fighter
- (U) There is no unnecessary duplication of effort within the AirForce or the Department of Defense.

(U) OTHER APPROPRIATION FUNDS ($ in Thousands): none

(U) International Cooperative Agreements: none

2. (U) Project 2538 - ICNIA: Integrated, VHSIC-based, modular Communications, Navigation, and Identification system applicable to the Integrated Avionics Suite of ATF/ATA/LHX.

(U) FY 1998 Accomplishments:
- (U) Continued fabrication of ICNIA ADM modules and software module codeing
- (U) Successfully passed brassboard demonstration milestones

(U) FY 1989 Planned Program:
- (U) Final fabrication of ADM terminals
- (U) Test, and deliver ADM #1 (Army eight-waveform configuration).
- (U) Re-code operating system and radio funcion software modules into Ada.

(U) FY 1990 Planned Program:
- (U) Fabricate, test, and deliver ADM terminals 2, 3, & 4.
- (U) Code Navy-unique radio function software modules.
- (U) Initiate conversion of radio frequency (RF) modules into SEM-E configuration.

(U) FY 1991 Planned Program:
- (U) Fabricate ICNIA terminals 3 and 4 into Integrated Electromagnetic Spectrum Simulator (IESS) facility at Wright Patterson AFB, OH.
- (U) Complete recodeing of software into Ada and conversion of RF modules to SEM-E format.

(U) Program to Completion: Transitions to PE64250F.

(U) Work Performed By: In-house work by the ATF SPO, Wright-Patterson AFB, OH. Major contractors are TRW Corp, San Diego, CA and Rockwell-Collins, Cedar Rapids, IA.

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Program Element: #0603109F Budget Activity: #2 - Advanced Technology Development
PE Title: INEWS/ICNIA

(U) Related Activities:
- (U) PE 0604250F Integrated EW/CNI
- (U) PE 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: none

(U) International Cooperative Agreements: none

3. (U) Project 3003 - Common Signal Processor: This program consists of the heart of the INEWS/ICNIA Modualr Avionics System Architectuure, the common signal processor, which supports the Joint Integrated Avionics Working Group in developing the common Avionics Baseline for ATF/ATA/LHX Integrated Avionics.

(U) FY1988 Accomplishments:
- (U) Continued support for conversion of other projects into standard line replaceable module format (ICNIA, URR, VHSIC 1750)
- (U) Continued refinement of module specifications and standards
- (U) Completed initial standards development
- (U) Supported JIAWG government-industry forum to refine specs

(U) FY1989 Planned Program:
- (U) Publish initial ATF modular avionics FSD specifications
- (U) Deliver initial signal processor modules and software to the Ultra Reliable Radar program for integration to the advanced active array radar
- (U) Perform initial risk reduction demos

(U) FY1990 Planned Program:
- (U) Funds removed to support other OSD directed funding priorities thus ending program in FY1989.

(U) FY1991 Planned Program: Not Applicable

(U) Work Performed By: In house work conducted by the AF avionics laboratory and the ATF SPO. Contractor development effort performed by IBM Computer Corp., Manassass, Va.

(U) Related Activities:
- (U) Program Element 0604250F, Integrated EW/CNI.
- (U) Program Element 0603225F, DoD Common Programming Language (Ada).
- (U) Program Element 0603230F, Advanced Tactical Fighter

(U) Other Appropriation Funds: none

Program Element: #0603109F Budget Activity: #2 - Advanced Technology Development
PE Title: INEWS/ICNIA

(U) International Cooperative Agreements: none

4. (U) Project 3062 PAVE SPRINTER: integrates elements of the Integrated Avionics Suite into test bed aircraft and conducts flight demonstrations and tests.

(U) FY 1988 Accomplishments:
- (U) Continued development of five-function modular ICNIA from Project 2538.

(U) FY 1989 Planned Program:
- (U) Prepare for F-16 flight demonstration of five-function ICNIA
- (U) Complete hardware and software design of flyable Adm

(U) FY 1990 Planned Program:
- (U) Begin flight demonstration of five-function ICNIA in F-16.
- (U) Conduct intial maintainability demonstrations

- (U) FY 1991 Planned Program:
- (U) Flight test elements of Integrated Avionics as required to resolve questions arising from the ATF Dem/Val Phase and the ground avionics prototypes.
- (U) Complete demonstrations

(U) Work Performed by: The in-house organization responsible for all projects in this PE is the Advanced Tactical Fighter SPO, Wright-Patterson AFB, OH. Contractors primarily involved in individual projects are TRW, Inc., San Diego CA.

(U) Related Activities: none

(U) Other Appropriation Funds: none

(U) International Cooperative Agreements: none

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603109F
PE Title: INEWS/ICNIA
Project Number: 2734
Budget Activity: 2- Advanced Technology Development

A. (U) RESOURCES ($ In Thousands)

Project Title: VHSIC-based Subsystems

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
VHSIC 1750A Data Processor	18,629	22,763	27,626	16,300	N/A	106,607

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program develops and tests key VHSIC-based integrated avionics modules required for the Dem/Val Phase of the Advanced Tactical Fighter and its ground avionics prototype. These common digital modules are integral to the INEWS and ICNIA development efforts and are specified under joint standards by the Joint Integrated Avionics Working Group. 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 before extensive VHSIC chip and hardware fabrication, and permits early software integration ahead of hardware availability.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Fabricated VHSIC Mil-Std-1750A data processor module set.
   - (U) Continue integration studies of this design and development to the VHSIC Common Signal Processor (CSP) module set.
   - (U) Initiate development of 10" color liquid crystal high resolution cockpit avionics display unit.
   - (U) Awarded contract for the DAMES development

2. (U) FY 1989 Planned Program:
   - (U) Continue deliveries of VHSIC 1750 advanced development module sets to other avionics lab projects, including CSP
   - (U) Integrate VHSIC 1750 modules into CSP
   - (U) Continue color liquid crystal cockpit display development
   - (U) Initiate development of VHSIC (phase I) 32-bit central processing unit (CPU) module
   - (U) Install DAMES simulation at a neutral government location
   - (U) Conduct initial DAMES interoperability demonstrations on Common Signal Processor designs

3. (U) FY 1990 Planned Program:
   - (U) Conduct module validation & verification demonstration
   - (U) Complete color cockpit display development

Program Element: #0603109F Project Number: 2734
PE Title: INEWS/ICNIA Budget Activity: #2 - Advanced Technology Development

4. (U) FY 1991 Planned Program:
   - (U) Continue 32-bit CPU module development
   - (U) Continue DAMES interoperability demonstrations

5. (U) Program to Completion:

   - (U) Complete 32-bit CPU module development
   - (U) Deliver color liquid crystal displays to ATF integration facilities

D. (U) WORK PERFORMED BY: The in-house organization responsible for all projects in this PE is the Advanced Tactical Fighter SPO, Wright-Patterson AFB, OH. Contractors primarily involved in individual projects are:
- International Business Machines Corp., Oswego, New York and Westinghouse Electric Corp., Baltimore, Maryland.
- Lockheed Aircraft Corp., Burbank, California and Northrop Aircraft, Hawthorn, California.
- General Dynamics Corp., Ft. Worth, Texas and TRW, Inc., San Diego CA.
- ARINC Research Corp, Annapolis, Maryland.

E. (U) COMPARISON WITH FY 1988/FY1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	none	none	none
Schd	none	none	none
Cost	none	none	none

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: none
2. SCHEDULE CHANGES: none
3. COST CHANGES: none

F. (U) PROGRAM DOCUMENTATION:

- (U) TAF SON 304-80, Advanced Tactical Fighter

G. (U) RELATED ACTIVITIES:
- Program Element 0604250F, Integrated EW/CNI Development.
- Program Element 0603225F, DoD Common Programming Language (Ada).
- Program Element 0603230F, Advanced Tactical Fighter
- Program Element 0603109N, INEWS/ICNIA

Program Element: #0603109F Project Number: 2734
PE Title: INEWS/ICNIA Budget Activity: 2 - Advanced Technology Development

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

J. (U) MILESTONE SCHEDULE:

1.	(U) Deliver VHSIC 1750A ADMs	Jul 88 - Jun 89
2.	(U) Integrate modules into ATF AGP	Mar 89 - Jul 90
3.	(U) Initial ground lab demo	Jul 89
4.	(U) Flying lab demo	Jan 90
5.	(U) Begin FSD	Jan 91

FY 1990/FY 1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603112F Budget Activity: #2 Adv Tech Devel
PE Title: Advanced Materials for Weapons Systems

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2100 Laser Hardened Materials	*0	*0	10,638	11,733	Continuing	TBD
3153 Nondestructive Inspection Development	*0	*0	2,478	2,940	Continuing	TBD
TOTAL	*0	*0	13,116	14,673	Continuing	TBD

*Project 2100 was funded in Program Element 0603211F, Aerospace Structures and Materials, at $7.006M in FY 1988 and $8.416M in FY 1989. Project 3153 was also funded in Program Element 0603211F at $1.513M in FY 1988 and $2.650M in FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT: Program Element 0603112F, Advanced Materials for Weapon Systems, was created from the materials portion of 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 we have no program for transitioning new materials to Air Force systems other than projects 2100 and 3153. New developments in 0602102F, Materials, must wait for an advanced development component demonstration or manufacturing technology demonstration in order to complete materials developments. Beginning in FY 1990 Program Element 0603112F will develop the necessary processing and scale-up data on new classes of advanced materials for their respective applications. Having this new program element will shorten the transition time of new materials. Presently 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3153, Nondestructive Inspection Development: This project develops and demonstrates advanced nondestructive inspection and evaluation (NDI/E) methods to accurately monitor performance integrity and detect failure-causing defects in weapon system components and materials. Improvements in NDI/E capabilities and accuracies are critical to meeting structural integrity requirements for aerospace systems. Engineering and operational experience has established that NDI/E capabilities have a strong influence on design and manufacturing processes and maintenance practices. However,

Program Element: #0603112F Budget Activity: #2 Adv Tech Devel
Title: Advanced Materials for Weapons Systems

measurements of reliable flaw detection capabilities for in-service Nondestructive Inspection and Evaluation (NDI/E) equipment show a serious deficiency compared to requirements. This project examines new methods to reliably detect material and structural flaws that are an order of magnitude smaller than those detectable with current practice.

(U) FY 1988 Accomplishments:
- (U) Initiated two efforts to develop new X-Ray Computed Tomography. This technology is an offshoot of the medical CAT Scan capability upgraded to meet aerospace requirements including new equipment and methods for backscatter, dual-energy, and laminographic computed tomography.

(U) FY 1989 Planned Program:
- (U) Complete prototype equipment fabrication and initiate major testing and validation efforts on new Computed Tomography equipment applications and procedures.

(U) FY 1990 Planned Program:
- (U) Continue major testing and validation effort on new Computed Tomography equipment and procedures.
- (U) Initiate a program to develop full-scale composite structure NDI/E prototypes which feature rapid field-level impact damage site location, rapid scanning, data acquisition, and accept/reject decisions. This capability will greatly enhance composite structure supportability in Air Force systems.

(U) FY 1991 Planned Program:
- (U) Complete NDI validation testing and document cost effective procedures for critical applications of Computed Tomography.
- (U) Initiate a program to develop portable real-time filmless radiography for field and maintenance depot use.

(U) Work Performed By: This project is managed by the Materials Laboratory, Wright-Patterson AFB OH. The two contractors include Northrop Aircraft Co, Hawthorne CA; and Boeing Aerospace Co, Seattle WA.

(U) Related Activities:
- (U) Integrated with Materials (PE 0602102F), Air Force Manufacturing Technology Program (PE 0708011F), and the Air Force NDI Program Office, San Antonio TX.
- (U) Coordination with other Department of Defense and governmental activities is maintained. No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

FY 1990/FY 1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603112F
PE Title: Advanced Materials for Weapons Systems
Project Number: 2100
Budget Activity: #2 Adv Tech Devel

A. (U) RESOURCES ($ in Thousands)

Project Title: Laser Hardened Materials

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Laser Hardened Materials	*0	*0	10,638	11,733	Continuing	TBD

*Project 2100 was funded in Program Element 0603211F, Aerospace Structures and Materials, at $7.006M in FY 1988 and $8.416M in FY 1989.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES: This project develops and demonstrates new materials and design concepts for protection of Air Force space and airborne systems and personnel against laser radiation. A significant threat exists for all Air Force systems and aircrew. The threat is projected to grow considerably in the near term. This project develops the materials and passive techniques to protect susceptible components and subsystems to specific laser threats and demonstrates these approaches on representative hardware to ensure that validated hardening options are available for transition to Air Force systems. Goals of the program include protection against interference of automated subsystems (spoofing), denial of information to subsystems (jamming), and functional damage. The program seeks to ensure system mission accomplishment both during and after the laser threat encounter.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Transitioned single wavelength laser protection technology to the Maverick missile system program office.
   - (U) Tested laser hardening options for precision guided munition seekers.
   - (U) Tested aircrew visors which provide laser flash effects protection and damage protection.
   - (U) Hardware delivery for testing of laser hardened visible-near IR electro-optical system.

2. (U) FY 1989 Planned Program:
   - (U) Test laser hardening of visible-near IR electro-optical system.
   - (U) Initiate a program to provide advanced broadband laser eye protection. This technology covers the interim between fixed wavelength protection and true agile protection.
   - (U) Initiate program to evaluate laser vulnerability of aircraft structural materials.
   - (U) Initiate development of innovative optical sensor designs which emphasize both performance and laser survivability for future optical sensors.

Program Element: #0603112F Budget Activity: #2 Adv Tech Devel
Title: Advanced Materials for Weapons Systems

- (U) Initiate development of high temperature laser hardened transparency materials.

3. (U) FY 1990 Planned Program:
   - (U) Begin testing advanced broadband laser eye protection.
   - (U) Perform damage assessments to evaluate laser vulnerability of aircraft structural materials.
   - (U) Critical review of optical sensor designs which emphasize both performance and laser survivability. Transition to system designers.
   - (U) Initiate program to protect tactical aircrews from variable frequency (agile) lasers.

4. (U) FY 1991 Planned Program:
   - (U) Test high temperature laser hardened transparency materials.
   - (U) Continue testing advanced broadband laser eye protection.
   - (U) Select, fabricate, and test components to evaluate laser vulnerability of aircraft structural materials.
   - (U) Critical review of concepts to protect tactical aircrews from variable frequency (agile) lasers.

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 four contractors include McDonnell-Douglas Corp, St Louis MO; Texas Instruments, Dallas TX; Rockwell International, Thousand Oaks CA; and Sierracin Research Corp, Sylmar CA.

E. (U) COMPARISON WITH FY 1988 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	N/A	N/A	N/A
Sched	N/A	N/A	N/A
Cost	N/A	N/A	N/A

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: N/A
2. (U) SCHEDULE CHANGES: N/A
3. (U) COST CHANGES: N/A

F. (U) PROGRAM DOCUMENTATION:
   - (U) Program Management Directive (PMD) 2140(16)/0603211F
   - (U) TAC Statement of Operational Need (SON) 304-80, Sensor Protection
   - (U) AF SON 505-87, Personnel Protection

Program Element: #0603112F Budget Activity: #2 Adv Tech Devel
Title: Advanced Materials for Weapons Systems

- (U) SAC SON (Draft), Canopy Hardening

G. (U) RELATED ACTIVITIES:
- (U) Coordination with other Department of Defense and governmental activities such as the Tri-Service Laser Hardening Materials and Structures Working Group.
- (U) Integrated with PE 0708011F, Air Force Manufacturing Technology Program; PE 0602102F, Materials; PE 0602202F, Human Systems Technology; PE 0603231F, Crew Systems Technology; and PE 0604706F, Aircrew Laser Protection.
- (U) No duplication of effort within the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS: Not applicable.

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

J. (U) MILESTONE SCHEDULE:

1. (U) Reconnaissance Optics Hardening Test	2 Qtr 89
2. (U) Balanced (Performance/Hardening) Sensor Program Critical Design Review (CDR)	1 Qtr 90
3. (U) Variable Frequency Laser Eye Protection CDR	2 Qtr 90
4. (U) Out-of-Band Protection for Canopies and Structures Test	1 Qtr 91
5. (U) "Smart" Laser Eye Protection for Aircrews CDR	3 Qtr 91
6. (U) Optical Switches Contract Start	4 Qtr 91

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603202F
Title: Aircraft Propulsion Subsystem Integration
Project Number: 668A
Budget Activity: #2 Adv Tech Devel

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	APSI FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
APSI	19,394	20,905	23,152	27,771	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: 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, augmentors, and nozzles. Task II includes demonstrator engines such as the Joint Technology Demonstrator Engine (JTDE) for manned rated 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. Technology advances anticipated under this program can result in 35% to 60% reductions in aircraft takeoff gross weight and a 25% to 40% reduction in life cycle cost compared with current state-of-the-art engines.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Conducted final preparation for test of Expendable Turbine Engines Concept (ETEC) demonstrators.
   - (U) Conducted initial systems tests of fault tolerant electronic fuel controls.
   - (U) Conducted 6 hours of engine testing on full authority digital electronic fuel controls (for missiles) that cost 80% less and are 30% smaller and lighter in weight.
   - (U) Conducted aerodynamic and signature testing of advanced inlet and nozzle concepts for advanced super cruise fighter applications.
   - (U) Began new start in advanced inlets and nozzles for both missiles and aircraft in Mach 4-6 regime.
   - (U) Completed design and began fabrication of new generation Joint Technology Demonstrator Engines (JTDE).

Program Element: #0603202F
Title: Aircraft Propulsion Subsystem Integration

Project Number: 668A
Budget Activity: #2 Adv Tech Devel

- (U) Final design completed for Garrett cruise missile prop fan. This will be tested for signature only. Not engine test.

2. (U) FY 1989 Planned Program:
   - (U) Begin instrumentation and assembly of JTDEs.
   - (U) Perform system testing (including up to 2000 hours of Combined Environmental Reliability Tests) of fault tolerant electronic fuel control.
   - (U) Conduct assessments of four Expendable Turbine Engine Concept (ETEC) demonstrators at subsonic and supersonic conditions.
   - (U) Initiate wind tunnel testing of advanced integration concepts for supersonic cruise fighters with both Conventional Take Off and Landing and Short Take Off and Vertical Landing (STOVL).
   - (U) Complete signature testing of prop fan.

3. (U) FY 1990 Planned Program:
   - (U) Begin testing of JTDEs at both General Electric and Pratt and Whitney which will demonstrate technologies increasing engine thrust to-weight ratio by 30% and decreasing specific fuel consumption by 20%.
   - (U) Conduct altitude testing of the Garrett ETEC demonstrator engine at Arnold Engineering Development Center (AEDC).
   - (U) Initiate next generation ETEC program jointly with DARPA and Navy, to include prop fan technology.

4. (U) FY 1991 Planned Program:
   - (U) Finish testing General Electric and Pratt and Whitney JTDEs.
   - (U) Initiate design of next generation JTDEs which will have combined cycle/STOVL technologies.
   - (U) Finish design and begin fabrication of joint ETEC demonstrators.

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

D. (U) WORK PERFORMED BY: This program is managed by the Aero Propulsion Laboratory of the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB OH. The current contractors involved in this program are: Allison Gas Turbine Division, Indianapolis IN; Garrett Turbine Engine Company, 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

Program Element: #0603202F
Title: Aircraft Propulsion Subsystem Integration

Project Number: 668A
Budget Activity: #2 Adv Tech Devel

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: N/A
2. (U) SCHEDULE CHANGES: N/A
3. (U) COST CHANGES: N/A

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 0602201F.
- (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 a formal Memorandum of Understanding covering efforts under the Joint Technology Demonstrator Engine program.
- (U) Part of DOD Integrated High Performance Turbine Engine Technologies (IHPTET) initiative which combines efforts of Air Force, Navy, Army, DARPA, and NASA in advanced aerodynamics, materials, and innovative design capability such that a minimum weight, high core power technology can be achieved that offers at least 100% improvement over state-of-the-art technology by the turn of the century.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

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

J. (U) MILESTONE SCHEDULE:

1.	(U) Expendable Turbine Engine Concepts (ETEC) Tests	Jan 1989
2.	(U) JTDE High Efficiency Swept Fan Test	Jan 1989
3.	(U) ETEC Altitude testing at AEDC	Jan 1990
4.	(U) Test Mach 4-6 inlets and nozzles for aircraft	Oct 1990
5.	(U) JTDE Tests	Dec 1990
6.	(U) Joint ETEC tests	Oct 1992
7.	(U) JTDE STOVL Tests - Lift Augmentation Technologies	Feb 1995

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
69CK Advanced Devices	2,277	4,080	4,210	5,500	Continuing	TBD
69DF Attack Management	2,027	3,024	4,000	5,188	Continuing	TBD
665A Electro-Optical Targeting Sensors	1,206	5,640	6,315	7,175	Continuing	TBD
1177 Non-Cooperative Identification Techniques	900	4,860	4,404	5,240	Continuing	TBD
2334 Airborne Radar Electronic Counter-Countermeasures	0*	4,748	5,515	6,177	Continuing	TBD
2345 Covert Airborne Communications	1,279	1,750	2,550	3,302	Continuing	TBD
2746 Low Probability of Intercept Communications	266	780	0	0	0	NA
2877 Cruise Missile Advanced Guidance	4,196	0	0	0	0	NA
Total	12,151	24,882	26,994	32,582	Continuing	TBD

* (U) FY 1988 congressional action consolidated Air Force electronic warfare funds into Program Element 0604241F to include Project 2334.

B. (U) BRIEF DESCRIPTION OF ELEMENT: Principal Air Force source for development of advanced avionics technology. Technology supports improvements in fire control for both air and ground targets; 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. The funding increase in the outyears recovers the program after congressional reductions to the FY 88/89 programs. Focus of this growth is on target identification, monolithic device packaging, radar counter-countermeasures improvements, attack management and electro-optical sensor improvement.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 69CK, Advanced Devices: The requirements for device technologies developed in this project stem from military unique needs that cannot be satisfied by commercially available devices. Examples include: memory/logic monolithic integration; solid state transmit/receive modules for airborne radar array antennas; laser sources, detectors, and integrated optics for aerospace electro-optical sensors and countermeasures applications; and power supplies for low voltage, high current very high speed integrated circuit applications. This project provides the

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

devices which improve the performance, reduce the cost and increase the reliability of advanced avionics.

(U) FY 1988 Accomplishments:
- (U) Delivered a 2000 element solid state active array radar antenna to the Advanced Tactical Aircraft Demonstration-Validation radar contractor for risk reduction testing.

(U) FY 1989 Planned Program:
- (U) Test low voltage, 200,000 hour long life, power supply brassboards for very high speed integrated circuits.
- (U) Study hybrid radar array approaches to reduce high cost of solid state array implementations.

(U) FY 1990 Planned Program:
- (U) Complete low cost hybrid design approach to solid state radar array components.
- (U) Integrate silicon and gallium arsenide circuits on a common substrate to improve performance and reliability of integrated circuits.

(U) FY 1991 Planned Program:
- (U) Demonstrate monolithic, X-band, transmit/receive module technology using a 26-element antenna array.
- (U) Deliver advanced microwave radar array module packages as part of the thrust to reduce active array radar costs.

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

(U) Work Performed By: The Electronics Technology Laboratory, Wright-Patterson AFB OH manages this project. Contractors are: Hughes Aircraft, El Segundo CA; Texas Instruments, Dallas TX; and General Electric, Syracuse NY.

(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: Not Applicable.

2. (U) Project 69DF, Attack Management: Current avionics are independent systems which are not effectively integrated to help the pilot under combat conditions. This project provides intraflight mission management, attack management decision aids, integrated attack information presentation and weapon launch modes to alleviate these attack deficiencies against both air and surface targets.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

(U) FY 1988 Accomplishments:
- (U) Completed Air-to-Air Attack Management (AAAM) algorithm design for few versus many air-to-air attack senario.

(U) FY 1989 Planned Program:
- (U) Verify AAAM pilot-vehicle interface design through pilot-in-the-loop simulation.
- (U) Complete critical design of software to enable hitting multiple targets on a single pass (MULTACK).

(U) FY 1990 Planned Program:
- (U) Complete the evaluation of AAAM integrated air combat decision aids, information and sensor management program.
- (U) Complete concept definition for real-time targeting based on automated vehicle mission replanning.
- (U) Verify MULTACK weapon delivery software by simulation and transition technology to the F-15E and F-16 programs.

(U) FY 1991 Planned Program:
- (U) Evaluate real-time targeting concept for vehicles with limited weight/volume/power.
- (U) Define design requirements for mission avionics suite for automated air operations.
- (U) Complete design of internetted multi-aircraft MULTACK and perform non-real-time simulation.

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

(U) Work Performed By: Efforts in this project are managed by the Avionics Labortory, Wright-Patterson AFB OH. Contractors are McDonnell Douglas, St Louis MO and Northrop Corporation, Hawthorne CA.

(U) Related Activities:
- (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: Not Applicable.

3. (U) Project 665A, Electro-Optical Targeting Sensors: This project provides the electro-optical sensor technology base necessary to achieve a precision, real-time, automatic tactical/strategic 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. It also increases countermeasure immunity by several orders of magnitude.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

(U) FY 1988 Accomplishments:
- (U) Fabricated and tested a single spectral band focal plane array for second generation passive thermal imaging sensors to improve sensitivity and resolution.
- (U) Defined concepts for strategic targeting laser radar to provide improved range.

(U) FY 1989 Planned Program:
- (U) Determine 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) Complete preliminary definition of an advanced multi-function covert air-to-air sensor.

(U) FY 1990 Planned Program:
- (U) Complete design of a dual band thermal imaging sensor.
- (U) Complete design of an advanced multi-function covert air-to-air sensor.
- (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) Fabricate and test critical components for advanced dual band thermal imaging sensor.
- (U) Complete design of passive infrared high altitude imaging sensor to provide several orders of magnitude improvement in night reconnaissance.

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

(U) Work Performed By: Efforts in this project are managed by the Avionics Laboratory, Wright-Patterson AFB OH. Contractors are: Hughes Aircraft, El Segundo CA; New England Research Center, Sudbury MA; and Boeing Airplane Company, Wichita KS.

(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: Not Applicable.

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

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

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.

(U) FY 1988 Accomplishments:
- (U) Verified NCID algorithm approach of the Automatic Radar Target Identification (ARTI) Phase II program with high confidence identification on limited data set.

(U) FY 1989 Planned Program:
- (U) Complete ARTI Phase II data collection and validate identification capability over wide target aspect.
- (U) Design ultra high range resolution modifications for the APG-68 (F-16) radar to permit air-to-air validation of ARTI NCID approach.
- (U) Develop 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 NCID based on attribute level fusion of sensor inputs and target signature models.
- (U) Modify APG-68 radar to achieve ultra high range resolution capability in order to demonstrate the ARTI concept.

(U) FY 1991 Planned Program:
- (U) Complete intra-radar target identification algorithms and transition as product improvements to Service air interceptor aircraft.
- (U) Complete APG-68 radar modifications, integrate with NCID processor, and verify surface-to-air NCID performance.

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

(U) Work Performed By: Efforts in this project are managed by the Avionics Laboratory, Wright-Patterson AFB OH. Major contractor is General Dynamics, Pomona CA.

(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.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Avionics

(U) International Cooperative Agreements: Not Applicable.

5. (U) Project 2334, Airborne Radar Electronic Counter-Countermeasures (ECCM): Current and future airborne weapon system radars must operate in an intense electronic combat environment. This project develops technologies and concepts for reduction of susceptibilities to enemy electronic countermeasures and is an integral part of the USAF ECCM Master Plan.

(U) FY 1988 Accomplishments:
- (U) Established baseline of electronic countermeasures (ECM) effects upon airborne radars.
- (U) Established preliminary system design for electronic combat multifunction radar (EMR) ECCM technology.

(U) FY 1989 Planned Program:
- (U) Design the simultaneous transmit and receive offensive ECCM technique, which will enhance weapon system survivability.
- (U) Identify and develop critical components for EMR that will improve airborne radar ECCM capability.

(U) FY 1990 Planned Program:
- (U) Develop the ECCM concept of simultaneous transmit and receive to counter ECM effects upon airborne radars.
- (U) Complete system requirements and initiate critical component fabrication to include the multiplex (mux) filter for the EMR.

(U) FY 1991 Planned Program:
- (U) Continue hardware upgrade and demonstrate key elements of the simultaneous transmit and receive capability.
- (U) Complete key component development (mux-filter and Rotman Lens) and component integration for the EMR.

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

(U) Work Performed By: Efforts in this project are managed by the Avionics Laboratory, Wright-Patterson AFB OH. 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) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0603203F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics for Aerospace Vehicles

6. (U) Project 2345, Covert Airborne Communications: Current radio system detectability must be reduced in order 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 low regard applied to covertness. Current reconnaissance/intelligence data links do not have jam resistance wideband imagery channels. Current air-to-air (A/A) 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 1988 Accomplishments:
- (U) Delivered and tested error correction and detection subsystem for air-to-air data link applications.

(U) FY 1989 Planned Program:
- (U) Complete design and fabrication of a wide bandwidth spread spectrum modem using advanced circuit technology; with application for air-to-air data links.
- (U) Complete design of receiver/transmitter subsystems and antennas for a wide bandwidth air-to-air data link.

(U) FY 1990 Planned Program:
- (U) Conduct the detailed design and development of a L-band low probability of intercept voice terminal for short range communication to support intra-flight operations.
- (U) Integrate and test an air-to-air wide bandwith data link for reconnaissance/intelligence applications.

(U) FY 1991 Planned Program:
- (U) Complete reconnaissance/intelligence air-to-air data link tests and transition technology to the Advanced Tactical Air Reconnaissance System program.
- (U) Fabricate low probability of intercept L-band terminal.

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

(U) Work Performed By: Efforts in this project are managed by the Avionics Laboratory, Wright-Patterson AFB OH. Major contractor is Unisys, Salt Lake City UT.

(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: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2506 Control of Flight	11,837	12,068	552	4,767	Continuing	TBD
2508 Aeromechanics	900	1,700	500	1,800	Continuing	TBD
2899 Aircraft Battle Damage Repair	575	0	0	0	0	1,525
2978 Reliability and Maintainability	3,415	4,940	5,730	5,300	Continuing	TBD
3422 Integrated Control/Avionics Technology	4,631	2,534	12,368	9,991	Continuing	TBD
TOTAL	21,358	21,242	19,150	21,858	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The major thrust of this Program Element (PE) is to develop and validate component technologies for improved aerodynamics, flight control systems and vehicle subsystems for current and future aircraft with emphasis on cost, performance, survivability, reliability, and maintainability. In FY 1989, Project 2899 work will be consolidated under Project 2978. This aligns current programs with the major thrusts identified in the PE. PE 0603245F, Advanced Flight Technology Integration, flight tests the component technologies developed in this PE. The Flight Dynamics Laboratory, Wright-Patterson AFB OH manages this work.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2506, Control of Flight: Develops agility/maneuver and flight-critical control technologies via the following programs: (1) Short Takeoff and Landing/Maneuver Technology Demonstrator (STOL/MTD) Program - Develops the technology to achieve an operational STOL capability and improves maneuverability for future fighters. Designs, fabricates, and uses pitch axis thrust vectoring/reversing (TV/TR) exhaust nozzles. STOL/MTD will reduce wet runway landing distance by 72 percent, takeoff distance by 29 percent, which greatly enhances the ability to operate from damaged runways or dispersed bases. It also can improve maneuverability up to 67 percent. (2) Integrated Control (ICON) Program - Develops and validates a fault-tolerant, flight and propulsion control system to optimize vehicle performance over all flight phases. Fault-tolerant software and architecture insures flight safety and high reliability. ICON will utilize the total vehicle force and moment generation capability of the aircraft including control surfaces, inlets, engine, and nozzles. (3) Multi-Axis Thrust Vectoring Program - Develops the technology for improved air combat lethality and survivability by improving aircraft control and maneuverability while reducing weight, radar cross section, and drag. This capability will be achieved by using a pitch and yaw thrust vectoring nozzle and reducing or eliminating aerodynamic surfaces.

Program Element: #0603205F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Vehicle Technology

(U) FY 1988 Accomplishments:
- (U) Completed fabrication of the TV/TR ground test nozzles.
- (U) Completed integrated flight/nozzle control system software development and verification.
- (U) Successfully altitude tested nozzle #1 at NASA Lewis.

(U) FY 1989 Planned Program:
- (U) Complete fabrication and installation of the TV/TR exhaust nozzles on the aircraft.
- (U) Conduct taxi tests of the integrated braking/steering system.
- (U) Update the integrated flight/nozzle control software based on flight data.
- (U) Transfer STOL/MTD flight/nozzle control data to the Advanced Tactical Fighter.
- (U) Begin development of STOL/MTD software for combat maneuver enhancement.
- (U) Define agility metrics using STOL/MTD performance projections and military utility data.
- (U) Perform evaluations/assessments for a multi-axis thrust vectoring and ICON system.
- (U) Initiate procurement of Integrated Control Avionics for Air Superiority (ICAAS) program mission simulation long lead-time items (dome, background/target projectors).

(U) FY 1990 Planned Program:
- (U) Complete STOL/MTD maneuver enhancement nozzle cooling work.

(U) FY 1991 Planned Program:
- (U) Develop and test vehicle management system as part of the Integrated Control (ICON) program.
- (U) Complete control logic development for the ICON program and start performance validation.
- (U) Complete multi-axis thrust vectoring control logic work.
- (U) Start multi-axis thrust vectoring software and nozzle design.

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

(U) Work Performed By: Prime is McDonnell Douglas Co, St Louis, MO.

(U) Related Activities:
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

2. (U) Project 2508, Aeromechanics: Includes the following programs: (1) the Hybrid Laminar Flow Control (HLFC) program which designs, fabricates and ground tests a wing leading edge suction concept to produce low-drag laminar flow on transport aircraft wings; (2) the

Program Element: #0603205F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Vehicle Technology

Mission Adaptive Wing (MAW) program which develops the aerodynamic technologies needed to support the smooth skin, variable camber MAW F-111 being flight tested under PE 0603245F; and (3) the Advanced Technology Wing program which will design, fabricate and ground test an advanced wing concept which incorporates lightweight structural design approaches, flexible wing control and a built-in wing array radar for long-range detection of post 1990 threats.

(U) FY 1988 Accomplishments:
- (U) Fixed a potential horizontal rear stabilizer single point failure in the MAW automatic camber control mode which reduces aircraft wing-root bending and aircraft sensitivity to gusts.

(U) FY 1989 Planned Program:
- (U) Complete design engineering and start hardware fabrication for the HLFC system.
- (U) Write the final flight test report for the MAW program.

(U) FY 1990 Planned Program:
- (U) Complete hardware fabrication and start ground testing for the HLFC system.

(U) FY 1991 Planned Program:
- (U) Complete ground testing of the HLFC program.
- (U) Start component development for the advanced technology wing.

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

(U) Work Performed By: Prime is the Boeing Company, Seattle WA.

(U) Related Activities:
- (U) PE 0603253F, Advanced Avionics Integration.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles.
- (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: Not Applicable.

3. (U) Project 2978, Reliability and Maintainability: Includes the following programs: (1) the Self-Repairing Flight Control System (SRFCS) program develops reconfigurable flight control and expert maintenance diagnostic systems. This program will increase the survivability of battle damaged aircraft, reduce physical actuator redundancy, 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 twice as reliable; and (3) the Aircraft Battle Damage Repair (ABDR) program

Program Element: #0603205F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Vehicle Technology

develops and demonstrates field repairs for battle damaged aircraft, geared towards increasing aircraft availability and sortie rates.

(U) FY 1988 Accomplishments:
- (U) Completed SRFCS expert maintenance diagnostics for an analog F-16 flight control system.
- (U) Real time simulator tested single-surface reconfiguration software using perfect flight control system failure data.
- (U) Developed IEEE fracture mechanics models, inspection, and test criteria for electronic component failures.

(U) FY 1989 Planned Program:
- (U) Produce SRFCS design criteria ready for transition to the Advanced Tactical Fighter.
- (U) Start modeling of the SRFCS for simulation of typical aircraft combat maneuver entry and exit as well as short takeoff and landing conditions.
- (U) Fabricate and test IEEE specimens and correlate results with the fracture mechanics model.
- (U) Start ABDR multi-contoured skin/structural component and internal fuel tank repair technique development.

(U) FY 1990 Planned Program:
- (U) Field demonstrate full SRFCS maintenance diagnostics for an analog F-16 flight control system.
- (U) Continue ABDR hardware orientated quick field usable aircraft repair technique development.
- (U) Conduct IEEE hardware testing in a combined environmental test facility.

(U) FY 1991 Planned Program:
- (U) Field test and operationally assess the SRFCS maintenance diagnostic system.
- (U) Using F-15 radar components, demonstrate IEEE program application to operational hardware. This completes the program.
- (U) Complete ABDR aircraft integral fuel tank repair and damage inspection tool development.

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

(U) Work Performed By: McDonnell Douglas Co., St Louis MO; General Electric Co., Binghamton NY; Hughes Aircraft, El Segundo CA; Booz-Allen, Dayton OH; and Honeywell Inc., Minneapolis MN.

(U) Related Activities:
- (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: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603205F
Title: Aerospace Vehicle Technology
Project Number: 3342
Budget Activity: #2 Adv Tech Devel

A. (U) RESOURCES ($ in Thousands)

Project Title: Integrated Control/Avionics Technology

Popular Name	FY 1988 Actual	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Integrated Control and Avionics for Air Superiority, ICAAS	4,631	2,534	12,368	9,991	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
Integrated Control and Avionics for Air Superiority (ICAAS) - This program develops advanced flight guidance/control and pilot/vehicle interface component technologies needed to enable USAF fighter aircraft to kill and survive when outnumbered in air combat. A supporting mission environment simulation and crew station capability will be developed to augment ICAAS performance and effectiveness assessment.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Defined ICAAS requirements and started preliminary engineering design work.
   - (U) Demonstrated feasibility of using Ada based software in a real time integrated flight and fire control system for the first time.

2. (U) FY 1989 Planned Program:
   - (U) Evaluate preliminary ICAAS designs and down select to a single contractor.
   - (U) Mature preliminary ICAAS designs into a final integrated design.

3. (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 fighters vs 16 enemy aircraft.
   - (U) Develop ICAAS mission environment simulation and crew station capability.

4. (U) FY 1991 Planned Program:
   - (U) Conduct ICAAS 2 vs 8 internetted simulations.
   - (U) Update ICAAS software based on computer simulations and flight test.

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

D. (U) WORK PERFORMED BY: Prime Contractor is McDonnell Douglas Co., St Louis MO. The Flight Dynamics Laboratory, Wright-Patterson AFB OH will conduct in-house mission simulations and crew station development in support of ICAAS performance and effectiveness evaluation, as well as manage overall ICAAS work.

Program Element: #0603205F Project Number: 3342
Title: Aerospace Vehicle Technology Budget Activity: #2 Adv Tech Devel

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-0-
Sched	None	None	-0-
Cost	None	None	-0-

NARRATIVE DESCRIPTION OF CHANGES

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.
- (U) TAF SON 304-83 Advanced Tactical Fighter.
- (U) TAF SON 321-82 Dual Role Fighter.

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: Not Applicable.

J. (U) MILESTONE SCHEDULE:

- (U) Preliminary Design Review (PDR) conducted	4 Qtr 88
- (U) Contractor down selection conducted	1 Qtr 89
- (U) Critical Design Review (CDR) conducted	1 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) System validation and assessment completed	4 Qtr 92

FY 1990/FY 1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
69CW Advanced Composites	8,273	8,488	9,043	9,581	Continuing	TBD
486U Advanced Metallic Structures	7,705	8,111	9,044	9,124	Continuing	TBD
2100 Laser Hardened Materials	7,006	8,416	*0	*0	Continuing	TBD
3153 Nondestructive Inspection Development	1,513	2,650	*0	*0	Continuing	TBD
TOTAL	24,497	27,665	18,087	18,705	Continuing	TBD

*Projects 2100 and 3153 are transferred to Program Element 0603112F in FY 1990 in order to accelerate the transition of advanced materials to weapon systems.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Advanced Development program demonstrates advanced structural design concepts using new or improved metallic (486U) and nonmetallic materials (69CW). More damage tolerant, reliable, maintainable and durable structures of lighter weight and lower cost are developed for weapon systems application.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 improve life cycle costs for Air Force aircraft, missiles, and space systems.

(U) FY 1988 Accomplishments:
- (U) Ground tested a graphite/bismaleimide leading edge for the F-111 horizontal stabilizer to replace the current metal honeycomb.
- (U) Initiated development of ceramic composite structures program to produce lightweight radar absorbing structures with a 2000°F capability for turbine engine nozzle applications.
- (U) Initiated a program to develop transparency systems for future tactical aircraft to improve supportability, fuselage integration, man-machine interfaces (heads-up displays, crew ingress/egress) and combat and natural hazard survivability.
- (U) Fabricated high temperature thermoplastic F-15 engine access door and F-16 main landing gear doors which demonstrate low weight, damage tolerant non-load bearing structures.

(U) FY 1989 Planned Program:
- (U) Flight demonstration of high temperature thermoplastic F-15 engine access doors and F-16 main leading gear doors.
- (U) Test carbon-carbon 2-D nozzle divergent flap hot surface on an F-110 engine to demonstrate operational durability.

00150

Program Element: #0603211F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Structures

(U) FY 1990 Planned Program:
- (U) Flight test A-10 thermoplastic trailing edge flap. This is the first thermoplastic aerodynamic part to be flown.
- (U) Develop low observable infrared and radar absorbing structures (RAS) for aircraft and missile applications.
- (U) Design ceramic composite turbine engine nozzle component to demonstrate radar signature attenuation and weight savings.

(U) FY 1991 Planned Program:
- (U) Test the ceramic component designed in FY 1990 for structural soundness, leading to engine test in FY 1992.
- (U) Test low observable infrared RAS for aircraft and missiles.
- (U) Fabricate and test a transparency system for future tactical aircraft under the program initiated in FY 1988.

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

(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) Integrated with the Industrial Base Program [Air Force Manufacturing Technology Program] (PE 070811F); Aerospace Flight Dynamics (PE 0602201F), and Materials (PE 0602102F).
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

2. (U) Project 486U, Advanced Metallic Structures: This project develops and demonstrates new metallic structures technology using metal matrix composites (MMC), 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 1988 Accomplishments:
- (U) Structural test of F-5E fuselage component made from an advanced aluminum alloy displaying high strength, low density, and corrosion resistance.
- (U) Initiated a supportability program using hybrid (metal-nonmetal) structures with potential 50% life cycle cost reductions over current technology.
- (U) Fabricated titanium matrix composite fan blades for engine

Program Element: #0603211F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Structures

test in FY 1989 to demonstrate improved strength and durability.
- (U) Completed preliminary design of elevated temperature aluminum structures as a lower cost replacement for titanium.

(U) FY 1989 Plans:
- (U) Initiate a program to combine MMC with advanced damping techniques for large rigid space structures.
- (U) Use advanced metallic structures to replace maintenance-prone aircraft parts and significantly reduce life cycle costs.

(U) FY 1990 Plans:
- (U) Fabricate elevated temperature aluminum structures designed in FY 1988 and prepare for verification testing in FY 1991.
- (U) Initiate development of MMC compressor with operating temperature to 1400°F, an increase over the current 1100°F.
- (U) Test MMC fighter vertical stabilators which demonstrate weight and strength advantages over current aluminum.

(U) FY 1991 Plans:
- (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.
- (U) Complete preliminary design of MMC/advanced damping large space structure initiated in FY 1989.

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

(U) Work Performed By: This program is managed by the Flight Dynamics Laboratories, 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) Integrated with the Air Force Manufacturing Technology Program (PE 0708011F); Aerospace Flight Dynamics (PE 0602201F); Materials (PE 0602102F); and Survivability, Lethality, and Key Technologies (PE 0603224C).
- (U) Supports the DOD Integrated High Performance Turbine Engine Technologies (IHPTET) initiative.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603216F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Propulsion and Power Technology

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

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
2480 Aviation Turbine Fuel Technology	1,540	0	0	0	Continuing	TBD
2697 Atmospheric Propulsion Concepts	1,715	3,600	4,362	5,018	Continuing	TBD
3035 Aircraft Power Systems	1,947	3,866	3,841	4,290	Continuing	TBD
3036 Battery Technology	389	0	0	0	Continuing	TBD
681B Advanced Turbine Engine Gas Generator (ATEGG)	21,037	24,899	26,720	29,948	Continuing	TBD
TOTAL	26,628	32,365	34,923	39,256	Continuing	TBD

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 fuel options to support advanced hypersonic vehicles flying three to six times the speed of sound; advanced aircraft power systems that use nonflammable hydraulic fluids; and cold weather engine starting at -65°F from the present capability of +12°F. This is a Science and Technology effort.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2480, Aviation Turbine Fuel Technology: Provides for the wartime/peacetime availability of aviation turbine fuels. Investigates new fuel sources to minimize cost and ensure continuous aviation fuel deliveries to the Air Force for conventional aircraft. Evaluates new innovative fuel technology with high heat absorbing capability (endothermic) for future air vehicles. Although not currently funded, this project is expected to resume in the future.

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.

(U) FY 1988 Program:

- (U) Initiated component development for a flightweight Variable Flow Ducted Ramjet (VFDR) which allows increased maneuverability by throttling a fuel rich gas into a ramjet combustor to achieve a 50% decrease in time to target.

Program Element: #0603216F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Propulsion and Power Technology

- (U) Developed airframe/propulsion interface specifications for Variable Flow Ducted Ramjet (VFDR) in an AIM-120 size configuration utilizing a gas generator/valve, ramjet combustor and booster.

(U) FY 1989 Planned Program:
- (U) Verify gas generator/throttle valve performance relative to flow rate and evaluate gas generator transition time to reach a command fuel flow.
- (U) Conduct preliminary VFDR ramburner combustor performance tests to verify engine efficiency.

(U) FY 1990 Planned Program:
- (U) Complete VFDR component development and begin the integration process for engine performance verification tests.
- (U) Complete flame piloting and stabilization tests to ensure the reliability of the ramburner combustor.

(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 injestion of foreign objects into the VFDR engine.

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

(U) Work Performed By: Aero Propulsion Laboratory personnel manage contracts with 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 assures efficient utilization of limited ramjet resources by the Services and coordinates the development of the ramjet technology base to provide non-duplicative options for future missiles systems.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

3. (U) Project 3035 Aircraft Power Systems: Develops and demonstrates aircraft power systems such as hydraulics, engine starters, auxilary power units (APU) and secondary electrical power that fulfill rapidly increasing power levels and reliability.

Program Element: #0603216F Budget Activity: #2 Adv Tech Devel
Title: Aerospace Propulsion and Power Technology

(U) FY 1988 Program:
- (U) Initiated component testing for a hydraulic system using a nonflammable fluid for increased safety and 8000 psi pressure for reduced weight and volume.
- (U) Began nonflammable hydraulic system fabrication for ground test demonstration.

(U) FY 1989 Planned Program:
- (U) Complete 8000 psi nonflammable hydraulic component tests to demonstrate acceptable design and performance.
- (U) Perform functional checkout of nonflammable hydraulic system demonstrator and initiate a 500 hour durability test.

(U) FY 1990 Planned Program:
- (U) Complete 8000 psi nonflammable hydraulic fluid demonstration.
- (U) Initiate advanced aircraft engine starter that will be capable of multiple starts or -65°F to meet cold weather soak requirements.
- (U) Evaluate new longer life starter vane material.

(U) FY 1991 Planned Program:
- (U) Fabricate hardware for low temperature engine starter system.
- (U) Conduct performance testing of engine starter from -65°F to 130°F to demonstrate 10 simulated engine starts without refurbishing starter.
- (U) Begin aircraft electrical secondary power distribution system that is aimed at replacing centralized hydraulics, gear boxes, and mechanical controls.

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

(U) Work Performed By: The nonflammable hydraulic fluid system is managed by Aero Propulsion Laboratory personnel with McDonnell Aircraft Co, St Louis MO as the contractor.

(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 Department of Defense.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

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 1990/FY 1991 RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603216F
Title: Aerospace Propulsion and Power Technology

Project Number: 681B
Budget Activity: #2 Adv Tech Devel

A. (U) RESOURCES ($ in Thousands)

Project Title / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
ATEGG	21,037	24,899	26,720	29,948	Continuing	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 the backbone of the Integrated High Performance Turbine Engine Technologies (IHPTET) initiative. IHPTET is a three phase, totally integrated DOD, DARPA, NASA, and Industry effort focused on doubling turbine engine propulsion capabilities by the turn of the century (Advanced Tactical Fighter engine is the baseline).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Program:
   - (U) Completed first build demonstration of IHPTET Phase I core. Achieved a 10% thrust-to-weight increase and a 15% reduction in specific fuel consumption over baseline fighter engines.
   - (U) Demonstrated a compressor utilizing one-piece bladed rotors, abradable seals and high through flow aerodynamics. This improved compressor efficiency by 2%, stall margin by 25% and had a 4% weight reduction.
   - (U) Demonstrated a combustor that had a 400°F temperature rise improvement and a 8% weight reduction while retaining full life capability.
   - (U) Evaluated advanced single crystal turbine blades, vanes and airseals that provided a 25% core power increase with improved efficiency and lower weight.

2. (U) FY 1989 Planned Program:
   - (U) Complete a second build demonstration of IHPTET Phase I core with goals of 20% thrust-to-weight increase and a 20% reduction in specific fuel consumption.
   - (U) Evaluate 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.

Program Element: #0603216F
Title: Aerospace Propulsion and Power Technology

Project Number: 681B
Budget Activity: #2 Adv Tech Devel

- (U) Utilize a nonmetallic combustor liner and a zoned combustor to demonstrate a 10% reduction in weight and a 500°F temperature increase.
- (U) Initiate Joint Turbine Advanced Gas Generator (JTAGG) small engine gas generator program with the Army and Navy which will provide the baseline for small turbine engines.
- (U) Initiate dedicated durability testing of advanced compressor and turbine configurations to provide reliability and maintainability information of new structures and materials.

3. (U) FY 1990 Planned Program:
   - (U) Complete demonstration of Integrated High Performance Turbine Engine Technologies (IHPTET) Phase I advanced core with an overall 30% increase in thrust-to-weight and a 20% reduction in specific fuel consumption.
   - (U) Demonstrate a metal matrix composite compressor with advanced titanium rotor structure to reduce weight by 10%.
   - (U) Evaluate single crystal turbine blades with advanced thermal coatings, modified ceramic shrouds and innovative cooling schemes to improve core power by 35% with a 12% weight reduction.
   - (U) Design and fabricate core hardware components for JTAGG demonstration.

4. (U) FY 1991 Planned Program:
   - (U) Initiate design and fabrication of IHPTET Phase II core gas generator. Established goals are a 35% improvement in thrust-to-weight with a 22% reduction in specific fuel consumption.
   - (U) Evaluate improved compressors using metal matrix rotor structure and single support rotors to achieve a 10% increase in rotor speed.
   - (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 cooling effectiveness blades.
   - (U) Begin instrumentation and assembly of initial JTAGG demonstrator.

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

D. (U) WORK PERFORMED BY: The program is managed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base OH. Contractors currently involved in this effort are: General Electric, Evendale OH; Pratt and Whitney, West Palm Beach FL; Garrett Turbine Engine Co, Phoenix AZ; and Allison Gas Turbine Division of General Motors, Indianapolis IN.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost

Program Element: #0603216F
Title: Aerospace Propulsion and Power Technology

Project Number: 681B
Budget Activity: #2 Adv Tech Devel

Tech	N/A	N/A	N/A
Sched	N/A	N/A	N/A
Cost	N/A	N/A	N/A

NARRATIVE DESCRIPTION OF CHANGES

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.

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, fan drive turbines, and afterburners 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 Technologies (IHPTET) initiative which combines efforts of Air Force, Navy, Army, DARPA, and NASA in advanced aerodynamics, materials, and innovative design capability such that a minimum weight, high core power technology, can be achieved that offers at least 100% improvement over state-of-the-art technology by the turn of the century.
- (U) No duplication of effort within the Department of Defense.

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

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

J. (U) MILESTONE SCHEDULE:

1. (U) Complete High-Through-Flow Durability Tests	August	1988
2. (U) Initial Innovative Component Concepts Application	September	1988
3. (U) Major Core Power Increase Initial Demonstration	February	1989
4. (U) Initial Non-Metal Rotor Application	September	1989
5. (U) Begin flowpath testing of Pratt ATEGG build 2	September	1990
6. (U) Begin flowpath testing of Allison ATEGG	December	1990
7. (U) Begin structural ATEGG demonstration test	June	1992

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2363 Advanced Visual Technology System	797	1,048	400	400	Continuing	TBD
2364 Training and Performance Data Center	225	1,000	0*	0*	0	TBD
2557 Advanced On-the-Job Training System	2,188	1,270	0	0	0	10,613
2743 Aircrew Combat Mission Enhancement	3,342	3,208	3,790	4,700	Continuing	TBD
2922 Personnel Assessment Systems	489	691	739	800	Continuing	TBD
2949 Basic Job Skills Assessment and Enhancement	446	821	1,200	1,272	Continuing	TBD
2951 Training Decisions System	49	0	0	0	0	65
3057 Intelligent Computer-Assisted Training	273*	470*	1,700	1,825	Continuing	TBD
Total	7,777*	8,508*	7,829	8,997	Continuing	TBD

*In FY 1988/1989 Project 3057 was in PE 0603751F; totals include Project 3057. Project 2364 transferred by OSD to Defense Logistics Agency (DLA) PE 0604722S.

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2363, Advanced Visual Technology System: This project develops and demonstrates, flight simulator visual display systems which will enable effective tactical combat training.

(U) FY 1988 Accomplishments:
- (U) Designed a prototype dome visual display system which presents high quality panoramic imagery over a wide field-of-view enabling realistic and effective training at about half the cost of current visual systems.

(U) FY 1989 Planned Program:
- (U) Build the prototype dome system at contractor facility.

(U) FY 1990 Planned Program:
- (U) Install the prototype system in lab at Williams AFB, AZ.

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

(U) FY 1991 Planned Program:
- (U) Determine training effectiveness of the dome display.
- (U) Develop alternative designs for full field-of-view display systems to enhance the training capability and reduce acquisition and maintenance costs.

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

(U) Work Performed By: AF Human Resources Laboratory, Operations Training Division, Williams AFB, AZ. The prime contractor is: McDonnell Douglas, St Louis, MO.

(U) Related Activities:
- (U) PE 0602205F, Personnel, Training, and Simulation
- (U) PE 0603231F, Crew Systems Technology
- (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 with the Operations Training Division at Williams AFB, AZ.
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 2364, Training and Performance Data Center: By OSD direction, in FY 1990, this project is transferred to DLA.

3. (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, specifications for full scale development and fielding will be transitioned to PE 0604243F, Manpower, Personnel, and Training Development.

4. (U) Project 2743, Aircrew Combat Mission Enhancement (ACME): ACME will develop, demonstrate and evaluate a simulator-based air combat training system to enable affordable, effective, and realistic aircrew combat training. It will consist of different levels of simulators to provide alternate levels of realism in the training environment. These alternate levels of fidelity will enable up to 14 live participants. Long distance networking will enable joint-Service/combined arms training.

(U) FY 1988 Accomplishments:
- (U) Completed development of a lightweight fiber-optic helmet-mounted visual display system, providing high detail color imagery over an unlimited field-of-view at about one fourth the cost of large dome display systems.

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

(U) FY 1989 Planned Program:
- (U) Begin refinements to the fiber-optic helmet-mounted display (FOHMD) system to improve image resolution.
- (U) Integrate two FOHMDs with four low fidelity pilot/ operator stations to create initial training system.
- (U) Develop a multi-ship mission control system to enable effective control of simulator training exercises.

(U) FY 1990 Planned Program:
- (U) Demonstrate 2 vs 4 aircrew combat training system.
- (U) Begin fabrication of multi-ship mission control system.
- (U) Begin development of more accurate and realistic threat and weapons simulations for training.

(U) FY 1991 Planned Program:
- (U) Complete enhancements for the fiber-optic helmet-mounted display visual system to improve image resolution.
- (U) Demonstrate a prototype 2 vs many aircrew combat training system

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

(U) Work Performed By: AF Human Resources Laboratory, Operations Training Division, Williams AFB, AZ. Prime contractors are: Univ of Dayton, Dayton, OH; Singer Co, Binghamton, NY; and Canadian Commercial Corp, Ottawa, Canada.

(U) Related Activities:
- (U) PE 0602205F, Personnel, Training, and Simulation Tech.
- (U) PE 0604227F, Flight Simulator Development.
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: The US and Canada are developing a Fiber-Optic Helmet-Mounted Display System for flight simulators. Work is performed by CAE Electronics Ltd., Quebec, Canada, through a contract with the Canadian Commercial Corporation, Ottawa, Canada. To complete the program Canada and the US have programmed $1.360 million. Total funding under this joint cost-sharing agreement, in effect since July 1981, is $15.730 million.

5. (U) Project: 2922, Personnel Assessment Systems: Provides technology to enable the AF to meet its manpower needs for combat readiness and sustainability and for the development of systems to provide information on individual job performance and job requirements. As mandated by Congress, cost effective methodologies for task-level measurement of on-the-job performance will be developed to enable validation of enlistment

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

selection and classification standards, and relate those standards to job requirements. Develops tools and methods to enhance the consideration of manpower, personnel, and training factors early in the system design and acquisition process.

(U) FY 1988 Accomplishments:
- (U) Demonstrated positive correlation between AF enlistment standards and job performance for seven AF specialties.

(U) FY 1989 Planned Program:
- (U) Examine the relationship between experience and performance at different levels of aptitude to determine if and when experience compensates for lower aptitude.
- (U) Determine the value added by job performance information over and above that provided by training information in selection and classification test validation studies.

(U) FY 1990 Planned Program:
- (U) Begin development of automated procedures for matching comparable weapon system task data for use in the design of new weapon systems.
- (U) Continue development and evaluation of low cost job performance measurement methodologies.
- (U) Demonstrate validity of manhour savings for automated job knowledge test generation procedures.
- (U) Begin development of automated procedures for clustering tasks into efficient jobs or training modules.

(U) FY 1991 Planned Program:
- (U) Develop computer adaptive occupational survey techniques.
- (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) Program to Completion: This is a continuing program.

(U) Work Performed By: AF Human Resources Laboratory, Manpower and Personnel Division, Brooks AFB, TX. The prime contractors are: Operational Technologies Corp., San Antonio, TX and Universal 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 within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

6. (U) Project 2949, Basic Job Skills Assessment and Enhancement: Modern high technology systems have relieved the human from performing many of the routine diagnostic and repair tasks and made it more difficult for first term airmen to obtain the necessary job experiences for growth from novice to expert. This project develops computer-based training systems to replace that lost experience.

(U) FY 1988 Accomplishments:
- (U) Completed field test of the Avionics Troubleshooting Tutor for the F-15 avionics manual test station, resulting in improvement in troubleshooting skills equivalent to 36 months experience for airmen trained with the tutor, compared to standard training

(U) FY 1989 Planned Program:
- (U) Field test Avionics Job Family Trainer to determine if common expert skills across three AF F-15 avionics specialties can be taught.
- (U) Develop Mechanical Job Family Trainer for F-15 mechanics, hydraulics specialists, and crew chiefs.

(U) FY 1990 Planned Program:
- (U) Complete evaluation of the Avionics Job Family Trainer.
- (U) Field evaluation of the Mechanical Job Family Trainer
- (U) Develop Avionics Extended Job Family Trainer for 8-10 related F-15, F-16, and F-111 avionics specialties.

(U) FY 1991 Planned Program:
- (U) Field evaluation of the Avionics Extended Job Family Trainer
- (U) Develop Mechanical Extended Job Family Trainer for 8-10 related specialties.

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

(U) Work Performed By: AF Human Resources Laboratory, Training Systems Division, Brooks AFB, TX. The prime contractor is Metrica Inc., Bryan, TX.

(U) Related Activities:
- (U) PE 0602205F, Personnel, Training, and Simulation
- (U) PE 0604243F, Manpower, Personnel, and Training Dev
- (U) No unnecessary duplication within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None

7. (U) Project: 2951, Training Decisions Systems: Project terminated due to inadequate technical progress.

Program Element: #0603227F Budget Activity: #2 - Adv Technology Dev
PE Title: Personnel, Training, and Simulation Technology

8. (U) Project: 3057, Intelligent Computer-Assisted Training: This project will develop and demonstrate software to enable AF training developers to rapidly and inexpensively build ICAT systems without the need for computer programming specialists. ICAT systems act like a human tutor, continually evaluating and interacting with the student to deliver more individualized and effective training. This project will also develop guidelines and specifications for the most effective instructional strategies and applications for ICAT.

(U) FY 1988 Accomplishments:
- (U) Determined the state-of-the-art of ICAT technology and computer hardware required for ICAT development.

(U) FY 1989 Planned Program:
- (U) Begin software design and development of a rapid prototyping testbed for ICAT systems.
- (U) Develop designs to allow for adaptation of training delivery for differences in student ability.

(U) FY 1990 Planned Program:
- (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) Begin development of ICAT demonstrations to determine the most appropriate career fields for application of ICAT technology.

(U) FY 1991 Planned Program
- (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) Program to Completion: This is a continuing program.

(U) Work Performed By: AF Human Resources Laboratory, Training Systems Division, Brooks AFB, TX. Prime contractor is the 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 within AF or DOD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2722 Biomedical Chemical Warfare Defense	3,500	4,472	4,781	4,993	Continuing	TBD
2829 Cockpit Automation Technology	5,540	5,528	5,585	4,541	Continuing	TBD
2830 Advanced Life Support Systems	1,922	1,978	2,637	2,977	Continuing	TBD
2868 Crew Escape Technologies	7,092	4,022	4,100	2,628	Continuing	TBD
2992 Space Crew Enhancement	660	1,008	1,010	1,469	Continuing	TBD
3257 Virtual Image Cockpit	630	3,264	4,493	5,085	Continuing	TBD
3781 Robotic Telepresence	0	0	0	213	Continuing	TBD
Total	19,344	20,272	22,606	21,906	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program conducts advanced development on concepts to protect and extend the performance of Air Force personnel in hazardous wartime environments. The program applies primarily to aircrew, but some applications extend to groundcrew conducting flightline operations. Specific projects include human factors considerations in the design of cockpits that significantly improve situational awareness, and that also improve the protective features of air and groundcrew life support equipment. A new start in 1991 will develop man-machine interfaces for remote control of robotic systems doing hazardous AF tasks, such as flightline work during chemical attack. All demonstrated concepts in this program element will feed into full scale development programs to address fifteen documented needs from USAF commands which require specific warfighting capabilities.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2722, Biomedical Chemical Warfare Defense: This project meets a critical need to defend our forces and sustain military operations in a chemical warfare environment. The project's goal is to ensure 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 close 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 personnel protection; (4) collective protection for groups of personnel; and (5) medical support and air evacuation.

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

(U) FY 1988 Accomplishments:
- (U) Test of multi-man cooling concept indicated flightline personnel wearing chemical defense clothing may work four times longer with cooling.

(U) FY 1989 Planned Program:
- (U) Complete computer model to better estimate casualties of air base personnel during realistic war exercises.
- (U) Transition to full scale development piezoelectric technology for detecting chemical agents in a cockpit.
- (U) Transition to full scale development laser technology for detecting chemical agents on an air base.

(U) FY 1990 Planned Program:
- (U) Study benefit of laser technology applied to personnel contamination sensors.
- (U) Develop computer program to model AF wartime medical system.

(U) FY 1991 Planned Program:
- (U) Develop hand-held laser technology for a personnel chemical contamination sensor.

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

(U) Work Performed By: Several contracts including ones with Systems Research Laboratories, Beavercreek OH, and BDM Corporation, McClean VA. In-house development is performed at USAF School of Aerospace Medicine, Brooks AFB TX.

(U) Related Activities:
- (U) Program Element (PE) #0602202F, Human Systems Technology.
- (U) PE #0604703F, Aeromedical/Chemical Defense Systems Dev.
- (U) PE #0604601F, Chemical Defense Equipment.
- (U) The Army is Department of Defense lead for chemical warfare defense; this project works Air Force-unique requirements.
- (U) Multiservice applications identified in the Joint Services 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: Not Applicable.

2. (U) Project 2829, Cockpit Automation Technology (CAT): This project develops a crew system design method that applies structured systems engineering and human factors principles early in the development cycle of manned aerospace vehicles. With this approach, predicted pilot performance and mission success with new automation concepts are measured using contractor's simulators to find the

best cockpit design. When implemented in industry, costly, last minute, cockpit redesigns can be reduced or avoided altogether.

(U) FY 1988 Accomplishments:
- (U) Completed development of methodology for cockpit design.
- (U) Demonstrated method by developing six improvements to baseline cockpit (enhanced F-15E) for mid-1990s mission.

(U) FY 1989 Planned Program:
- (U) Applied CAT's computer-aided engineering/analysis system.
- (U) Begin ground simulations of the upgraded baseline cockpit to compare the benefits of aiding pilot tasks with automation.

(U) FY 1990 Planned Program:
- (U) Test the rapid-prototyping, real-time, laboratory simulator for its effectiveness in cockpit evaluation.
- (U) Develop software for in-flight analysis of pilot performance and workload.

(U) FY 1991 Planned Program:
- (U) Ground test the performance and workload evaluation system.
- (U) Apply mission analysis to a notional strategic crew system.

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

(U) Work Performed By: Work has been performed by the Northrup Corporation, Aircraft Division, Hawthorne CA and by Boeing Advanced Systems, Seattle WA. Boeing continuing through 1992. In-house development is by the Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB OH.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0603205F, Aerospace Vehicle Technology - Agreement provides matrixed manning for development of pilot/vehicle interface technologies and simulation capabilities.
- (U) Man-machine integration activities were coordinated by a Tri-Services Initiative Panel (chartered by Joint Directors of Laboratories) chaired by this project office (2829).
- (U) Coordination occurs through a Crew Station Working Group within Air Force Systems Command. Also through a Joint Aeronautical Commander's Group Committee.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 2830, Advanced Life Support Systems (ALSS): This project develops and integrates advanced aircrew life support subsystems. Given successful completion of efforts to develop a Tactical Life Support System, project emphasis is shifting toward an advanced,

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

high altitude, aircrew protection suit for the Strategic Air Command's reconnaissance mission. Concurrently, options for a transatmospheric pressure suit will be developed for aircrew of the National Aerospace Plane.

(U) FY 1988 Accomplishments:
- (U) Transitioned to full scale development a positive pressure breathing system protecting pilots from high accelerations.
- (U) Improved mobility of arms in pressure suits for strategic aircrews.

(U) FY 1989 Planned Program:
- (U) Improve components of tactical aircrew breathing system (combined breathing regulator and g-valve).

(U) FY 1990 Planned Program:
- (U) Begin development of Advanced High Altitude Pressure Suit with a configuration option for the National Aerospace Plane to improve egress and radiation protection.

(U) FY 1991 Planned Program:
- (U) Performance testing of component technologies for high altitude pressure suit systems.

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

(U) Work Performed By: Boeing Advanced Systems, Seattle WA and ILC Dover, Dover DE. In-house development and testing is by the 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 Equipment RDT&E Steering Group under Joint Logistics Commanders.
- (U) No unnecessary duplication within the Air Force or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Contractor relationship with Canadian government has been used indirectly to conduct development testing. 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. Lastly, the USAF and the Ministry of Defense of the United Kingdom are negotiating cooperative

research concerning aircrew protection and performance.

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. The technologies developed will transition to the next generation ejection seats for the Air Force and Navy.

(U) FY 1988 Accomplishments:
- (U) Flight controller design, fabrication and testing.
- (U) Performance tests of a new, advanced, rocket sled for CREST ejection tests were successfully completed.

(U) FY 1989 Planned Program:
- (U) Rocket sled test demonstrations of CREST seat will begin.

(U) FY 1990 Planned Program:
- (U) Complete the rocket sled test demonstrations of CREST seat.
- (U) Computational simulations will validate actual test data.

(U) FY 1991 Planned Program:
- (U) Transition CREST test results, design specifications and a logistics support analysis to full scale development.
- (U) Follow-on investigations will begin in hypersonic escape.

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

(U) Work Performed By: Boeing Advanced Systems, Seattle WA. In-house development and test is done 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) Life support activities are included in the USAF Ten Year Life Support Master Development Plan.
- (U) Coordinated through Tri-Service Life Support Equipment RDT&E Steering Group under Joint Logistics Commanders.
- (U) No unnecessary duplication within the Air Force or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

5. (U) Project 2992, Space Crew Enhancement (SPACE): This project develops specialized crew protection and man-machine integration needed

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

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 1988 Accomplishments:
- (U) Fabricated a telescope for a space shuttle test (#2 priority experiment in DoD Man-in-Space program) that will measure human capability to observe and track ground targets.

(U) FY 1989 Planned Program:
- (U) Ground tests of space telescope to check performance.

(U) FY 1990 Planned Program:
- (U) Integrate telescope for shuttle flight test via Space Test Program and Military-Man-In-Space program.

(U) FY 1991 Planned Program:
- (U) Identify crew station design criteria and advanced technologies for manned military space systems.

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

(U) Work Performed By: Systems Research Laboratories, Beavercreek OH, and Rockwell International, Los Angeles CA. In-house development is done 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) Military space crew activities are coordinated with other services, and the National Aeronautics and Space Administration through the Space Technology Interdependency Group.
- (U) No unnecessary duplication within the Air Force or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

6. (U) Project 3257, Virtual Image Cockpit (VIC): This project develops virtual man-machine interfaces for aircraft cockpits to significantly improve pilot situational awareness. "Virtual" 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. Displays can be projected on the inside of the pilot's helmet visor to provide either images of the terrain as viewed from aircraft infrared sensors, and/or symbols to indicate

aircraft, flight and weapons status. One of the concepts being developed is a helmet-mounted display (HMD), 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 huge payoffs in pilot performance, therefore, this major new project is leveraging substantial industry resources to rapidly develop helmet-mounted displays for immediate applications in fighter aircraft. FY 1990 and 1991 funding increases will provide flight testing of the night vision goggle/head-up display to enable accelerated transition to full scale development in response to Strategic Air Command, Tactical Air Command and Military Airlift Command requirements. FY 1991 and beyond funding will provide component development and demonstration of virtual cockpit technologies for far term application.

(U) FY 1988 Accomplishments:
- (U) Completed development of high resolution, helmet-mounted sight for next generation rotary and fixed-wing aircraft.

(U) FY 1989 Planned Program:
- (U) Begin analysis of helmet-mounted display/sight (HMD/HMS) operational payoff and develop design goals.
- (U) Begin lab test of low profile, ejection capable, night vision goggle (NVG) head-up display (HUD).
- (U) Begin parallel development of advanced, ejection capable, night vision goggle/head-up display (NVG/HUD).
- (U) Begin development of air-to-surface, binocular HMD.

(U) FY 1990 Planned Program:
- (U) Continue development of advanced NVG/HUD and air-to-surface, binocular HMD.
- (U) Begin flight testing low profile NVG/HUD and all-aspect HMD.

(U) FY 1991 Planned Program:
- (U) Continue flight testing of all-aspect, helmet-mounted display (HMD) and low-profile NVG/HUD.
- (U) Continue development of advanced NVG/HUD and air-to-surface, binocular HMD.
- (U) Begin development of components of virtual image cockpit.

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

(U) Work Performed By: In-house development is by the Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB OH. Contracts to be awarded in FY 1989.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) PE #0603790D, NATO Cooperative R&D.

Program Element: #0603231F Budget Activity: 2 - Advanced Technology Development
PE Title: Crew Systems and Personnel Protection Technology

- (U) PE #0604706F, Life Support Systems.
- (U) Coordination occurs through a Crew Station Working Group within Air Force Systems Command.
- (U) Negotiating joint development with the Navy on helmet-mounted displays and low profile, 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 efforts on helmet-mounted display technologies for aircrews.

7. (U) Project 3781, Robotic Telepresence: This project will develop telepresence concepts to control mobile robots in hazardous tasks (e.g., bomb disposal or flightline operations during chemical warfare attack). Robotic telepresence will use the man-machine interface technologies, now being demonstrated in exploratory development, to permit a human operator to "feel" (with sight, sound and touch) as if he were physically at the work site, while actually manipulating the robot's operation from a safe location. Such a concept affords remote, human-in-the-loop control of mobile robots well beyond the current capabilities of teleoperation. Sophisticated control technologies will link human cognition, judgement and adaptability to robots capable of operating in lethal environments, with increased robot strength, and higher precision.

(U) FY 1988 Accomplishments: Not Applicable.

(U) FY 1989 Planned Program: Not Applicable.

(U) FY 1990 Planned Program: Not Applicable.

(U) FY 1991 Planned Program:
- (U) Establish human-robot interface performance requirements.

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

(U) Work Performed By: Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH.

(U) Related Activities:
- (U) PE #0602202F, Human Systems Technology.
- (U) Coordination with Army, Navy and Department of Energy through the Joint Technology Panel for Robotics.
- (U) Contact with National Aeronautics and Space Administration.
- (U) No unnecessary duplication within the Air Force or DoD.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603245F Budget Activity: #2 Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2061 Vehicle/Avionics/Weapon Integration	594	4,742	10,104	11,478	Continuing	TBD
2568 Advanced Wing Technology	1,723	1,800	2,000	3,500	Continuing	TBD
2682 Airframe Propulsion Integration	8,926	8,017	6,825	3,510	Continuing	TBD
2979 Reliability and Maintainability	2,376	3,460	3,346	4,780	Continuing	TBD
3391 X-29 Advanced Tech Demonstrator	8,519	5,740	500	0	0	23,744
TOTAL	22,138	23,759	22,775	23,268	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The major thrust of this Program Element (PE) is flight test of fully integrated sets of synergistic technologies under simulated mission conditions. The emphasis is on technologies which can provide low cost, reliability, low-maintenance, and increased tactical performance and survivability for current and future aircraft. PE 0603205F, Aerospace Vehicle Technology, provides component technologies that are integrated and flight tested in this PE. The Flight Dynamics Laboratory, Wright-Patterson AFB OH manages this work. Flight testing is performed at the Dryden Flight Research Facility and the Air Force Flight Test Center at Edwards AFB CA.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2568, Advanced Wing Technology: Includes the following programs: (1) The Mission Adaptive Wing (MAW) which is a joint AF/NASA program that flight tests, on an F-111 testbed, the payoffs of integrating variable camber (leading and trailing edge wing control) with a smooth skin wing (no flaps or ailerons). Varying the wing shape control during flight improves range, turning rate, and ride quality. (2) A joint NASA/Air Force Hybrid Laminar Flow Control (HLFC) program that evaluates performance improvements using leading edge suction to effect laminar boundary layer control. Potential fuel savings of 15% for derivative and future transport aircraft is expected. (3) The Wing Technology program under which radar, structural and shape control technologies for an advanced wing will be integrated into a new wing design and flight tested for long-range detection of late 1990 threats.

(U) FY 1988 Accomplishments:
- (U) Flight demonstrated a 25% increase in range using the MAW when flying multi-condition missions.
- (U) Flight demonstrated a 20% increase in maneuverability and sustained G's with the use of the MAW on an F-111 testbed.

Program Element: #0603245F Budget Activity: #2 Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

- (U) Demonstrated a 35% per flight hour reduction in wing maintenance using a fully enclosed variable camber wing.

(U) FY 1989 Planned Program:
- (U) Complete flight testing of the MAW and release design criteria for application to the ATF and other vehicles.
- (U) Develop a flight test plan for integration and flight testing of the HLFC system on a transport aircraft.
- (U) Define concepts for integrating phased radar arrays, lightweight structures, and wing shape flexibility into an advanced wing.

(U) FY 1990 Planned Program:
- (U) Complete the wing technology program predesign study for improved aircraft agility and long-range detection of late 1990 threats.
- (U) Complete HLFC program hardware integration.

(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) Start integration design work for the wing technology program.

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

(U) Work Performed By: Prime contractors are Boeing Company, Seattle WA, and General Dynamics Corp, Ft Worth TX.

(U) Related Activities:
- (U) PE 0603211F, Aerospace Structures and Materials. Provides technologies for integration and flight test on Advanced Flight Technology Integration test aircraft.
- (U) PE 0603203F, Advanced Avionics for Aerospace Vehicles. Provides transmit/receive module technology for application to embedded aircraft structures.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 2682, Airframe Propulsion Integration: The following programs provide vehicle-level integration and flight demonstration for takeoff/landing performance, close-in-combat, and full-mission optimized cruise/maneuvering performance: Short Takeoff and Landing/Maneuver Technology Demonstrator (STOL/MTD) - This program integrates and flight validates on a modified F-15B aircraft two-dimensional (pitch axis) thrust vectoring/reversing (TV/TR) exhaust nozzles, flight/ nozzle controls, and aircraft rough field landing gear. The result will be an aircraft that will (a) be controlled in the pitch

Program Element: #0603245F Budget Activity: #2 Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

axis by vectored thrust; (b) have improved maneuver and deceleration performance; and (c) take off and land on a 1500 ft by 50 ft icy 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.

(U) Integrated Control (ICON) - This program integrates and flight validates an integrated flight and propulsion control system to optimize vehicle performance over all flight phases. The integrated system will utilize the aerodynamic surfaces, inlets, engine, and nozzles to provide a reliable control capability for derivative and future aircraft. Aircraft range, acceleration, and engine life will be increased.

(U) Multi-Axis Thrust Vectoring - This program integrates and flight validates low weight and highly reliable multi-axis (pitch and yaw) thrust vectoring nozzles with improved control and maneuverability to enhance air combat lethality and survivability.

(U) FY 1988 Accomplishments:
- (U) Completed aircraft modifications and started a limited flight test program to check out new aircraft control surfaces and controls prior to TV/TR exhaust nozzle installation.

(U) FY 1989 Planned Program:
- (U) Conduct STOL/MTD envelope clearance flights prior to TV/TR exhaust nozzle installation and flight test.
- (U) Complete STOL/MTD flight testing with TV/TR nozzles.

(U) FY 1990 Planned Program:
- (U) Complete STOL/MTD military operational utility testing including full afterburner flight.
- (U) Begin definition of a design of an integrated flight propulsion control system for the ICON program.
- (U) Start integrated engineering design definition work for the Multi-Axis Thrust Vectoring program.

(U) FY 1991 Planned Program:
- (U) Start integration of the performance system into the aircraft for the ICON program.
- (U) Start integrated engineering design work for the Multi-Axis program.

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

(U) Work Performed By: Prime contractor is McDonnell-Douglas Aircraft Corp, St Louis MO.

Program Element: #0603245F Budget Activity: #2 Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

(U) Related Activities:
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 2979, Reliability/Maintainability: Self-Repairing Flight Control System (SRFCS) - Program consists of flight testing reconfigurable flight controls and demonstrating expert system based maintenance diagnostics. Self-repair is accomplished by utilizing aerodynamic flight control surface redundancy to reconfigure the aircraft during flight. Detailed diagnostics identify and isolate flight control surface failures for flight-line maintenance. A scaled down version of the diagnostic system, embedded in the aircraft's flight control system, will combat non-ground-test duplicatable failures.

(U) FY 1988 Accomplishments:
- (U) Completed design for an onboard expert diagnostic system for in-flight control surface failure detection and isolation.
- (U) Integrated single-surface reconfiguration strategies for left horizontal tail failure and other noncritical control surfaces into a NASA F-15 testbed aircraft.

(U) FY 1989 Planned Program:
- (U) Conduct initial flight tests for a single-surface impairment and integrate the results into the SRFCS design.
- (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 1990 Planned Program:
- (U) Complete single-surface reconfiguration flight testing.
- (U) Complete the integrated engineering design for a complete multi-axis SRFCS program.

(U) FY 1991 Planned Program:
- (U) Start aircraft modification and integration of the advanced SRFCS program.

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

(U) Work Performed By: Prime contractors are McDonnell-Douglas Corp, St Louis MO; General Electric Company, Binghamton NY; and Alpha Tech Inc, Burlington MA. The Flight Dynamics Laboratory, Wright-Patterson AFB OH will perform in-house real time simulations.

(U) Related Activities:
- (U) No duplication of effort within the Department of Defense.

Program Element: #0603245F Budget Activity: #2 Adv Tech Devel
Title: Advanced Flight Technology Integration (AFTI)

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

4. (U) Project 3391, X-29 Advanced Technology Demonstrator: This program 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 1988 Accomplishments:
- (U) Completed X-29 aircraft #1 flight testing. Results indicate 10-20% less drag and 5-25% less weight if X-29 technologies were incorporated into a fighter aircraft.
- (U) Upgraded aircraft #2 flight controls for high AOA flight.
- (U) Completed aircraft #2 spin chute and instrumentation upgrades.

(U) FY 1989 Planned Program:
- (U) Conduct ground tests checking out all aircraft #2 systems and accomplish high AOA flight testing. Predicted to have significant transonic performance improvements.
- (U) Conduct extensive computer simulations of the flight controls supporting flight testing.

(U) FY 1990 Planned Program:
- (U) Publish X-29 flight research/analysis report.

(U) FY 1991 Planned Program: Not Applicable.

(U) Program to Completion: Not Applicable.

(U) Work Performed By: Prime contractor is Grumman Aircraft Corp, Bethpage NY.

(U) Related Activities:
- (U) The X-29 program is jointly funded with NASA.
- (U) No duplication of effort within the Department of Defense.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0603245F
Title: Advanced Flight Technology Integration (AFTI)

Project Number: 2061
Budget Activity: #2 Adv Tech Devel

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

D. (U) WORK PERFORMED BY: Prime contractor is McDonnell Douglas Co, St Louis MO. 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.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-0-
Sched	None	None	-0-
Cost	None	None	-0-

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:
   - (U) TAF SON 304-83 Advanced Tactical Fighter
   - (U) TAF SON 310-85 Air Defense Aircraft
   - (U) TAF SON 002-86 Improved Interceptor (Draft)

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) No duplication of effort within the Department of Defense.

H. (U) OTHER APPROPRIATED FUNDS: Not Applicable.

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

J. (U) MILESTONES SCHEDULE:

- (U) Aircraft ICAAS 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

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603250F Project Number: #649L
PE Title: Lincoln Laboratory Budget Activity:#2-Advanced Technology Development

A.(U) RESOURCES ($ in Thousands)

Project Title Lincoln Laboratory Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Lincoln Laboratory	25,999	23,003	25,603	26,988	Continuing	TBD

B.(U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Lincoln Laboratory 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. From this technology base, Lincoln Laboratory engages in advanced research and technology demonstration in the areas of military satellite communications, space radar technology, space-based visible surveillance, deep-space and tactical battlefield surveillance, advanced solid-state devices, materials and processing technology. Lincoln Laboratory also provides technical advice and consultation to the military services and defense agencies.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1.(U) FY 1988 Accomplishments:

- (U) Designed/fabricated an analog neural network electronic circuit for speech recognition in voice activated tasks.
- (U) Developed/confirmed theoretical model for very large scale integration (VLSI) laser-formed connections for wafer-scale electronic circuit designs. Improved wafer's general usefulness.
- (U) Developed signal intercept architectures for interference cancellation based on signal of interest features using minimally calibrated antenna arrays. Improves signal recognition and anti-jam performances.
- (U) Demonstrated neural network unsupervised learning using multidimensional laser radar data for target recognition.
- (U) Designed an extremely high frequency (EHF) adaptive antenna configuration which can produce multiple, independently steerable agile beams. Overcome present radar and communication limitations.
- (U) Transitioned to the Navy for operational use the Transportable Fleet Satellite EHF Package Operations Center (FEPOC).
- (U) Supported the design of a high-data-rate Defense Satellite Communications System (DSCS)-III follow-on payload.
- (U) Continued work on Lasercom brassboard system, space-qualified units of the transmitter, diagnostic assemblies and flight design electronics. Present cross-links limit sensor data transfers.

2.(U) FY 1989 Planned Program:

- (U) Establish rapid turnaround integrated circuit (IC) modification capability using a laser restructuring technique.

Program Element: #0603250F Project Number: #649L
PE Title: Lincoln Laboratory Budget Activity: #2-Advanced Technology Development

- (U) Develop low-noise charged-coupled device (CCD) imagers.
- (U) Initiate the development of agile EHF adaptive antenna subsystems.
- (U) Flight test multidimensional sensor; laser radar (CO2 and GaAs), passive infrared [8-12 micron (um)] and millimeter-wave radar [85 Gigahertz (GHz)].
- (U) Finish brassboard system and space qualification of important Lasercom flight-design subsystems.
- (U) Continue restructured Lasercom program based on current technology.
- (U) Complete design and initiate fabrication of space-based radar signal processor test bed.
- (U) Develop gallium arsenide permeable base transistor (PBT) 60-GHz monolithic microwave integrated circuits (MMICs).
- (U) Develop 100-element coherent linear diode laser arrays [5 Watts Continuous wave (CW)] for more efficient power generation.
- (U) Develop film-growth techniques and device exploration in diamond which increased the electronic device's speed.

3.(U) FY 1990 Planned Program:

- (U) Design wafer-scale neural network system for image processing.
- (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.
- (U) Continue development of the brassboard agile EHF adaptive antenna.
- (U) Continue Lasercom technology program to higher data rates, smaller sizes, less weight for other system applications.
- (U) Begin phased performance evaluation of space-based radar test articles in near-field test range
- (U) Complete space-based radar signal processor test bed.
- (U) Develop GaAs PBT 60-GHz power and 94-GHz small-signal MMIC.
- (U) Continue development of film-growth techniques and fabrication of transistors made from diamond material.
- (U) Develop radiation hardened CCD imagers for surveillance.
- (U) Demonstration field tests of advanced CCD focal planes in an integrated space surveillance sensor.

4.(U) FY 1991 Planned Program:

- (U) Extend rapid prototyping design to submicron electronic devices.
- (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.
- (U) Integrate/test Lasercom package flight-design engineering model.
- (U) Continue Lasercom technology extension program to higher rates, higher power, smaller and lower-cost cross-link packages.
- (U) Integrate all space-based radar test-beds for comprehensive capability demonstration in near-field test range.
- (U) Continue development of higher power coherent laser diode arrays

Program Element: #0603250F Project Number: #649L
PE Title: Lincoln Laboratory Budget Activity:#2-Advanced Technology Development

- (U) Model and fabricate diamond transistors for high power and high-frequency performance.
- (U) Develop and demonstrate large area array CCD imagers in infrared (IR) and ultraviolet (UV) bands for space-surveillance sensors.

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

D. (U) WORK PERFORMED BY: There are no prime contractors that support this program. Funds are used to pay salaries and purchase supplies for in-house activities at Lincoln Laboratory.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-0-
Schd	None	None	-0-
Cost	Yes	None	-491

NARRATIVE DESCRIPTION OF CHANGES

1.(U) TECHNICAL CHANGES: Not Applicable
2.(U) SCHEDULE CHANGES: Not Applicable
3.(U) COST CHANGES: Funding reductions, in this Program Element (PE) reduced manpower, eroded Lincoln Laboratory's technical base and limited their ability to respond to new technical opportunities.

F. (U) PROGRAM DOCUMENTATION: 1951, MIT Lincoln Laboratory FCRC Charter; May, 1975, Department of Defense Plan for Administration of Lincoln Laboratory.

G. (U) RELATED ACTIVITIES:

- (U) PE 0303603F, Milstar
- (U) PE 0602702F, Command, Control and Communications
- (U) PE 0102424F, Space Track
- (U) PE 0102428F, Space Surveillance Technology
- (U) PE 0303401F, Communications Security
- (U) PE 0601102F, Defense Research Science
- (U) PE 0601101E, Restructurable Very Large Scale Integration
- (U) PE 0602301E, Wafer-Scale Integration
- (U) PE 0603220C, Laser Imaging Technology
- (U) PE 0603789F, Command, Control, Communications and Intelligence
- (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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
666A Advanced Reference Systems Development	1,954	2,500	2,843	2,949	Continuing	TBD
2733 Advanced Reconnaissance/Strike Radars	*	6,300	6,341	8,295	Continuing	TBD
2735 Advanced Systems Avionics Applications	1,131	2,100	4,280	4,466	Continuing	TBD
3833 Sensor Integration for Covert Penetration	0	100	1,268	2,530	Continuing	TBD
Total	3,085	11,000	14,732	18,240	Continuing	TBD

* (U) FY 1988 contractual activities supported by $3.7M from PE 0603109F and $2.0M from PE 0603208F.

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 as well as reduce 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 1988 Accomplishments:
- (U) Demonstrated a high accuracy strapdown accelerometer that reduces cost by a factor of three and has application in inertial navigation systems requiring high accuracy.

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

(U) FY 1989 Planned Program:
- (U) Complete flight test of a high accuracy ring laser gyroscope inertial navigation system.
- (U) Complete 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 system (GPS) receiver that will demonstrate improved performance in a jamming environment.
- (U) Complete design of a strapdown stellar inertial system.
- (U) Initiate joint Air Force/Navy integrated antenna system development that will significantly reduce the number of antennas on aircraft.

(U) FY 1991 Planned Program:
- (U) Complete testing and evaluation of an anti-jam GPS brassboard receiver.
- (U) Fabricate a strapdown stellar inertial brassboard system.
- (U) Complete system design of an integrated antenna system that will reduce antennas on aircraft.

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

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH manages this project. Contractors are: Rockwell International, Anaheim CA; Northrop, Hawthorne CA; and Mayflower Communications, Reading MA.

(U) Related Activities:
- (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: Not Applicable.

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 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. Growth in FY 1991 funds supports continued development of radar technology to

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

automatically acquire surface targets and to detect those concealed in foliage.

(U) FY 1988 Accomplishments:
- (U) Completed integration of Ultra Reliable Radar (URR) solid state active phased array aperture with radio frequency (RF) and power supply (PS) hardware as a step in demonstration of improved fire control radar.

(U) FY 1989 Planned Program:
- (U) Complete active array rooftop/range testing to provide critical data for risk reduction to the Advanced Tactical Fighter radar.
- (U) Demonstrate first-ever airborne fire control active array radar with payoff in improved performance, reliability and maintainability for future systems.

(U) FY 1990 Planned Program:
- (U) Exploit model based vision research and parallel processor technology development to optimized algorithm/hardware interface.
- (U) Complete conceptual design of a wide area air-to-surface search and detection radar designed to find high value targets deliberately camouflaged/concealed in foliage.

(U) FY 1991 Planned Program:
- (U) Demonstrate in a laboratory environment a real-time, automatic, radar ground target acquisition capability.
- (U) Complete concept development for a tactical fighter constrained airborne, real-time, all-weather, automatic target acquisition sensor.
- (U) Complete detailed design and initiate fabrication of a low frequency tactical airborne radar with capability to detect camoulfaged/concealed targets.

(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 0603203F, Advanced Avionics for Aerospace Vehicles.
- (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: Not Applicable.

3. (U) Project 2735, Advanced Systems Avionics Applications: Over the

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

past decade electronic technology developments have increased so rapidly that technology opportunities have far exceeded resources available to capitalize on them. This project will define, develop, and demonstrate integrated avionics architectures that exploit new oportunities in parallel processing networks, reduced instruction set computers, software for avionics applications, expert system tools and conformal electronic device packaging. Growth in FY 1990 funds reflect this focus.

(U) FY 1988 Accomplishments:
- (U) Completed preliminary design of an Ada Graphics Software Support System (AGSSS) that will improve maintenance, supportability, and producibility of software developed for airborne graphic displays.

(U) FY 1989 Planned Program:
- (U) Complete integration of the integrated terrain access and retrieval system into the integrated test bed.
- (U) Complete the AGSSS program and demonstrate graphics programming in Ada.

(U) FY 1990 Planned Program:
- (U) Complete prototyping of an advanced avionics radio frequency module that exploits advanced technology and cool- and packaging techniques that will improve reliability and maintainability of avionics systems.
- (U) Exploit/Integrate computer aided software engineering advances that will lead to a tenfold improvement in software productivity.

(U) FY 1991 Planned Program:
- (U) Complete the design of a program to exploit advances in device technology, software, processing, packaging, cooling and fault tolerance. Product will improve avionics system reliability, producibility, and maintainability.
- (U) Demonstrate a common radio frequency module that incorporates advanced cooling and packaging techniques.

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

(U) Work Performed By: The Avionics Laboratory, Wright-Patterson AFB OH manages this project. Contractors are TRW, Dayton OH and Research Triangle Park, Durham NC.

(U) Related Activities:
- (U) PE 0603109F, INEWS/ICNIA.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriate Funds: Not Applicable

Program Element: #0603253F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Avionics Integration

(U) International Cooperative Agreements: Not Applicable.

4. (U) Project 3833, Sensor Integration for Covert Penetration: Most 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 airborne 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 1988 Accomplishments: Not Applicable.

(U) FY 1989 Planned Program:
- (U) Evaluate current systems to determine best approach to integrate sensors for covert penetrations.
- (U) Investigate applications of expert systems to avionics sensor control, information fusion and threat avoidance.

(U) FY 1990 Planned Program:
- (U) Develop preliminary design of promising sensor suites for application to covert penetration.
- (U) Establish covert penetration resources environment to include sensor, aircraft, and ground truth models and integrate models into an avionics simulation.
- (U) Demonstrate contributions of data from individual sensors in support of covert penetration.

(U) FY 1991 Planned Program:
- (U) Develop preliminary design of adaptive sensor control techniques that will utilize fault tolerant, reuseable software modules and advanced algorithms.
- (U) Investigate shared sensor aperture control and multi-use techniques.

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

(U) Work Performed By: Efforts in this project are managed by the Avionics Laboratory, Wright-Patterson AFB OH.

(U) Related Activities:
- (U) PE 0603737D, Balanced Technology Initiative.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

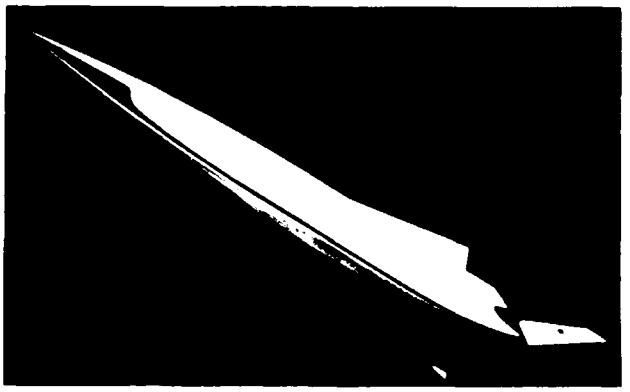
(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603269F
PE Title: National Aerospace Plane (NASP) Technology Program
Project Number: 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Start Phase IIB - Oct	Start Phase IIC - Mar	Complete Phase II 4Q	Phase III Go-Ahead 1Q	
Engineerng Milestones	NA	Engine Design Rev Mar 89	Engine Test 3Q	X-30 PDR 2Q	
T&E Milestones	NA	NA	NA	NASP Resrch Plan 1Q	X-30 1st flight 3Q95
Contract Milestones	Continue Phase II	Continue Phase II	Continue Phase II	Award X-30 Contract 1Q	Deliver 2 X-30s 1Q95
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Propulsion	91,400	82,055	73,045	0	304,650 (0)
Airframe	28,349	31,539	26,726	0	118,479 (0)
Tech Mat & Matl's	51,633	75,160	80,846	22,986	328,158 (57,236)
Applica-tions	1,689	2,171	2,272	2,605	21,088 (11,447)
X-30 Aero-Spacecraft	0	0	0	229,907	1,373,977 (1,144,070)
Support Contract	643	1,053	735	843	7,272 (3,816)
In-House Support	4,375	4,210	5,345	6,130	60,404 (38,216)
GFE/Other	4,611	34,579	110,773	127,053	803,739 (491,249)
Total [1]	182,700	230,767	299,742	389,524	3,017,767 (1,746,034)

Note 1: Detailed funding breakouts shown above the "Total" line represent a pro-rata DoD share of joint DoD/NASA program.

Program Element: 0603269F
PE Title: National Aerospace Plane (NASP) Technology Program
Project Number: 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 known as the National Aero-Space Plane (NASP) program. The NASP program will develop the technological basis for aircraft capable of long range hypersonic cruise in the atmosphere and for space launch vehicles capable of single-stage-to-orbit performance with takeoff and landing from a conventional runway. These technologies will then be demonstrated in a manned flight research vehicle, the X-30. These demonstrated technologies would then provide the basis for military and civil vehicles capable of: global unrefueled operation, reaching any point on 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. Such NASP-derived vehicles would provide revolutionary increases in military capability. The NASP is envisioned to be a manned, airbreathing, hydrogen fueled, single-stage-to-orbit vehicle capable of operating (horizontal takeoff/landing) from conventional runways.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments
- (U) Continued effort on complex fluid dynamics calculations including refinement of computer models with component test data
- (U) Continued characterization/development of advanced materials, investigated associated manufacturing technologies/techniques
- (U) Began construction of selected engine and airframe ground demonstration components
- (U) Initial checkout runs for engine ground test facilities
- (U) Began construction of cryogenic tank structures
- (U) Continued mission applicability studies/survivability analyses
- (U) Continued vehicle fabrication and flight test planning
- (U) Established materials consortium with all major contractors

2. (U) FY 1989 Planned Program
- (U) Complete upgrade, begin routine operation of engine test facilities
- (U) Begin scale-up of durable high temperature resistant materials
- (U) Continue fabrication of major structural demonstration components including cryogenic tankage, wing/fuselage attach structure, a large fuselage section, wing leading edges, etc
- (U) Perform engine component testing through Mach 16
- (U) Begin fabrication of large-scale hypersonic scramjet engines
- (U) Continue to develop and refine the three X-30 airframe contractor designs and integrate with engine designs
- (U) Continue materials, computational fluid dynamics, and other key technology work while refining engine/vehicle
- (U) Conduct major review of contractor scramjet engine designs

3. (U) FY 1990 Planned Program
- (U) Complete the development of large-scale, near-flightweight hypersonic scramjet engines
- (U) Ground test NASP propulsion systems, including the large-

Program Element: 0603269F
PE Title: National Aerospace Plane (NASP) Technology Program
Project Number: 3384
Budget Activity: # 2 - Advanced Technology Development

scale hypersonic scramjet engines to Mach 8
- (U) Test subscale engines and full scale components to Mach 16
- (U) Three airframe contractors will complete and submit designs for the X-30 flight research aircraft
- (U) Complete Phase II military and civil utility and application studies to support the Phase III go/no-go decsion
- (U) Go/no-go decision to proceed into Phase III of the program

4. (U) FY 1991 Planned Program
- (U) Award and negotiate X-30 airframe/engine contracts
- (U) Continue detailed design for the X-30 engine and airframe
- (U) Initiate pilot production facilitization effort for high temperature, lightweight materials
- (U) Complete and submit test and evaluation plan
- (U) Order long lead items for two X-30 flight research aircraft
- (U) Continue technology maturation efforts.
- (U) Negotiate vehicle design and fabrication contracts
- (U) Continue and expand application/utility/vulnerability studies for potential follow-on operational systems

5. (U) Program to Completion:
- (U) Complete design and fabricate two X-30 flight research vehicles for flight test
- (U) Conduct ground static and fatigue tests of X-30 airframe
- (U) First flight of X-30 and conduct initial flight test program with normal flight envelope expansion
- (U) Conduct extended X-30 flight research program to demonstrate the viability of single-stage-to-orbit and hypersonic cruise
- (U) Complete assessments of operational utility and application 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, OH. Actual technology development is being conducted by contractors, universities, and in-house government laboratories. Contractors for engine development are Pratt and Whitney, West Palm Beach, FL; and Rocketdyne, Canoga Park, CA. Contractors for airframe component development are General Dynamics, Fort Worth, TX; McDonnell-Douglas, St Louis, MO; and Rockwell, Los Angeles, CA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	NA	None
Cost	None	6 Mos	-96,472

Program Element: 0603269F | Project Number: 3384
PE Title: National Aerospace Plane (NASP) Technology Program | Budget Activity: # 2 - Advanced Technology Development

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: The first atmospheric flight of the X-30 slipped six months due to funding reductions made to the program during the budget and out years.

F. (U) PROGRAM DOCUMENTATION:
- (U) SON SAC 07-79, Jun 79
- (U) SON AFSPACECOM 06-84, Mar 86
- (U) Memorandum of Agreement for NASP (AF, Navy, SDIO, DARPA), 25 Apr 86
- (U) DoD/NASA Memorandum of Understanding, 27 Sep 88

G. (U) RELATED ACTIVITIES:
- (U) NASP is a Joint DoD/NASA program and participation of DoD organizations is governed by a Memorandum of Agreement (MOA), signed by all parties and by the Under Secretary of Defense for Research and Engineering, dated 25 April 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 September 88
- (U) Broad programmatic policy and direction is provided to the NASP program by the NASP Steering Group, chaired by the Under Secretary of Defense (Acquisition) with the NASA Associate Administrator for Aeronautics and Space Technology 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

This is a Science and Technology program. No T&E activities until Phase III.

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Submit Research Plan	1Q/FY1991	Start of Phase III
X-30 First Atmospheric Flight	3Q/FY1995	Start of flight research program to demonstrate NASP technologies
X-30 First Orbital Flight	4Q/FY1996	First demonstration of the prime NASP program goal

00190

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603270F Budget Activity: 2 Advanced
PE Title: Electronic Combat Technology Technology Development

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2432 Warning & Avoidance Receiver Systems Technology	6,200	6,900	8,700	9,000	Continuing	TBD
2754 C3 Countermeasures Technology	2,800	2,860	3,000	4,000	Continuing	TBD
2222 Electro-Optical Countermeasures	6,900	5,000	4,142	6,459	Continuing	TBD
691X Electronic Warfare Technology	11,500	11,510	12,000	12,000	Continuing	TBD
431G Infrared Countermeasures	8,300	9,200	10,500	11,500	Continuing	TBD
Total	*35,700	35,470	38,342	42,959	Continuing	

* FY 1988 funding for this program was contained in PE 060421F.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides advanced development in the area of electronic warfare where an expanded technology base is needed to solve critical penetration aid problems for all classes of radio frequency, infrared, electro-optical, and laser threats. The program includes advanced electronic warfare (EW) transmitters, receivers, advanced power management, and command, control and communication countermeasures. This program also provides for component, technique, and subsystems development leading to the reduction of acquisition and life cycle cost of electronic warfare equipment and systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 2432, Warning and Avoidance Receiver Systems Technology: Develops integrated systems technologies to cope with projected integrated multi-spectral threat environments for strategic and tactical aircraft.

00191

Program Element: #0603270F Budget Activity: 2 Advanced
PE Title: Electronic Combat Technology Technology Development

(U) FY 1988 Accomplishments:
- (U) Started Very High Speed Integrated Circuits (VHSIC)-based core processor hot-bench for integration with available recievers, processors, and advanced ECM techniques generator.
- (U) Started,
- (U) Started ADA language for EW applications analysis.

(U) FY 1989 Planned Program:
- (U) Continue VHSIC-based core processor hot-bench for integration with available recievers and processors along with advanced ECM techniques generator.
- (U) Complete ADA language for EW applications analysis.
- (U) Continue

(U) FY1990 Planned Program:
- (U) Continue VHSIC-based core processor integration.
- (U) Start an
- (U) Start an analysis of angle of arrival power management concepts.
- (U) Start

(U) FY1991 Planned Program:
- (U) Continue advanced
- (U) Continue VHSIC-based EW applications.
- (U) Start a
- (U) Continue
system concept.

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

(U) Work Performed By: Program Management is provided through the Air Force Avionics Laboratory, Wright-Patterson AFB OH. Major Contracts are with: Westinghouse, Baltimore MD; TRW, San Diego Ca; Raytheon, Goleta, CA; and Northrop, Rolling Meadows IL.

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics
- (U) Program Element 0604220F, EW Counter Response
- (U) Program Element 0604701F, Reconnaissance Equipment
(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

Program Element: #0603270F Budget Activity: 2 Advanced Technology Development
PE Title: Electronic Combat Technology

Director of Laboratories/Technical Panel for Electronic Warfare and is 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

(U) Project 2754, C3 Countermeasures Technology: Consolidates Command, Control and Communication Countermeasures (C3CM) efforts to develop and demonstrate counters to enemy C3 system. Develops airborne jamming and deception techniques, drone-borne and expendable C3CM technology and analysis simulation and evaluation support.

(U) FY 1988 Accomplishments:
- (U) Initiated

- (U) Completed helliborne test of the mini-drone jammer during Green Flag exercise.

(U) FY 1989 Planned Program:
- (U) Started C3CM sensor signal fusion project.
- (U) Continue strategic link jammer.
- (U) Continue

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

- (U) Complete efforts whic

- (U) Initiate brass board development of a

(U) FY 1991 Planned Program:
- (U) Complete strategic link jammer test.
- (U) Complete sensor, signal fusion project.
- (U) Complete low frequency C3CM system flight test.
- (U) Initiate program.

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

(U) Work Performed By: Program Management is provided through the Air Force Avionics Laboratory, Wright-Patterson AFB OH. Major Contracts are with: Magnovax, Ft Wayne,IN; and Harris, Melborne FL.

00193

Program Element: #0603270F Budget Activity: 2 Advanced Technology Development
PE Title: Electronic Combat Technology

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics
- (U) Program Element 0604220F, EW Counter Response
- (U) Program Element 0604701F, Reconnaissance Equipment
  (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 and is 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.

(U) Project 2222, Electro-Optical Countermeasures (EOCM): Develops technology for detecting and countering optical and television (TV) directed threats against aircraft.

(U) FY 1988 Accomplishments:
- (U) Continue development of a

(U) FY 1989 Planned Program:
- ( ) Start an
- (U) Start Coronet Prince flight test.
- (U) Continue

(U) FY 1990 Planned Program:
- (U) Start EO/RF coordinated test.
- (U) Complete Coronet Prince prototype flight test.
- (U) Continue

(U) FY 1991 Planned Program:
- (U) Complete Coronet Prince prototype test program.
- (U) Continue

Program Element: #0603270F Budget Activity: 2 Advanced Technology Development
PE Title: Electronic Combat Technology

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

(U) Work Performed By: The Air Force Avionics Laboratory, Wright-Patterson AFB OH, manages the program. Testing is performed primarily at the Air Force Armament Division, Eglin AFB FL, and the Tonopah Test range at Nellis AFB NV. The major contractors are: Westinghouse, Baltimore MD, General Electric Corp. Binghampton NY.

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics
- (U) Program Element 0604220F, EW Counter Response
- (U) Program Element 0604701F, Reconnaissance Equipment
  (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 and is 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:

FY 1988/1989 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603270F
PE Title: Electronic Combat Technology

Project Number: 691X
Budget Activity: 2 Advanced Technology Development

A. (U) RESOURCES ($ In Thousands)

Project Title Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Electronic Warfare Technology	11,500	11,510	12,000	12,000	Continuing	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) electronic collection systems to inform the field commander of changes in the electronic environment; (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 stand-off jammer technology that will lead to greatly reduced on-board countermeasures 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:

(U) FY 1988 Program
- ( ) Completed tri-service

- (U) Completed
- (U) Completed
- (U) Continue radar signature reduction.
- (U) Continue

CLASSIFIED BY: Multiple Sources
DECLASSIFIED ON: OADR

00196

Program Element: #0603270F
PE Title: Electronic Combat Technology

Project Number: 691X
Budget Activity: 2 Advanced Technology Development

(U) FY 1989 Planned Program
- (U) Continue
- (U) Continue updated
- (U) Continue Military Airlift Command (MAC)
- (U) Continue
- (U) Start MAC EW Suite development.
- (U) Continue development.

(U) FY 1990 Planned Program
- (U) Continue MAC EW Suite development.
- (U) Continue RF expendable program.
- (U) Flight test
- (U) Continue Program.
- (U) Continue

(U) FY 1991 Planned Program:
- (U) Complete advanced threat warning antenna development and test.
- (U) Start limited field testing of MAC EW suite.
- (U) Start flight test of the
- (U) Start development program.

(U) Program to Completion: This is an ongoing program.

D. (U) WORK PERFORMED BY: The Air Force Avionics Laboratory, 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 AMENDED FY 88/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: None
3. COST CHANGES: None

00197

Program Element: #0603270F
PE Title: Electronic Combat Technology

Project Number: 691X
Budget Activity: 2 Advanced Technology Development

F. (U) PROGRAM DOCUMENTATION:
- (U) TAC SORS(s): 315-73; 304-80; and 301-78
- (U) SAC SORS(s): 23-69; 13-73; 6-81
- (U) MAC SORS(s): 7-81; 8-81; and 9-81

G. (U) RELATED ACTIVITIES:
- (U) Program Element 0602204F, Aerospace Avionics
- (U) Program Element 0604220F, EW Counter Response
- (U) Program Element 0604701F, Reconnaissance Equipment
- (U) Program Element 0604270F, EW Development
- (U) Program Element 0603270A, Electronic Combat Technology
- (U) Program Element 0603270N, Electronic Combat Technology
- (U) Program Element 060203F, 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 and is 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.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

	Dates
- (U) Flight Test MAC EW Suite	FY 1990
- (U) Complete Advanced Threat Warning Antenna development test	FY 1991
- (U) Conduct MAC EW suite feasibility and interoperability demonstration	FY 1992

FY 1988/1989 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603270F
PE Title: Electronic Combat Technology

Project Number: 431G
Budget Activity: 2 Advanced Technology Development

A. (U) RESOURCES ($ In Thousands)

Project Title Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
431G Infrared Countermeasures	8,300	9,200	10,500	11,500	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project demonstrates advanced development countermeasures against enemy air defense guidance systems which operate in the infrared (IR) spectrum. Examples of such systems are

In the past, air defense systems operated only in the communications and radar frequencies
However,
Efforts in this project include a supporting simulation and analysis effort to guide the appropriation of funds through the evaluation of new concepts and techniques designed to prevent or delay detection of U.S. Air Force

to warn crew members

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Completed flight demonstration of
- (U) Completed effort.
- (U) Continued sensor.
- (U) Started

(U) FY 1989 Planned Program:
- (U) Continue advanced aerodynamic flare development.
- (U) Continue Silent Attack Warning System (SAWS) demonstration and ground test program.
- (U) Start development of
- (U) Start a

Program Element: #0603270F
PE Title: Electronic Combat Technology

Budget Activity: 2 Advanced Technology Development

(U) FY 1990 Planned Program:
- (U) Continue the HAVE GLANCE Program.
- (U) Continue SANS demo and ground test program.
- (U) Continue field test of the

(U) FY 1991 Planned Program:
- (U) Complete SANS flight test.
- (U) Complete
- (U) Continue.

- (U) Start
- (U) Continue HAVE GLANCE

(U) Program to Completion: This is an ongoing program.

D. (U) WORK PERFORMED BY: The Air Force Avionics Laboratory, 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 OD test facilities are sometimes used. The major contractors are: Westinghouse, Baltimore, MD; Raytheon, Goleta, CA; and Northrop, Rolling Meadows,IL. These are approximately four other contractors.

E. (U) COMPARISON WITH AMENDED FY 88/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: None
3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) TAC SOER(s): 312-75; 304-80; and 312-80
- (U) SAC SOER(s): 86-020
- (U) MAC SOER(s): 7-81; 8-81; and 9-81.

G. (U) RELATED ACTIVITIES:
- (U) Program Element 0602204F, Aerospace Avionics
- (U) Program Element 0604220F, EW Counter Response
- (U) Program Element 0604701F, Reconnaissance Equipment
- (U) Program Element 060270FF, EW Development

Program Element: #0603270F
PE Title: Electronic Combat Technology

Budget Activity: 2 Advanced Technology Development

- (U) Program Element 0603270A, Electronic Combat Technology
- (U) Program Element 0603270N, Electronic Combat Technology
- (U) Program Element 060203F, 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 and is 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 for the Department of Defense.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

	Dates
- (U) Advanced IR Countermeasures Design Review	September 1989
- (U) Silent Attack Warning System Field Test	November 1989
- (U)	November 1989
- (U) HAVE GLANCE Flight Test	Mid 1990s

1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603302F Budget Activity: #2 - Advanced Tech Dev
PE Title: Space and Missile Rocket Propulsion Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
6339 Air-Launched Missile Propulsion Technology	700	2,100	2,426	2,394	Continuing	TBD
6340 Space Systems Propulsion Technology	3,359	4,495	6,996	8,023	Continuing	TBD
6341 Ballistic Missile Propulsion Technology	2,124	2,400	2,172	1,868	Continuing	TBD
TOTAL	6,183	8,995	11,594	12,285	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This science and technology program provides advanced rocket propulsion technology for tactical weapons, strategic weapons, and space systems to increase mission capabilities and improve reliability and maintainability. This program provides the full-size demonstration of new technologies whose initial feasibility was demonstrated in Rocket Propulsion, PE 0602302F, at the bench-scale level. These full-size demonstrations combine individual high risk component technologies into integrated motors, engines, and subsystems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 6339 - Air-Launched Missile Propulsion Technology: The rocket propulsion technology in this project provides increased mission flexibility to engage a variety of targets, increased terminal velocity and maneuvering for increased probability of kill, and lower plume signature to increase launch aircraft survivability. The only ongoing program, high performance/low observable (HPLO) motor, features a unique pulse-motor with three discrete pulses. The pulses allow a missile to turn sharply after launch or engage distant targets without compromising performance against closer-range targets. Motors using the low signature propellant are difficult to detect because of the short burning time of each pulse and lower visible and radar signatures from the plume. A new thrust-vector control system will provide improved maneuvering capability, increasing the probability of kill. Use of the HPLO motor in the Advanced Medium Range Air-to-Air Missile, for example, would provide a 60 percent reduction in detectability, would double velocity at intercept, and would enable internal carriage on advanced fighters due to reduced fin size. Contract completion has been delayed one year by Congressional action--an FY 1988 cut and an FY 1989 withhold of 50 percent pending a coordinated air-to-air technology roadmap with the Navy.

(U) FY 1988 Accomplishments:
- (U) Began fabrication of HPLO motor components to prepare for performance verification.

Program Element: 0603302F Budget Activity: #2 - Advanced Tech Dev
PE Title: Space and Missile Rocket Propulsion Technology

(U) FY 1989 Planned Program:
- (U) Conduct component tests to confirm the preliminary HPLO motor design for ground tests of a complete motor.
- (U) Begin fabrication of motors for tests to evaluate the preliminary motor design in a complete motor.

(U) FY 1990 Planned Program:
- (U) Operate motors built in FY 1989 on ground test stands. Use test data to update preliminary design.

(U) FY 1991 Planned Program:
- (U) Update pulse motor design with data from first motor firings and conduct final ground test firings of the HPLO motor.
- (U) Select final HPLO motor design and begin fabrication of motors to be available for flight testing the Hypervelocity Motor program, Advanced Missile Technology Integration project.

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

(U) Work Performed By: Hercules Inc., Rocket Center WV.

(U) Related Activities:
- (U) PE 0603363F Hypervelocity Missile.
- (U) PE 0207163F AMRAAM Pre-Planned Program Improvement.
- (U) Coordination accomplished through the Air Force-Navy-Air-to-Air Missile Oversight Committee and the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee at the working level. There is no duplication within the Air Force, NASA, or Department of Defense.

(U) Other Appropriate Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 6340 - Space Systems Propulsion Technology: We demonstrate advanced concepts for propulsion from low-earth orbit to higher orbits (e.g. geosynchronous) and evasive maneuvering. Two ongoing developments can provide high-performance satellite propulsion. First, the Flightweight XLR-132 engine is a modular, storable propellant, space-propulsion system that can be used for evasive maneuvering for survivability. The XLR-132 could provide a 140 percent increase in payload capability over that provided by the Inertial Upper Stage. The modular design allows the ability to cluster any number of engines. The second development demonstration is a compact, cryogenic-propellant feed system for use on an upper stage that would allow available payload volume to increase 60 percent. A future advanced space propulsion effort is a possible flight test of an electric propulsion (arcjet) thruster, providing performance increases of 65 to 120 percent over chemical propulsion.

Program Element: 0603302F Budget Activity: #2 - Advanced Tech Dev
PE Title: Space and Missile Rocket Propulsion Technology

(U) FY 1988 Accomplishments:
- (U) Completed component evaluation for the Flightweight XLR-132 engine, selected the baseline engine design, and began engine fabrication.
- (U) Completed the design of the flightweight tank and oxidizer feed system, for the Compact Cryogenic-Propellant Feed System. Congressional funding cuts delayed component fabrication.
- (U) Stopped work on the low-thrust, cryogenic-propellant engine due to Congressional reductions.

(U) FY 1989 Planned Program:
- (U) Test the thrust chamber, injectors, and turbopump in preparation for complete engine tests of the Flightweight XLR-132 engine.
- (U) Conduct component development tests and begin fabrication of the Compact Cryogenic Feed System.
- (U) Begin work on an advanced electric propulsion (arcjet) engine.

(U) FY 1990 Planned Program:
- (U) Combine components of Flightweight XLR-132 engine for a complete engine demonstration under simulated orbital conditions.
- (U) Complete fabrication of the doughnut-shaped tank and feed system for the Compact Cryogenic Feed System.
- (U) Complete preliminary design of the arcjet engine components and begin fabrication and testing.

(U) FY 1991 Planned Program:
- (U) Document the Flightweight XLR-132 engine design for transition to a satellite propulsion system.
- (U) Complete testing of assembled full size components for the compact cryogenic-propellant feed system.
- (U) Complete the arcjet engine component development and prepare preliminary engine system designs for ground tests.
- (U) Initiate effort to demonstrate solar collector for orbit transfer propulsion.

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

(U) Work Performed By: Rockwell International, Rocketdyne Division, Canoga Park CA; Aerojet Tech Systems Co, Sacramento CA; Ball Aerospace Systems Division, Boulder CO.

(U) Related Activities:
- (U) PE 0305171F Shuttle Operations (Upper Stages).
- (U) Coordination accomplished through the Joint Army-Navy-NASA-AF Interagency Propulsion Committee and the AF/NASA

Program Element: 0603302F Budget Activity: #2 - Advanced Tech Dev
PE Title: Space and Missile Rocket Propulsion Technology

Space Technology Interdependency Group at the working level. There is no duplication within the AF, Department of Defense or NASA.

- (U) Other Appropriations Funds: Not Applicable.

- (U) International Cooperative Agreements: Not Applicable.

3. (U) Project 6341 - Ballistic Missile Propulsion Technology: The ongoing program, Advanced Integrated Stage Concept, is a revolutionary motor configuration nesting the forward dome of the first stage motor case into the nozzle of the second stage motor. The integrated stage configuration eliminates the interstage needed for the nozzle exit cone. This increases missile throw weight by 20 percent or shortens the missile. We received Congressional direction for FY 1988, reserving $3.3 million for the Integrated Stage Concept. However, $2.2 million was the maximum that could be spent in FY 1988 due to late release of funds.

(U) FY 1988 Accomplishments:
- (U) Completed design of intermediate size motors to test components in preparation for final verification tests.
- (U) Began component fabrication.

(U) FY 1989 Planned Program:
- (U) Complete component fabrication and start development tests.
- (U) Prepare final design based on results of component tests.

(U) FY 1990 Planned Program:
- (U) Complete ground test firings of intermediate size motors to verify performance.

(U) FY 1991 Planned Program:
- (U) Document results of ground test firings for possible system use.
- (U) Begin a demonstration of fast burn booster technology to improve future missile survivability.

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

(U) Work Performed By: Aerojet Solid Propulsion Co, Sacramento CA.

(U) Related Activities:
- (U) PE 0603311F Advanced Strategic Missile Systems.
- (U) Coordination accomplished through the Joint Army-Navy-NASA-AF Interagency Propulsion Committee at the working level. There is no duplication within AF, NASA, or Department of Defense.

(U) Other Appropriations Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

00205

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603363F Budget Activity: #2 - Advanced Tech Development
PE Title: Hypervelocity Missile/Armament Technology Integration

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2718 Air-to-Surface Armament Technology Integration	6,605	5,577	9,203	7,044	Continuing	TBD
3254 Air-to-Air Missile Technology Integration	*0	*0	103	145	Continuing	TBD
TOTAL	6,605	5,577	9,306	7,189	Continuing	TBD

*Air-to-Air Missile Technology Integration is a new start in FY 1990.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the Air Force's primary advanced technology development program for integration of air-to-surface and air-to-air conventional weapons technologies. Advanced technologies are fully integrated into a testbed and thoroughly tested (ground, captive, and free flight) under realistic mission conditions to evaluate their suitability for further development and subsequent design modifications. The program consists of the Air-to-Surface Armament Technology Integration project (formerly titled Hypervelocity Missile Technology Demonstration) and the Air-to-Air Missile Technology Integration project. This program serves as the basis 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2718, Air-to-Surface Armament Technology Integration: This project integrates and demonstrates advanced air-to-surface armament technologies for potential incorporation into advanced weapon systems and pre-planned product improvements (P^3I) of current systems. The Hypervelocity Missile (HVM) Technology Demonstration effort incorporates a small, low cost missile with a hit-to-kill capability to defeat mobile armored targets. Missile guidance is provided by sensors on the host aircraft. The payoff from this effort includes multiple kills per pass and low unit cost per missile. Other efforts within this project integrate advanced subsystems to demonstrate technical performance and potential operational value. These subsystems include; Tactical LADAR Seeker (TLS), Autonomous Synthetic Aperature Radar Guidance (ASARG), Hard Target Ordnance Technology (HTOT), Insensitive High Explosives (IHE), Smart Submunition, etc. The payoff from this effort is enhanced air-to-surface weapons lethality against advanced targets.

Program Element: 0603363F Budget Activity: 2 - Advanced Tech Development
PE Title: Hypervelocity Missile/Armament Technology Integration

(U) FY 1988 Accomplishments:
- (U) Initiated ground launches of HVM missiles.
- (U) Completed HVM weaponization study.

(U) FY 1989 Planned Program:
- (U) Complete ground launches of HVM missiles.
- (U) Initiate risk reduction efforts for the HVM follow-on program.

(U) FY 1990 Planned Program:
- (U) Complete risk reduction for the HVM follow-on program.
- (U) Initiate resizing of HVM for air launched live firings.
- (U) Initiate planning for the integration and demonstration of emerging air-to-surface weapons technologies.

(U) FY 1991 Planned Program:
- (U) Complete resizing of HVM for air launched live firings.
- (U) Design the interface between the HVM targeting system and launch pod, and the host aircraft.
- (U) Continue planning and select advanced air-to-surface technologies for subsystem integration and demonstration.

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

(U) Work Performed By: The HVM effort is managed by the Armament Division, Eglin AFB FL. The primary contractor is LTV, Vought Corporation, Dallas TX. The remainder of the project is managed by the Air Force Armament Laboratory, Eglin AFB, FL. Test facilities at the Armament 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 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: Not Applicable.

2. (U) Project 3254, Air-to-Air Missile Technology Integration: This project integrates and demonstrates advanced air-to-air missile technologies to establish their performance and potential operational value for incorporation into advanced missile systems and pre-planned product improvements (P^3I) of current systems. The payoff from this project includes; improved performance, enhanced

Program Element: 0603363F Budget Activity: 2 - Advanced Tech Development
PE Title: Hypervelocity Missile/Armament Technology Integration

operational flexibility, and increased reliability and affordability.

(U) FY 1988 Accomplishments: Not Applicable.
(U) FY 1989 Program: Not Applicable.

(U) FY 1990 Planned Program:
- (U) Study design options for an advanced testbed using Advanced Medium Range Air-to-Air Missile (AMRAAM) technology.
- (U) Initiate design a soft recovery capability for an AMRAAM class advanced air-to-air missile testbed.

(U) FY 1991 Planned Program:
- (U) Initiate design of an advanced testbed using Advanced Medium Range Air-to-Air Missile (AMRAAM) technology.
- (U) Complete design of a soft recovery capability for an AMRAAM class advanced air-to-air missile testbed.
- (U) Initiate integration of a Very High Speed Integrated Circuit (VHSIC) technology seeker processor, advanced guidance laws, and an improved thermal battery into an advanced missile testbed.

(U) Program To Completion: This a continuing program.

(U) Work Performed By: This project is managed by the Air Force Armament Laboratory, Eglin AFB, FL. Test facilities at the Armament Division, Eglin AFB, FL, and at White Sands Missile Range, NM support this program.

(U) Related Activities:
- (U) PE 0602602F, Conventional Munitions
- (U) PE 0603601F, Conventional Weapons
- (U) The USA/USN/USAF Memorandum of Understanding (MOU) 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: Not Applicable.

FY 1990/1991 BIENNIAL BUDGET 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2181 Advanced Space Computer Technology	2,059	4,800	5,355	6,848	Continuing	TBD
2198 Advanced Space Technology Assessments	98	195	200	250	Continuing	TBD
3784 Advanced Space Communications Technology	0	1,000	1,493	1,932	Continuing	TBD
3834 Advanced Spacecraft Technology Integration	0	0	250	300	Continuing	TBD
682J Advanced Space Power Technology	1,815	2,000	2,700	3,400	Continuing	TBD
TOTAL	3,972	7,995	9,998	12,730	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Science and Technology program develops new and improved satellite systems and subsystems. Efforts are focused on three high-leverage technologies: radiation hardened microelectronics, space power, and survivable space communications. Supporting bench top and on-orbit demonstrations will accelerate the transition of promising technologies from the laboratory to operational use and reduce the cost and risk of full scale development. Continuing technology assessments evaluate space technology programs DOD wide, focus our investment, and optimize our return. Together, these efforts support our need for assured, low-cost access to space.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2181, Advanced Spacecraft Computers: Microchips for military space applications must tolerate long exposure to cosmic radiation and operate through nuclear attack. Currently available Very High Speed Integrated Circuit (VHSIC) technology cannot meet the combined speed and survivability requirements of Air Force space systems. This project demonstrates that radiation hard VHSIC technology can be produced, meets our requirements, and can enter full scale production at acceptable cost. Our main thrust is a 16-bit Generic VHSIC Spaceborne Computer (GVSC) that is 10-30 times faster and 100 times more radiation hard than current space-worthy computer technology. The GVSC will transition to Program Elements #0303603F, #0305119F, #0305165F, and #0603220C in FY 91-93.

(U) FY 1988 Accomplishments:
- (U) Produced fully functional radiation hardened GVSC processor and 64K memory chips in first fabrication pass.
- (U) Completed GVSC breadboard and space qualification plan.

(U) FY 1989 Planned Program:
- (U) Complete fabrication of GVSC chipsets and 64K memories.

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

- (U) Deliver, test and evaluate GVSC breadboard, and demonstrate compliance with user specifications.
- (U) Complete advanced GVSC submicron architecture and validate space qualification plan.

(U) FY 1990 Planned Program:
- (U) Design control processor that integrates GVSC chipsets, memories, and input/output devices into a single functional unit to manage satellite sensor and communications data.
- (U) Develop techniques to "pack" chipsets and memory cards and reduce control processor weight by 1/2.
- (U) Develop a radiation hardened analog-to-digital converter to process raw sensor data into a digital GVSC format.
- (U) Develop a 256K reprogramable memory that will allow "adaptive" satellites to rewrite their "hard" memories, and change their missions or housekeeping routines.
- (U) Begin advanced submicron GVSC subsystem development for next generation small standard space computer.

(U) FY 1991 Planned Program:
- (U) Fabricate GVSC-based control processor.
- (U) Deliver and test multi-chip packing for control processor.
- (U) "Pack" processor into increasingly denser forms for eventual fabrication on a single wafer, reducing system weight an additional 2-4 times.
- (U) Assemble and space qualify control processor.
- (U) Continue analog-to-digital converter and 256K reprogramable memory development.
- (U) Fabricate submicron technology to double GVSC speed at half the power, and 1/4th the weight.

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

(U) Work Performed By: Air Force Space Technology Center, Kirtland AFB NM; IBM, Manassas VA; Honeywell Inc, Clearwater FL.

(U) Related Activities:
- (U) DARPA Strategic Computing Initiative (VHSIC Program).
- (U) Program Element #0602601F, Advanced Weapons.
- (U) Program Element #0603728F, Advanced Computer Technology.
- (U) Program Element #0303603F, MILSTAR Sat Comm Sys.
- (U) Program Element #0305119F, Space Boosters (TITAN IV).
- (U) Program Element #0305165F, NAVSTAR Global Pos Sys.
- (U) Program Element #0603220C, Boost Surveillance & Track Sys.
- (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: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

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 1988 Accomplishments:
- (U) Completed radiation-hardened microelectronics assessment.

(U) FY 1989 Planned Program:
- (U) Complete satellite 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) Program to Completion: This is a continuing program.

(U) Work Performed By: Air Force Space Technology Center, Kirtland AFB NM; Advanced Sciences Incorporated, Albuquerque NM.

(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: Not Applicable.

3. (U) Project 3784, Advanced Space Communications Technology: Over the next 10 years, demand for satellite communications is forecast to grow exponentially, making this one of our most pressing space R&D priorities. This project develops light weight, low power communications subcomponents to reduce the size and cost of future satellites. Emphasis is on solid state extremely high frequency (EHF) technology for the Defense Satellite Communications System (DSCS) or other MILSTAR-like follow-on programs. This project also supports requirements for integrated satellite control so satellites can monitor and adjust their position automatically.

(U) FY 1988 Accomplishments:
- (U) Completed and delivered low frequency solid state

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

amplifiers for possible DSCS retrofit or follow-on programs. Delivered test equipment to establish diode reliability for laser crosslinks.
- (U) Continued EHF crosslink transmitter diode effort.

(U) FY 1989 Planned Program:
- (U) Begin design of solid state EHF uplink, crosslink, and downlink satellite receiver/transmitter subcomponents.
- (U) Complete EHF crosslink transmitter diodes, transition to solid state EHF crosslink transmitter power amplifier.

(U) FY 1990 Planned Program:
- (U) Begin EHF device fabrication for higher capacity protected service, resistance to jamming and nuclear effects.
- (U) Begin EHF crosslink power amplifier fabrication to reduce reliance on heavy, unreliable tube transmitter technology.

(U) FY 1991 Planned Program:
- (U) Complete fabrication and testing of EHF devices. Demonstrate 2-3 times better signal reception and 3-5 times more efficient transmission to reduce satellite and ground terminal power usage, size, and cost.
- (U) Complete EHF solid state power amplifier design, begin fabrication and testing.

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

(U) Work Performed By: Air Force Space Technology Center, Kirtland AFB NM; Rome Air Development Center, Griffiss AFB NY; Air Force Wright Aeronautical Laboratories, Wright- Patterson AFB OH; Defense Research Establishment, Ottawa, Canada.

(U) Related Activities:
- (U) Program Element #0602702F, Command/Control/Communications.
- (U) Program Element #0603790D, NATO Research and Development.
- (U) Canadian Defense Program D6470, EHF SATCOM R&D.
- (U) Program Element #0603250F, Lincoln Laboratory
- (U) Program Element #0603789F, Tactical C3 Adv Development.
- (U) Program Element #0303110F, DSCS.
- (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: Annex D-88-CA-001 Master Data Exchange Agreement Between the DOD (USA) and DND (CAN)—DSCS Follow-on; Memorandum of Record, Air Force Space Technology Center, Albuquerque NM and National Defense Research Center, Ottawa, CAN.

Program Element: #0603401F Budget Activity: #2 - Adv Technology Development
PE Title: Advanced Spacecraft Technology

4. (U) Project 3834, Advanced Spacecraft Technology Integration (ASTI): For years, the Advanced Fighter Technology Integration program has benefitted aircraft development. It demonstrates the maturity of leading edge technologies and reduces risk. ASTI can do the same for spacecraft. While the Space Test Program can fly some individual experiments on host platforms, many technical achievements can't fly as "guests." For example, a new standardized digital data bus couldn't be demonstrated as an add-on under the Space Test Program, since the host would have its own data bus. But ASTI could prove the new data bus's readiness by flying as part of a low cost satellite that also shows the maturity of other technologies such as active structural damping or integrated thermal management. ASTI could also provide in-space demonstrations for technologies developed as the result of the DARPA-Air Force Memorandum of Agreement on the Advanced Space Technology Program (ASTP) and could use the ASTP's Standard Small Launch Vehicle (Pegasus class) as a booster to keep costs low.

(U) FY 1988 Accomplishments: Not Applicable.

(U) FY 1989 Planned Program: Not Applicable.

(U) FY 1990 Planned Program:
- (U) Select lead-off experiments and technologies.
- (U) Perform trade-offs between laboratory demonstrations and establish schedules.

(U) FY 1991 Planned Program:
- (U) Begin detailed design and component development and evaluation for first ASTI flight.

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

(U) Work Performed By: Air Force Astronautics Laboratory, Edwards AFB CA.

(U) Related Activities:
- (U) Program Element #0603245F, Advanced Fighter Technology Integration and DARPA--X-29 Adv Technology Demonstrator
- (U) Program Element #0603402F, Space Test 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: Not Applicable.

5. (U) Project 682J, Advanced Space Power Technology: This project develops advanced non-nuclear satellite power storage and processing systems. Current efforts are focused on a Survivable Concentrating Photovoltaic Array (SCOPA) that can survive three

times the laser threat and eight times the nuclear threat current planar solar cell arrays can endure. In addition, since concentrator arrays require about 1/100 the number of solar cells, we expect approximately a 100-fold reduction in cell cost, a 30-60 percent reduction in deployed array area, and a corresponding improvement in our ability to avoid satellite detection. SCOPA is ranked 11th of 55 on the Tri-Service Space Test Program priorities list. This project also produces and life tests the next generation Nickel-Hydrogen (NiH_2) batteries that offer 50-65 percent weight reduction over current technology and long operational life (7-10 years). They will transition to Program Elements #0303603F, #0305160F, and #0305165F beginning FY 92.

(U) FY 1988 Accomplishments:
- (U) Continued life testing 130 50-amp-hour and 21 100-amp-hour NiH_2 batteries.
- (U) Completed SCOPA element fabrication.
- (U) Started laser and X-ray testing of SCOPA modules.

(U) FY 1989 Planned Program:
- (U) Complete SCOPA test module integration.

(U) FY 1990 Planned Program:
- (U) Complete NiH_2 life test three-year data.
- (U) Start SCOPA space flight acceptance testing.

(U) FY 1991 Planned Program:
- (U) Begin SCOPA payload integration on test satellite.
- (U) Continue NiH_2 life test (five year program).
- (U) Begin advanced battery effort to reduce power storage and processing subsystem weight by 30 to 40 percent.

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

(U) Worked Performed By: Air Force Astronautics Laboratory, Edwards AFB CA; Air Force Aeropropulsion Laboratory, Wright-Patterson AFB OH; Naval Weapons Support Center, Crane IN; TRW, El Segundo CA; Boeing, Seattle WA.

(U) Related Activities:
- (U) Program Element #0602203F, Aerospace Propulsion.
- (U) Program Element #0603402F, Space Test Program.
- (U) Program Element #0303603F, MILSTAR Sat Comm Sys.
- (U) Program Element #0305160F, Def Meteorological Sat Program.
- (U) Program Element #0305165F, NAVSTAR Global Pos Sys.
- (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 1990/1991 BIENNIAL BUDGET 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2821 Space Systems Design and Test Standards	373	710	690	600	Continuing	TBD
2822 Interactions Measurement Payloads	2,550	2,720	2,590	2,968	Continuing	TBD
2823 Charge Control System	430	500	685	580	Continuing	TBD
Total	3,353	3,930	3,965	4,148	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This advanced technology development program investigates those space environmental interactions which degrade spacecraft operations. This program's goal is to specify the environment and reduce the effects of these interactions. Energetic particles routinely cause loss of valuable data from the Defense Meteorological Satellite Program primary mission sensor. Electrostatic discharges induce phantom commands in systems of our geosynchronous satellites. The Space Shuttle glows in orbit, showing how infrared sensors are affected. Impact from orbital debris is becoming more likely as our presence in space increases. Operations continue without adequate understanding of these effects and how to alleviate them. Trends show that these problems will worsen with the larger and more complex Air Force space systems of the future. For example, the constraints of high-voltage operations on new space power technologies are currently unknown. Experiments will result in standards, guidelines, and trade-off alternatives for system design, operation, and maintenance. Experimental sensors to warn about debris and environmental disturbances will be tested in space.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2821, Space Systems Design and Test Standards: Results of experiments conducted under Project 2822, Interactions Measurement Payloads, will be provided to Space Division as handbooks, standards, and computer-aided engineering (CAE) tools, where appropriate. For example, a recently developed computer graphics package shows the design engineer where electrical charges build up on spacecraft. Contamination effects will be characterized for computer-aided spacecraft identification and mission assessment tools.

(U) FY 1988 Accomplishments:
- (U) Transitioned spacecraft charging CAE tools to Space Division Acquisition and Logistics Directorate (SD/AL).
- (U) Delivered Spacecraft Anomalies Military Handbook to SD/AL.

Program Element: #0603410F Budget Activity: #2 - Advanced Technology Development
Title: Space Systems Environmental Interactions Technology

(U) FY 1989 Planned Program:
- (U) Validate computer model of spacecraft charging in low-earth polar regions.
- (U) Begin Spacecraft Charging Military Standard and Handbook.

(U) FY 1990 Planned Program:
- (U) Deliver Space Environment Military Standard and Handbook to SD/AL.
- (U) Begin contamination characterization for computer-aided spacecraft identification and mission assessment tools.

(U) FY 1991 Planned Program:
- (U) Complete contamination characterization for computer-aided spacecraft identification and mission assessment tools.
- (U) Transition Spacecraft Charging Military Standard and Handbook to SD/AL.
- (U) Begin Orbital Contamination Military Standard and Handbook.

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

(U) Work Performed By: This project is managed by the Air Force Geophysics Laboratory, Hanscom AFB MA. Work is being performed by S-Cubed, Inc., La Jolla CA, and Rockwell Space and Electronics Division, Seal Beach CA.

(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 major focus is to determine environmental constraints of high-voltage operations on new space power technologies. In-space experiments will gather data and diagnose the environmental conditions under which interactions occur. Preliminary studies will be conducted on the interaction of astronaut life-support/maneuvering equipment with the polar environment. Experiment results 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 1988 Accomplishments:
- (U) Completed development of Spacecraft Contamination Visual Imager.
- (U) Conducted critical design review for Shuttle Potential and Return Electron Experiment (SPREE).

(U) FY 1989 Planned Program:
- (U) Complete fabrication and testing of Photovoltaic Array Space Power Plus Diagnostics (PASP Plus) experiment.
- (U) Begin design of Compact Environmental Anomalies Sensor Experiment (CEASE).
- (U) Begin integration of Spacecraft Contamination Visual Imager for spaceflight.

(U) FY 1990 Planned Program:
- (U) Complete extravehicular activity (EVA)/robotics equipment evaluation plan and begin ground-based chamber testing.
- (U) Complete development of SPREE and begin flight integration.

(U) FY 1991 Planned Program:
- (U) Complete PASP Plus flight hardware fabrication.
- (U) Complete ground-based chamber testing for EVA/robotics equipment and begin in-space experiment development.
- (U) Launch SPREE instrument.
- (U) Begin development of orbital debris experiment.

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

(U) Work Performed By: This project is managed by the Air Force Geophysics Laboratory, Hanscom AFB MA. Work is being performed by the Jet Propulsion Laboratory, Pasadena CA, and SRI International, Menlo Park CA.

(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.

Program Element: #0603410F Budget Activity: #2 - Advanced Technology Development
Title: Space Systems Environmental Interactions Technology

(U) International Cooperative Agreements: None.

3. (U) Project 2823, Charge Control System (CCS): The purpose is to develop an CCS technology demonstration for geosynchronous applications that automatically controls surface charge buildup on spacecraft. Follow-on efforts will be development of technology demonstrations for low- and mid-earth orbit satellites.

(U) FY 1988 Accomplishments:
- (U) Completed fabrication of CCS flight hardware.
- (U) Completed accommodation study for flight of CCS on the Geostationary Operational Environmental Satellite (GOES).

(U) FY 1989 Planned Program:
- (U) Complete environmental testing of CCS.
- (U) Begin integration of CCS experiment on host vehicle.

(U) FY 1990 Planned Program:
- (U) Complete integration modifications and deliver CCS for flight.
- (U) Define spaceflight operational and data analysis procedures.

(U) FY 1991 Planned Program:
- (U) Provide integration support to the Space Test Program office.
- (U) Launch CCS as experiment aboard GOES.
- (U) Begin data collection/analysis.

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

(U) Work Performed By: This project is managed by the Air Force Geophysics Laboratory, Hanscom AFB MA. Work is performed by Hughes Research Laboratories, Malibu CA.

(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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603601F Budget Activity: #2 - Advanced Tech Development
PE Title: Conventional Weapons Technology

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
670A Ordnance Technology	10,737	16,334	12,533	14,174	Continuing	TBD
670B Air-to-Surface Guidance Technology	4,717	8,335	12,538	14,160	Continuing	TBD
670E Air-to-Air Guidance Technology	*0	400	450	500	Continuing	TBD
TOTAL	15,454	25,069	25,521	28,834	Continuing	TBD

*Air-to-air guidance technology was previously funded jointly with air-to-surface guidance technology under Project 670B. Beginning in FY 1989, air-to-air and air-to-surface guidance technologies are funded separately under Project 670E and Project 670B respectively.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the Air Force's primary advanced technology development program for air-to-surface and air-to-air conventional weapons technologies including; guidance, ordnance, and aeromechanics. Hardware and software for advanced technologies are developed and evaluated to determine feasibility, effectiveness, and potential operational value. This program serves as the basis for future integration and demonstration of conventional weapon systems vital to Force survivability and the conventional deterrent posture of the United States.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 670E, Air-to-Air Guidance Technology: This project develops and demonstrates the feasibility, effectiveness, and potential operational value advanced midcourse and terminal guidance technologies for short and medium range air-to-air conventional weapons. The payoff from this project includes; all-weather delivery, increased accuracy, a "launch and leave" capability, increased number of kills per sortie, increased aircraft survivability, and improved reliability and affordability.

(U) FY 1988 Accomplishments: Not applicable (FY 1989 new start).

(U) FY 1989 Planned Program: Initiate Hardware-In-the-Loop (HIL) testing of Advanced Processor Technology for Air-to-Air Missiles (APTAAM) and integrate with the Advanced Seeker Technology for Air-to-Air Missiles (ASTAAM) hardware as a potential future upgrade to the Advanced Medium Range Air-to-Air Missile (AMRAAM).

Program Element: 0603601F Budget Activity: 2 - Advanced Tech Development
PE Title: Conventional Weapons Technology

(U) FY 1990 Planned Program: Complete HIL testing of APTAAM/ASTAAM and begin concept formulation studies to prepare for the FY91 start of a multi-mode seeker development program.

(U) FY 1991 Planned Program: Initiate the multi-mode seeker development program to defeat advanced airborne threats.

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

(U) Work Performed By: This program is managed by the Air Force Armament Laboratory, Eglin AFB, FL. Test facilities at Armament Division, Eglin AFB FL, support this program. The major contractor is Raytheon Co., Bedford, MA.

(U) Related Activities:
- (U) PE 0602602F, Conventional Munitions
- (U) PE 0603363F, Hypervelocity Missile (HVM)
- (U) The USN/USAF Memorandum of Agreement on Tactical Air-to-Air Missiles, dated 26 May 88, 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: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Ordnance Technology	10,737	16,334	12,533	14,174	Continuing	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 non-nuclear ordnance technologies for air-to-surface and air-to-air conventional weapons. The payoff from this project includes; improved munitions storage capacity and transportation safety, increased warhead effectiveness against high value buried and hardened targets, increased aircraft gun effectiveness, improved submunition dispensing, and low cost manufacturing techniques.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued ground demonstration of an advanced flight weight aircraft gun and advanced telescoped ammunition.
   - (U) Successfully tested a new "desensitized" high explosive formulation which is nearly as powerful as current explosives but is much safer to handle.
   - (U) Completed design of "insensitive" high explosive (IHE) formulations for MK-84 and I-2000 bombs, which is as powerful as current explosives and is dramatically safer to handle.
   - (U) Completed fabrication of a hard target ordnance package (target programmable fuze and warhead) for testing.
   - (U) Conducted ground test and demonstration of the HAVE SLICK advanced air-to-surface weapons dispenser airframe.
   - (U) Transitioned a Gallium Arsenide submunition guidance sensor from PE 0602602F for use in the FY89 smart submunition.

2. (U) FY 1989 Planned Program:
   - (U) Complete ground demonstration of an advanced aircraft gun and associated telescoped ammunition.
   - (U) Transition two plastic bonded IHE materials from PE 0602602F and initiate qualification testing of IHE formulations for general purpose bombs.
   - (U) Initiate test and evaluation of a hard target ordnance package for performance assessment against hardened targets.
   - (U) Continue ground test and demonstration of the HAVE SLICK advanced dispenser airframe.

Program Element: 0603601F
PE Title: Conventional Weapons Technology
Project Number: 670A
Budget Activity: 2 - Advanced Technology Development

- (U) Initiate design of a smart submunition to destroy mobile high value armor and defense suppression targets.
- (U) Initiate design of a programmable ordnance package (warhead/ fuze/safe & arm mechanism) to defeat advanced airborne threats.
- (U) Budget increase from FY88 reflects project restructuring to recover from Congressional reduction.

3. (U) FY 1990 Planned Program:
   - (U) Continue qualification testing of an IHE to meet Federal hazard classification standards.
   - (U) Continue testing and begin integration of a hard target ordnance package designed to defeat heavily hardened targets.
   - (U) Complete ground test and demonstration of the HAVE SLICK dispenser for transition to full scale engineering development.
   - (U) Transition the aimable warhead fuze from PE 0602602F and complete design of a smart submunition to destroy mobile high value armor and defense suppression targets.
   - (U) Complete design and begin fabrication of a programmable ordnance package to defeat advanced airborne threats.
   - (U) Budget decrease from FY89 reflects lower start-up costs for new technology programs.

4. (U) FY 1991 Planned Program:
   - (U) Continue qualification testing of a hazard classification 1.6 insensitive high explosive.
   - (U) Complete testing and integration of a hard target ordnance package for transition to full scale engineering development.
   - (U) Transition heavy metal multi-fragment warhead technology from PE 0602602F and initiate fabrication & testing a smart submunition to defeat mobile high value armor and defense suppression targets.
   - (U) Complete fabrication and begin testing a programmable ordnance package to defeat advanced airborne threats.
   - (U) Budget increase from FY90 reflects fabrication costs for the smart submunition and programmable ordnance package.

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

D. (U) WORK PERFORMED BY: This program is managed by the Air Force Armament Laboratory, Eglin AFB, FL. Test facilities at Armament Division, Eglin AFB, FL; Arnold Engineering Development Center, Arnold AFB, TN; 6585th Test Group, Holloman AFB, NM; and the Naval Weapons Center, China Lake, CA, support this program. Major contractors are: McDonnell-Douglas Corp., St Louis, MO; Lockheed Missile and Space Co., Sunnyvale, CA; Motorola Inc., Scottsdale, AZ; General Electric Co., Burlington, VT; and Aerojet Corp., Sacramento, CA.

Program Element: 0603601F
PE Title: Conventional Weapons Technology
Project Number: 670A
Budget Activity: 2 - Advanced Technology Development

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPES OF CHANGES	IMPACT ON SYSTEM CAPABILITIES	IMPACT ON SCHEDULE	IMPACT ON FY 1990 COST
Technology	None	None	None
Schedule	None	None	None
Cost	None	None	None

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) 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) SAC SON 18-82, Strategic Conventional Standoff Capability, 19 Jun 84

G. (U) RELATED ACTIVITIES:
- (U) PE 0602602F, Conventional Munitions
- (U) PE 0604602F, Armament Ordnance Development
- (U) PE 0603363F, Hypervelocity Missile (HVM)
- (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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Air-to-Surface Guidance Technology	4,717	8,335	12,538	14,160	Continuing	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 terminal guidance technologies for air-to-surface conventional weapons. The payoff from this project includes; all-weather delivery, increased accuracy, a "launch and leave" capability, increased number of kills per sortie, increased aircraft survivability, and improved reliability and affordability.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Completed laboratory testing the Advanced Synthetic Aperture Radar Guidance (ASARG) seeker for application to advanced guided weapon systems and began low speed captive flight tests.
   - (U) Transitioned the low speed tactical laser radar (LADAR) seeker from PE 0602602F and initiated ground testing.
   - (U) Completed fabrication of the Advanced Processor Technology for Air-to-Air Missiles (APTAAM) Very High Speed Integrated Circuit (VHSIC) seeker processor and initiated Hardware-In-the-Loop (HIL) testing. This effort is funded under Project 670E in FY 1989.

2. (U) FY 1989 Planned Program:
   - (U) Complete low speed captive flight tests of the ASARG seeker.
   - (U) Complete ground tests of the low speed tactical LADAR seeker and initiate design of a high speed seeker to demonstrate the high speed performance of an autonomous seeker using LADAR technology.
   - (U) Budget increase from FY88 reflects project restructuring to recover from Congressional reduction.

3. (U) FY 1990 Planned Program:
   - (U) Initiate high speed captive flight tests of the ASARG seeker.
   - (U) Complete design and begin fabrication of hardware & software for the high speed tactical LADAR seeker.

Program Element: 0603601F
PE Title: Conventional Weapons Technology
Project Number: 670B
Budget Activity: 2 - Advanced Technology Development

- (U) Transition from PE 0602602F and initiate design of a joint Air Force/Army dual mode IR/MMW mobile target seeker for autonomous acquisition and tracking of ground mobile targets.
- (U) Budget increase from FY89 reflects cost of hardware/software fabrication for the high speed tactical LADAR seeker.

4. (U) FY 1991 Planned Program:
   - (U) Complete high speed captive flight test of the ASARG seeker for transition to full scale development.
   - (U) Complete fabrication and begin laboratory acceptance testing of the high speed tactical LADAR seeker.
   - (U) Complete design and begin fabrication of the joint dual mode IR/MMW seeker.
   - (U) Initiate design of a multi-mode fixed high value target seeker.
   - (U) Budget increase from FY90 reflects the cost of ASARG high speed flight testing and fabrication of the dual mode IR/MMW seeker.
   - (U) Transition the joint Air Force/Navy non-cooperative vector scoring system from PE 0602602F.

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

D. (U) WORK PERFORMED BY: This program is managed by the Air Force Armament Laboratory, Eglin AFB, FL. Test facilities at Armament Division, Eglin AFB, FL support this program. Major contractors are: Raytheon Co., Bedford, MA; Loral Corp., Phoenix, AZ.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPES OF CHANGES	IMPACT ON SYSTEM CAPABILITIES	IMPACT ON SCHEDULE	IMPACT ON FY 1990 COST
Technology	None	None	None
Schedule	None	None	None
Cost	None	None	None

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

G. (U) RELATED ACTIVITIES:
- (U) PE 0602602F, Conventional Munitions
- (U) PE 0603363F, Hypervelocity Missile (HVM)
- (U) PE 0603313A, Missile/Rocket Components
- (U) PE 0604258N, Target System Development
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: 0603601F
PE Title: Conventional Weapons Technology
Project Number: 670B
Budget Activity: 2 - Advanced Technology Development

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

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

J. (U) MILESTONE SCHEDULE: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3150 High Energy Laser and Optics Technology	3,144	1,903	2,401	2,978	Continuing	TBD
3151 Phased Integrated Laser Optics Technology	18,339	19,300	21,110	23,324	Continuing	TBD
3152 High Power Microwave Technology	6,433	7,528	8,454	8,910	Continuing	TBD
3277 Systems Survivability	0	0	323	478	Continuing	TBD
3647 Ground Based Laser Technology	41,561	59,940	38,036	23,061	Continuing	TBD
Total	69,477	88,671	70,324	58,751	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is the only advanced technology development program for directed energy (DE) concepts for Air Force applications. Major technology breakthroughs in high power laser devices, coherent diode laser arrays, high power microwaves, and nonlinear optics have been demonstrated and further development will continue. Emphasis will be on ground based laser antisatellite technology, high power microwave effects tests, and scaling of laser diode arrays. A new project will start in FY 1990 that develops technologies to protect Air Force systems from nuclear effects.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3150: High Energy Laser and Optics Technology. This project concentrates on high payoff optics and beam control concepts (e.g. nonlinear optics (NLO) and optical phased arrays). NLO processes can correct beam non-uniformities and facilitate combining and pointing multiple high energy laser beams very efficiently without conventional, high-cost optics and processing systems. Phased array systems will be used for both imaging and beam projection. An imaging subsystem is required to accurately place the laser beam on target and to assess damage. They can replace large monolithic optics by integrating and phasing small, off-the-shelf optical telescopes.

(U) FY 1988 Accomplishments:
- (U) Coupled ring dye lasers with nonlinear optics.
- (U) Completed small-scale Multi-use Multiple Telescope Testbed (MMTT).
- (U) Demonstrated multiple aperture optical imaging with MMTT.

(U) FY 1989 Planned Program:
- (U) Perform 1-dimensional array coupling using NLOs.

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Program Element: #0603605F Budget Activity: #2 - Advanced Technology Development
PE Title: Advanced Weapons Technology

- (U) Develop multiple aperture optical imaging scaling methodology.

(U) FY 1990 Planned Program:
- (U) Scale-up multiple aperture optical imaging system.
- (U) Visible chemical laser proof-of-principle scaling.

(U) FY 1991 Planned Program:
- (U) Perform active and passive satellite imaging experiments.
- (U) Transition NLO pointing and tracking brassboard.

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

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM manages this program. 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:

Other Procurement (MILCON)

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	4,400	-	-	-	0	4,400

(U) International Cooperative Agreements: Not Applicable.

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 that will identify potential vulnerabilities of select US systems to HPM threat parameters and provide a basis for future weaponization decisions. Representative systems and subsystems will be tested in a variety of HPM environments to determine their susceptibilities. This project is actively coordinated with the Army, Navy, Department of Energy, and other Department of Defense agencies by the Office of Secretary of Defense.

(U) FY 1988 Accomplishments:
- (U) Began tests of AIM-7M, IR Maverick, and F-16 shell.

Program Element: #0603605F Budget Activity: #2 - Advanced Technology Development
PE Title: Advanced Weapons Technology

- (U) Field demonstrated 200 joule source and began development of

(U) FY 1989 Planned Program:
- (U) Complete tests of AIM-7M, IR Maverick and F-16 shell.
- (U) Initiate tests of AWG-9 Tracker
- (U) Begin development of

(U) FY 1990 Planned Program:
- (U) Test
- (U) Conduct field tests with high efficiency HPM sources having high gain antennas.
- (U) Complete

- (U) Begin S/V/L tests of full-up, large scale systems.
- (U) Initiate development of

(U) FY 1991 Planned Program:
- (U) Complete for effects testing.
- (U) Field demonstrate
- (U) Field demonstrate compact, pulsed power driver for HPM.
- (U) Evaluate

(U) Program to Completion:
- (U) This is a continuing program.
- (U) Technical feasibility of

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM manages this program. The top five contractors are: Rockwell International Corp, Rocketdyne Division, Canoga Park, CA; Maxwell Laboratories, Inc., 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.
- (U) Program Element 0602101N, Directed Energy Weapons.
- (U) Program Element 0602202F, Human Systems Technology.
- (U) Program Element 0602204F, Aerospace Avionics.
- (U) Program Element 0603743F, Electronic Combat Technology.
- (U) Program Element 0603737D, Balanced Technology Initiative.
- (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.

Program Element: #0603605F Budget Activity: #2 - Advanced Technology Development
PE Title: Advanced Weapons Technology

(U) Other Appropriation Funds:

Other Procurement (MILCON)

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	-	10,900	-	-	0	10,900

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 3277: Systems Survivability. This project starts in FY 1990 and will develop methodologies to test and technologies to protect Air Force systems against effects of nuclear attack.

(U) FY 1988 Accomplishments: Not Applicable.

(U) FY 1989 Planned Program: Not Applicable.

(U) FY 1990 Planned Program:
- (U) Begin major redesign of existing electromagnetic pulse (EMP) test equipment.

(U) FY 1991 Planned Program:
- (U) Begin to develop hardening techniques for ground systems.
- (U) Continue redesign of EMP test equipment.

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

(U) Work Performed By: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM manages this program. Contracts will be competed in FY 1990.

(U) Related Activities:
- (U) Program Element 0602601F, Advanced Weapons.
- (U) Program Element 0602204F, Aerospace Avionics.
- (U) Program Element 0604711F, Systems Survivability (Nuclear Effects).
- (U) Program Element 0602715H, Defense Nuclear Agency.
- (U) Program Element 0603749F, Command, Control, Communication Countermeasures Advanced Systems.
- (U) Program Element 0604747F, Electromagnetic Radiation Test Facilities.
- (U) Program Element 0603224C, Survivability, Lethality, Key Technologies.
- (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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603605F
PE Title: Advanced Weapons Technology
Project Number: 3151
Budget Activity: #2 - Advanced Technology Development

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

Project Title: Phased Integrated Laser Optics Technology (PILOT)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
PILOT	18,339	19,300	21,110	23,324	Continuing	TBD

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

This project investigates and demonstrates the practicality of

Using a concept developed in-house, this project attempts to

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:

- (U) delivered to AF.
- (U)
- (U) Began Technology Demonstrator effort to couple approximately
- (U) Completed Near-Term Applications Study.

2. (U) FY 1989 Planned Program:

- (U) Complete Module Development and Technology Demonstrator designs. Begin hardware fabrication.

3. (U) FY 1990 Planned Program:

- (U) Complete Module Development and Technology Demonstrator efforts with fabrication and testing of
- (U) Begin studies for technology transition to users.
- (U) Begin second generation scaling of Alternate 2-D Array Technology.

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Program Element: #0603605F
PE Title: Advanced Weapons Technology
Project Number: 3151
Budget Activity: #2 - Advanced Technology Development

4. (U) FY 1991 Planned Program:

- (U) Begin follow-on Baseline Demonstration that combines results of both Module Development and Technology Demonstrator.
- ( ) Baseline Demonstration will develop and demonstrate _
- ( ) Begin initial design for _
- (U) Continue transition studies.

5. (U) Program to Completion:

- (U) This is a continuing program.
- (U) Transition technology to low and medium power applications.

D. (U) WORK PERFORMED BY: The Air Force Weapons Laboratory, Kirtland Air Force Base, NM, manages this program. The top five civilian contractors are: McDonnell Douglas, St Louis, MO; General Electric Astro-Space Division, Philadelphia, PA; RCA, David Sarnoff Research Center, Princeton, NJ; United Technologies Research Center, East Hartford, CT; and Spectra Diode Laboratories Inc., San Jose, CA.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech:	None	None	None
Schd:	None	None	None
Cost:	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

Program Element: #0603605F
PE Title: Advanced Weapons Technology
Project Number: 3151
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.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

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

J. (U) MILESTONE SCHEDULE:

- (U) Demonstration	March 1990
- (U) Alternate Technology Scaling Begins	May 1990
- (U) Low Power Transitions Begin	FY 1990
- (U) Baseline Demonstration Begins	FY 1991
- (U) Design For	FY 1991
- (U)	FY 1992
- (U)	FY 1994

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
GBLT	41,561	59,940	38,036	23,061	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project develops and demonstrates technology needed for a decision to develop a ground based laser antisatellite (ASAT) weapon. The program will develop the detailed system concepts and demonstrate the required technologies for: (1) scalable laser devices; (2) the specific optical components; and (3) the required laser beam control to efficiently compensate and propagate the laser radiation through the atmosphere to a target in space. Low-power integrated uplink experiments will demonstrate the critical beam control. Atmospheric compensation is the key technology. This program will concentrate on two wavelengths: near infrared, represented by chemical oxygen iodine laser (COIL); and visible, represented by pulsed excimer. Currently, the COIL has demonstrated the highest power and is the most mature, but it lacks the detailed system studies and design refinements of the Strategic Defense Initiative (SDI) efforts on excimer. Development of single pulsed excimer (SPE) device and other required technologies for SPE systems was added for FY 1989. The concept evaluation for will also include the SDI/Army Free Electron Laser (FEL) which operates in the same frequency range as the COIL, and deuterium fluoride (DF) chemical lasers like the Mid-Infrared Advanced Chemical Laser (MIRACL). 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. In FY 1989-1990, the Air Force will participate in a tri-service effort to fund an upgrade to the MIRACL/SeaLite Beam Director (SLBD) which is a GBL system at White Sands Missile Range, NM. The upgrade has two key objectives: to provide high energy laser engineering and performance data on full aperture tracking using the SLBD system;

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:

- (U) The Excimer Mid Range Laser Device (EMRLD) master oscillator was installed.
- (U) Began fabrication of subscale low-distortion high-power mirrors, deformable mirrors, and an aperture sharing element.
- (U)

Program Element: #0603605F
PE Title: Advanced Weapons Technology
Project Number: 3647
Budget Activity: #2 - Advanced Technology Development

- (U) Began integrated uplink experiment design.
- (U) 35 kilowatts extracted from scalable COIL device.
- (U) Performed closed loop experiment with a 1.5 meter telescope to demonstrate sensing/correction of atmospheric turbulence.

2. (U) FY 1989 Planned Program:

- (U) Complete EMRLD experiments.
- (U) Begin upgrade MIRACL/SLBD system.
- (U) Begin development of uplink components.
- (U) Develop high-power SPE device.
- (U) Develop other required technologies for SPE.
- (U) Begin fabrication of a 3.5 meter telescope designed for low-power atmospheric compensation and beam control testing.

3. (U) FY 1990 Planned Program:

- (U) Perform atmospheric compensation experiments to demonstrate performance at wavelengths of interest.
- (U) Complete upgrade of MIRACL/SLBD system.
- (U) Begin fabrication of uplink components.
- (U)
- (U) Aimpoint maintenance experiment.
- (U) Complete system performance trades.

4. (U) FY 1991 Planned Program:

- (U) Perform scaling experiments.
- (U) Perform uplink experiments

- (U) Complete cost optimization.
- (U) Complete coupled resonator experiment.

5. (U) Program to Completion:

- (U) This is a continuing program.
- (U) Complete large aperture telescope in FY 1992.
- (U) Perform realistic atmospheric compensation experiments with weapon-class size telescope.
- (U) decision for go-ahead for GBL development.
- (U) Further develop specific technologies for selected system concepts.

D. (U) WORK PERFORMED BY: This program is managed by the Air Force Weapons laboratory, Kirtland Air Force Base, NM. The Navy will manage the MIRACL/SLBD upgrade. 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; Martin Marietta Corp, Denver Aerospace, Denver, CO; and Hughes Aircraft Company, Electro-Optical & Data Systems Group, El Segundo, CA.

Program Element: #C603605F
PE Title: Advanced Weapons Technology
Project Number: 3647
Budget Activity: #2 - Advanced Technology Development

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

(U) MIRACL/SLBD upgrade added in FY 1989. Restructured FY 1989 program caused the decision date to be extended until the second quarter of
$15 million added by Appropriations Bill for Single Pulsed Excimer work in FY 1989.

F. (U) PROGRAM DOCUMENTATION:

- (U)

G. (U) RELATED ACTIVITIES:

- (U) Program Element 0602601F, Advanced Weapons.
- (U) Program Element 0604406F, Space Defense Systems.
- (U) Program Element 0603314A, High Energy Laser and Directed Energy Components.
- (U) Program Element 0603792N, Advanced Technology Transition.
- (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: Not Applicable.

J. (U) MILESTONE SCHEDULE:

- (U) Uplink Experiment Definition	FY 1989
- (U) SPE Development	FY 1989
- (U) EMRLD Testing Complete	FY 1989
- (U) MIRACL/SLBD Upgrade Complete	FY 1990
- (U) Uplink Experiments	
- (U) COIL/FEL/Excimer/DF Concept Evaluations Complete	
- (U) Go-Ahead Decision for High Power Development and Integration	

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603707F
Title: Weather Systems Advanced Development

Budget Activity: #2 - Advanced Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1 Weather Systems (Advanced Development)	4,798	5,304	5,551	5,619	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This advanced technology development program improves all aspects of environmental support to Air Force and Army combatant commands, and other DOD agencies. A principal thrust is improving our ability to gather and interpret target weather data in uncontrolled or enemy-controlled battle areas. A technology demonstration will show that weather parameters critical to the success of tactical missions can be gathered from manned or unmanned reconnaissance platforms. Testing of the Imaging Infrared MAVERICK system in the mid-70's showed that weather caused a "contrast reversal", making it impossible for the sensor to detect and lock-on to a target. Models and algorithms will be developed that account for the effects of weather conditions on the ability of television, infrared, or radar sensors to detect and lock on to a target. Pilots and operations staff can use these Tactical Decision Aids (TDAs) during mission planning to select the best angle of attack or to choose a weapon with the type of sensor that will perform best for the target weather conditions. Technology demonstrations will show the feasibility of automatically observing cloud cover, visibility, present weather, and obstructions to vision as part of the Automated Weather Distribution System (AWDS) at ground-based observing sites. Real-time alerting of critical weather events will then be possible and weather support manpower may be reduced. Doppler radar analysis techniques will be developed for the Next Generation Weather Radar (NEXRAD). More accurate observations and adequate forewarning of such storm hazards as turbulence, wind shear, hail, and tornadoes will result, providing better protection to valuable combat assets. In May 1988, surveillance sensors lost track of 981 satellites due to increased atmospheric drag after a solar storm; it took 96 manhours to reestablish their position and regain control. We will gather basic data on solar storms and other operational environmental phenomena to develop predictive tools for Air Weather Service's Environmental Technology Transition (ETT) program.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project XXX1, Weather Systems (Advanced Development). Develops advanced technology to improve environmental support to Air Force and Army operational commands, and other DOD agencies.

Program Element: #0603707F
Title: Weather Systems Advanced Development

Budget Activity: #2 - Advanced Technology Development

(U) FY 1988 Accomplishments:
- (U) Started physical modeling of high-value targets for TDAs.
- (U) Started work on self-illuminating targets for visible TDAs.
- (U) Completed hurricane severity forecasting tool for NEXRAD.
- (U) Completed forecasting tool for solar storm particle output.

(U) FY 1989 Planned Program:
- (U) Complete concept validation of battlefield weather sensors.
- (U) Complete thunderstorm initiation algorithm for NEXRAD.
- (U) Begin tools to specify high-altitude atmospheric density.
- (U) Complete high-latitude, polar cap ionospheric model for ETT.

(U) FY 1990 Planned Program:
- (U) Complete development of brassboard visibility sensor for AWDS.
- (U) Complete tornado probability forecasting tool for NEXRAD.
- (U) Complete hail size forecasting tool for NEXRAD.
- (U) Complete tools that specify the state of the earth's magnetosphere.

(U) FY 1991 Planned Program:
- (U) Continue physical modeling of high-value targets for TDAs.
- (U) Continue development of cloud detection sensors for AWDS.
- (U) Begin small scale weather forecasting tools for ETT.

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

(U) Work Performed By: This program is managed by the Air Force Geophysics Laboratory, Hanscom AFB MA. Modeling of high-value targets is being done by Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB OH. The top five contractors are Lockheed Missile and Space Company, 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 Development.
- (U) Program Element 0305111F, Weather Service.
- (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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2103 Environmental Quality Technology	1,312	1,589	1,463	1,596	Continuing	TBD
2104 Civil Engineering Technology	3,017	5,961	5,489	6,086	Continuing	TBD
3037 Noise & Sonic Boom Impact Technology	1,733	2,384	2,194	2,289	Continuing	TBD
Total	6,062	9,934	9,146	9,971	Continuing	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 a chemical/biological or conventional attack; 2) apply cost-effective advances in civil engineering technologies to peacetime air base operations; and 3) 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. The Civil Engineering technology enables: 80% wartime survivability of critical air base facilities and utilities; air base battle damage assessment in minutes instead of hours; 90% improvement in repairability of essential air base facilities and utilities; and 100% improvement in post-attack fire suppression and crash rescue. The Environmental Quality technology enables: 80% on-site disposal of selected hazardous waste resulting in $13M per year savings in Air Force operations and maintenance costs; cost-effective control technology for industrial emissions from aircraft painting operations resulting in a $6M savings annually; and 95% faster emergency hazard corridor prediction.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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.

(U) FY 1988 Accomplishments:
- (U) Determined criteria for assessing the validity of environmental models--accurate environmental impact prediction.
- (U) Developed field test kit to allow reuse of toxic aircraft cleaning solvents--10% less solvents required.

Program Element: #0603723F
PE Title: Civil & Environmental Engineering Technology
Budget Activity: 2-Advanced Technology Development

(U) FY 1989 Planned Program:
- (U) Characterize the physical and chemical interaction of rocket explosions--95% faster emergency hazardous corridor prediction, saving lives near disaster sites.
- (U) Identify biodegradable solvents to replace toxic aircraft paint strippers--save up to $4M annually in disposal.

(U) FY 1990 Planned Program:
- (U) Develop cost-effective control technology for emissions from aircraft painting/de-painting--$6M annual savings.
- (U) Develop field test kit for asbestos detection in air base structures.

(U) FY 1991 Planned Program:
- (U) Develop insurance test for hazardous waste incineration.
- (U) Develop ways to reduce toxic waste generated by chromium electroplating of aircraft parts by 80,000 gallons/year.

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

(U) Work Performed By: Air Force Engineering and Services Lab, Tyndall AFB FL. Major contractors: EG&G, Idaho Fall ID; U. of Calif, Berkeley CA; ACUREX, Research Triangle Park, NC; Battelle, Columbus OH.

(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 or DoD.

(U) Other Appropriation Funds: None.

(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; better construct and repair runways; perform air base battle damage assessment and repair; perform crash rescue and suppression of aircraft fires and air base post-attack fires; and perform critical peacetime civil engineering construction, maintenance and repair.

(U) FY 1988 Accomplishments:
- (U) Developed hardened, transportable protective shelter--modular, prefabricated for air base operability.

Program Element: #0603723F
PE Title: Civil & Environmental Engineering Technology
Budget Activity: 2-Advanced Technology Development

- (U) Developed post-attack assessment model for firefighting--effective air base firefighter training and war plans.

(U) FY 1989 Planned Program:
- (U) Automate repair functions of prototype rapid runway repair excavator to reduce crater repair time by a third.
- (U) Assess vulnerability of air base fuel distribution systems--survivable fuel system design.

(U) FY 1990 Planned Program:
- (U) Battle damage assessment of air base facilities--post attack assessment in minutes instead of hours.
- (U) Rapid repair of air base facilities--air base recovery.
- (U) Prove design for all-weather, all-terrain crash rescue vehicle for post attack air base recovery--100% improvement in fire suppression/300% in northern bases.

(U) FY 1991 Planned Program:
- (U) Investigate the response of air base structures to enhanced blast weapons--next generation hardened shelter.
- (U) Develop optimum mix of materials/chemicals to strengthen soil to support contingency aircraft operations--contingency construction in days instead of months.

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

(U) Work Performed By: Air Force Engineering and Services Lab, Tyndall AFB FL. Major contractors: Applied Research Associates, Albuquerque NM; New Mexico Engineering Research Institute, Albuquerque NM; University of North Carolina, Raleigh NC; ODETICS, Annaheim 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 or DoD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

3. (U) Project 3037, Noise and Sonic Boom Impact Technology: Develops an assessment and prediction capability to evaluate impact of noise from subsonic and supersonic aircraft operations. The

Program Element: #0603723F
PE Title: Civil & Environmental Engineering Technology
Budget Activity: 2-Advanced Technology Development

environmental impacts of Air Force operations must be assessed. Today this takes from two to five years to complete. Improving this capability is essential in order 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 1988 Accomplishments:
- (U) Expanded sonic boom prediction model allowing more combat training scenarios in previously restricted areas.
- (U) Developed and field tested the sonic boom recorder resulting in enhanced collection and quality of data.

(U) FY 1989 Planned Program:
- (U) Refine the sonic boom prediction model from cumulative to single aircraft maneuvers.
- (U) Develop methods for evaluating unconventional soils (land slides, avalanche) and structures (adobe dwellings and archaeologic sites) for environmental impact assessments.
- (U) Develop noise response model for those animals impacted.

(U) FY 1990 Planned Program:
- (U) Develop acceptable criteria to determine the effectiveness of on-base jet engine noise suppression systems.
- (U) Integrate environmental planning methods with noise information retrieval system to estimate noise impacts.
- (U) Develop assessment methodology to predict impacts from low subsonic flight on humans, animals, and structures.

(U) FY 1991 Planned Program:
- (U) Integrate predicted impacts from subsonic and supersonic aircraft noise into an automated retrieval system.
- (U) Complete field validation of noise impact prediction models resulting in accurate impact identification.

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

(U) Work Performed 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 or DoD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603726F Budget Activity: #2-Advanced Technology Development
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2478 Tactical C3 Architecture	80	150	0*	0*	0*	TBD
2810 Cartographic Applications for Tactical and Strategic Systems (CATSS)	1253	1500	1455	1618	Continuing	TBD
2863 Integrated Photonics	3360	4192	4323	5030	Continuing	TBD
3192 Tactical Optical Disk System (TODS)	473	2184	2100	2567	Continuing	TBD
Total	5166	8026	7878	9215	Continuing	TBD

* Project 2478 transfers to PE 0603617F beginning in FY 1990.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program develops, demonstrates and validates C3I technologies in the following areas: digital cartographic data base structures for mission planning, navigation, targeting and weapons delivery applications; photonics technology to replace electronic technology in tactical and strategic systems; and digital optical disk storage for tactical intelligence and reconnaissance information collection and distribution applications. Starting in FY 1990, Project 2478 is being transitioned into a new systems demonstration and evaluation Program Element (0603617F) to allow more efficient transition of C3 advanced technology developments into Tactical Air Force operations.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2810, Cartographic Applications for Tactical and Strategic Systems (CATSS): The CATSS program is the single advanced development program addressing Air Force weapon system requirements for digital cartographic data to support mission planning, navigation, guidance, targeting and terrain analysis. Before the CATSS program, over 200 Air Force systems independently developed their own individual digital cartographic data applications software. This resulted in costly duplication/redevelopment of cartographic software and unnecessary proliferation of system specific data bases. This program develops standard alogrithms, software and display methods that can be applied to multiple Air Force systems.

(U) FY 1988 Accomplishments:
- (U) Demonstrated the capability to generate, manipulate and display perspective terrain features. This capability is needed for targeting applications such as TAC LANTIRNn at night.
- (U) Developed cartographic algorithms and transitioned them to USAF system developers and operational users.

Program Element: #0603726F Budget Activity: #2-Advanced Technology Development
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

3. (U) Project 3192, Tactical Optical Disk Systems (TODS):
Present C3I systems do not possess data storage capacities and performance required for real-time and near-real-time sensor inputs. Optical disk based data storage systems offer the high capacity and high speed data input/output capabilities needed for real time sensor requirements. Commercially available optical storage systems cannot operate in the military environment and meet the required throughput or storage capabilities. This project provides advanced technology development for TODS,a miniature, high capacity, reliable,erasable, data storage and transfer system that can operate in severe operational environments. This project provides a suite of optical disk systems which consists of 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 will be used for airborne storage and access to mission-oriented data. Application of the 14-inch TODS is on-board sensor data storage. The juke box will provide mass data storage at ground-based intelligence centers. This project supports TR-1 Ground Station, Strategic Air Command (SAC) deployable C2 center and SAC Headquarters Emergency Relocation Team.

(U) FY 1988 Accomplishments:
- (U) Validated the proof-of-concept 5.25-inch mechanical model for airborne operation.

(U) FY 1989 Planned Program:
- (U) Fabricate a 5.25-inch functional model to demonstrate record, playback and erase operations. This model will be subjected to environmental testing (temperature, vibration, shock, etc).
- (U) Begin development of the 14-inch TODS, providing high capacity data collection and retrieval on an optical disk with read/write/erase capability

(U) FY 1990 Planned Program:
- (U) Transition the 5.25-inch TODS to full scale development and possible integration into the F-16 aircraft.

(U) FY 1991 Planned Program:
- (U) Design the optical disk jukebox, to provide increased storage capacity for tactical ground intelligence shelters.

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

(U) Work Performed By: Contractor is Sundstrand Data Control, Remond, WA. RADC Griffiss AFB NY manages this program.

(U) Related Activities:
- (U) PE 0602702F, C3.
- (U) No unnecessary duplication exist within the Air Force or DOD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Activities: None.

Program Element: #0603726F Budget Activity: #2-Advanced Technology Development
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

(U) FY 1988 Accomplishments:
- (U) Developed a family of Multipurpose Fiber Optic Transceivers (MFOX) which provides a wide variety of transmission capabilities and accommodates multiple electro-optic interfaces.
- (U) Fabricated and field tested radar remoting capability by demnstrating the optical cable's ability to seperate the operational shelters 2 km from the radar antenna
- (U) Fabricated and field tested optical cable to replace telecommunications copper cable in a Tactical Air Control System, providing a ten-to-one reduction in size and weight and increased remoting distances.

(U) FY 1989 Planned Program:
- (U) Design, fabricate and test a high speed laser communications transceiver for ground and space environments providing a bandwidth increase for analog from 10MHz to 15MHz and digital from 50MBits to 2GBits.
- (U) Design and fabricate analog fiber optic link for distortion free communication transmission from 2 to 500MHz.

(U) FY 1990 Planned Program:
- (U) Develop intrusion resistant optical communications system capable of multiplexing several signals on the same cable.
- (U) Design and develop an interferometric intrusion detection optical communication processor for improved security.
- (U) Design and develop a coherent optical transmission system to replace microwave waveguide, increasing remoting distances for antennas, bandwidth and higher frequencies.

(U) FY 1991 Planned Program:
- (U) Fabricate an optical processor for phased array antennas for beam streering to prove system preformance.
- (U) Design a tictical, multi beam, phased array radar based upon optical processing and memory components.

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

(U) Work Performed By: Contractors are Hughes Aircraft Co., Fullerton, CA; Westinghouse Electric Corp, Baltimore, MD; Martin & Marietta, Denver, CO; TRW Space Defense Group, Redondo Beach, CA. RADC Griffiss AFB NY manages this program.

(U) Related Activities:
- (U) PE 0602702F, C3
- (U) PE 0602728F, Advanced Computer Technology
- (U) No unnecessary duplication exists within the Air Force or DOD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Activities: None.

Program Element: #0603726F Budget Activity: #2-Advanced Technology Development
PE Title: Command, Control, Communication and Intelligence Subsystem Integration

(U) FY 1989 Planned Program:
- (U) Demonstrate capability to generate cartographic data to support Joint STARS anywhere in the world, aiding in identification of ground targets behind enemy lines.
- (U) Provide standard digitized data and applications support to Air Force special operations forces program.
- (U) Provide cartographic software to Tactical Air Forces, SENTINEL BYTE in order to merge cartographic and unit level intelligence information.

(U) FY 1990 Planned Program:
- (U) Demonstrate enhanced automatic update capability for Joint Stars cartographic data base, reducing system update time.
- (U) Transition digital cartographic applications software to multiple Air Force system program offices.

(U) FY 1991 Planned Program:
- (U) Demonstrate enhanced imagery manipulation, image confirmation and digital cartographic software.
- (U) Demonstrate application of expert systems techniques to cartographic data base queries, applications and data validation.

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

(U) Work Performed By: Contractors are PAR Technology Corp., New Hartford, NY; Grumman Data System Corp., Woodbury, NY; Digicomp Research, Ithaca, NY. RADC, Griffiss AFB NY manages this program.

(U) Related Activities:
- (U) PE 0602702F, C3
- (U) PE 0603260F, Intelligence Advanced Development.
- (U) No unnecessary duplication exist within the Air Force or DOD.

(U) Other Appropriation Funds: None.

(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 & 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.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2527 Software Life Cycle Tools	1,597	1,584	3,000	3,300	Continuing	TBD
2529 Computer Architecture Applications	477	557	527	851	Continuing	TBD
2530 Distributed Systems Reliability and Survivability	950	2,542	3,500	3,500	Continuing	TBD
2532 Knowledge-Based Systems	1,057	2,556	3,000	3,200	Continuing	TBD
TOTAL	4,081	7,239	10,027	10,851	Continuing	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 computers and software required in combat systems (mission critical). This program develops distributed and optical 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 applications of AI to Air Force systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 program 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.

(U) FY 1988 Accomplishments:
- (U) Completed specifications for a software quality and productivity laboratory for assessing Ada and FORTRAN application-software systems.
- (U) Completed a system to enhance user requirement identification, thereby reducing, by 50 percent, those software errors which propagate to operational systems.

(U) FY 1989 Planned Program:
- (U) Build Software Life Cycle Support Environment prototype consisting of an integrated set of software packages that will increase software development productivity and reduce the total life cycle costs of software.

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Program Element: #0603728F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Computer Technology

- (U) Complete the design of an Ada Test and Verification System to allow analysis of Ada Software as part of the Air Force transition to the DOD Common programming language (Ada).

(U) FY 1990 Planned Program:
- (U) Develop a system to assess the impact of new and/or changing requirements on fielded software systems.
- (U) Enhance design techniques to increase fault tolerance of software systems.
- (U) Develop a software quality and productivity laboratory.

(U) FY 1991 Planned Program:
- (U) Complete software quality assessments of parallel and distributed computing architectures for applications to Command, Control, Communication and Intelligence (C3I) systems requiring integration of large amounts of data.
- (U) Develop a knowledge-based engineering environment for using a computer to automatically translate weapon system requirements into software code.
- (U) Develop automated data collection and analysis tools for software development.

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

(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) 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 2529 - Computer Architecture Applications: Today's weapon systems performance rely on the integration of multiple computers into an "architecture" to achieve system performance, fault tolerance and reliability. This project evaluates commercial and DOD developed computer architectures to determine their efficiency and applicability to Air Force C3I requirements. This project is developing an optical processor as the basis for an architecture that will be an order of magnitude faster than current capabilities, is radiation hardened and consumes little power.

(U) FY 1988 Accomplishments:
- (U) Completed design of an optical 16-bit programmable Cen-

tral Processing Unit, a candidate for meeting Advanced Air Superiority Missile signal and data processing requirements.
- (U) Developed simulation and modeling capabilities for evaluating prototype optical computing systems.

(U) FY 1989 Planned Program:
- (U) Fabricate and demonstrate a 1-Mbyte 2-dimensional optical interconnect shared memory multiprocessor system as an interim capability for a 3-dimensional automatic target recognition system.
- (U) Fabricate a large optical addressable memory for use in the Multi-Mission Remotely Piloted Vehicle.

(U) FY 1990 Planned Program:
- (U) Test, evaluate and demonstrate the 1-Mbyte radiation hardened optical addressable memory.
- (U) Design and develop a 1 tera-byte optical, content addressable, memory processor for space based radar applications.
- (U) Develop a 3-dimensional shared memory processor with optical interconnects.

(U) FY 1991 Planned Program:
- (U) Fabricate, evaluate and demonstrate an optical 16-bit programmable Central Processing Unit for autonomous guidance applications in conventional weapons.

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

(U) Work Performed By: Rome Air Development Center manages this program. Primary contractors are: Georgia Institute of Technology, Atlanta, GA; Syracuse University, Syracuse, NY; Opticom Corp., Lake Tahoe NV.

(U) Related Activities:
- (U) PE #0602702F, Command, Control and Communication
- (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 2530 - Distributed Systems Reliability and Survivability
Combining physical dispersion, mobility, and reconfiguration while still maintaining command authority is critical to strategic, tactical and space command and control. 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.

Program Element: #0603728F Budget Activity: #2-Advanced Technology Development
.E Title: Advanced Computer Technology

(U) FY 1988 Accomplishments:
- (U) Designed a Distributed Operating System (DOS) to prove that full integration and interoperability could be done among different computers.
- (U) Designed a real-time DOS for command and control applications which allows the processing systems to be physically dispersed.

(U) FY 1989 Planned Program:
- (U) Fabricate the real-time DOS.
- (U) Develop a survivable distributed computing system for replanning the Single Integrated Operation Plan.

(U) FY 1990 Planned Program:
- (U) Demonstrate the interconnection between multiple strategic sensors to provide battle management data using the Strategic Adaptive Planning Experiment testbed.
- (U) Demonstrate a parallel and/or distributed architecture 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.
- (U) Develop a distributed database system that can be physically dispersed for survivability.

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

(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; Harris, Melbourne FL; McDonnel Douglas, Huntington Beach, CA.

(U) Related Activities:
- (U) PE #0602702F, Command, Control and Communication.
- (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 2532 - Knowledge-Based Systems: Opportunities to apply knowledge-based systems abound. These 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 provides technology demonstrations and validation of increased cost-effectiveness in such

Program Element: #0603728F Budget Activity: #2-Advanced Technology Development
PE Title: Advanced Computer Technology

diverse applications as weapon system maintenance, logistic planning, tactical and strategic decision support systems, resource allocations, situation assessment and intelligence analyses.

(U) FY 1988 Accomplishments:
- (U) Developed individual Knowledge-Based Software Assistant (KBSA) modules including, the Specification Service which maintains a knowledge base of specifications being developed by the user.
- (U) Designed knowledge-based tools for reducing the time to replan the Strategic Air Command trans-post attack Single Integrated Operations Plan (SIOP) from months to hours.
- (U) Designed a computer language which makes requirements specification more natural.

(U) FY 1989 Planned Program:
- (U) Develop a prototype for SIOP replanning.
- (U) Integrate several KBSA modules into a partial system to help automate the software development process.
- (U) Develop requirements specification computer language.

(U) FY 1990 Planned Program:
- (U) Demonstrate the requirements specification language.
- (U) Develop a multi-processor, parallel computer implementation of a real-time knowledge-based system.
- (U) Demonstrate the partial life cycle KBSA system concept.

(U) FY 1991 Planned Program:
- (U) Demonstrate the real-time knowledge-based system.
- (U) Develop additional real-time AI decision aids for high-stress, time-critical Air Force mission environments.
- (U) Integrate and develop the full life cycle KBSA system.

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

(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 #0602301E, Strategic Computing 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: Not Applicable

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Elemen # 603789F Budget Activity: #2-Advanced Technology Development
PE Title: C3I Technology Development

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2314 Tactical Air Surveillance	6925	1397	0*	0*	0*	TBD
2317 Tactical Information Distribution	2179	1445	0*	0*	0*	TBD
2321 Tactical Battle Information Management	4271	2046	0*	0*	0*	TBD
2333 Surveillance Radar ECCM Technology	2885	3337	2751	2930	Continuing	TBD
2335 Communications and Navigation ECCM	4207	3421	1661	2039	Continuing	TBD
2747 Advanced Communication Network Techniques	514	328	179	150	Continuing	TBD
2748 Advanced High Frequency Technology	220	250	179	150	Continuing	TBD
2749 Battle Information Management Technology	50	0	0	0	0	NA
3433 Advanced Communications Techniques (LASERCOM)	10186	6000	4227	4123	Continuing	TBD
3804 TAF System Intergration	0	288	0*	0*	0	TBD
Total	31437	18512	8997	9392	Continuing	TBD

*Projects 2314, 2317, 2321, 3804, transfer to PE 0603617 beginning in FY1990

B. (U) BRIEF DESCRIPTION OF ELEMENT: This advanced technology development program demonstrates and validates ground and air 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 applications of laser communications techniques that provide secure ant-jam and low probability of intercept capabilities are also being developed within this program. Starting in FY 1990 projects 2314, 2317, 2321 and 3804 will transition to a new systems demonstration and evaluation Program Element (0603617F) to allow a more efficient transition of C3 advanced technology into Tactical Air Force (TAF) operations.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2333, Surveillance Radar ECCM Technology: Current TAF surveillance systems (E-3, TPS-43, TPS-[illegible]5) are limited in their ability to detect low observable targets that have reduced radar signatures and sophisticated electronic warfare systems This project develops surveillance radar which will detect and track

00252

Program Element: #0603789F Budget Activity: #2-Advanced Technology Development
PE Title: C3I Technology Development

targets (cruise missiles, high mach missiles, helicopters, etc.), while minimizing the radar's vulnerability to attack. This project develops and demonstrates advanced electronic counter-counter measures to achieve enhanced radar performance in the presence of enemy jamming. This project will develop the technology needed to design an S-Band Surveillance radar antenna that will conform to and be an integral part of the of an aircraft structure, eliminating the need for cumbersome radar domes and pods.

(U) FY 1988 Accomplishments:
- (U) Simulated mixing of advanced conformal array radar data with passive sensor data in a signal processor as a precurson to building an S-Band radar for aircraft use.
- (U) Began modifying the advanced airborne surveillance radar for adaptive bean steering to increase the number of targets that can be detected.
- (U) Began building an advanced S-Band radar with a conformal array that detects and tracks a significantly increased number in an ECM environment.

(U) FY 1989 Planned Program:
- (U) Transition radar Electronic Support Measures for aircraft track correlation to the E-3 AWACS program.
- (U) Transition combined/netted airborne radar technology to improve the E-3 AWACS.

(U) FY 1990 Planned Program:
- (U) Complete initial testing of advanced surveillance radar antenna mainbeam nulling techniques to determine the degree of jamming cancellation available.
- (U) Complete the fabrication of conformal array radar antenna.

(U) FY 1991 Planned Program:
- (U) Deliver the advanced model of the S-band airborne radar that uses a conformal array antenna.
- (U) Demonstrate the advanced S-band radar operating against multiple jammers.

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

(U) Work Performed By: RADC manages this program. Current contractors are General Electric Corporation, Utica, NY; SENSIS Corporation, Manlius, NY;

(U) Related Activities:
- (U) PE 0603617F, C3 Applications
- (U) PE 0602204F, Advanced Avionics for Aerospace Vehicles
- (U) PE 0602702F, C3
- (U) There is no unnecessary duplication within the Air Force or DOD.

(U) Other Appropriation Funds: None.

Program Element: #0603789F Budget Activity: #2-Advanced Technology Development
PE Title: C3I Technology Development

(U) International Cooperative Agreements: None.

2. (U) Project 2335, Communications and Navigation ECCM: Existing Air Force communications systems are vulnerable to hostile interception, jamming and exploitation. Spread spectrum techniques have been used to counter this threat, unfortunately, current spread spectrum systems require large bulky, high power computers that are difficult to maintain. This project is exploiting advanced signal processor architectures and adaptive antenna nulling techniques to provide effective counter-countermeasure capabilities without the spread spectrum limitations.

(U) FY 1988 Accomplishments:
- (U) Delivered advanced air-to-air Extremely High Frequency (EHF) (30GHz to 300GHz) terminal for aircraft installation and inter-flight anti-jam/low probability of intercept (AJ/LPI) communications flight test.
- (U) Demonstrated enhanced AJ/LPI radio capabilities through low data rate voice and adaptive signal processing techniques.

(U) FY 1989 Planned Program:
- (U) Complete development of a Media Resource Controller that embraces current communications capability by adaptively routing messages between tactical control centers over available radio communications systems.
- (U) Complete developing the VHSIC Speech Enhancement Unit and integrate into the Jam Resistant Communications (JARECO) Test bed to demonstrate improved tactical ground communications.
- (U) Complete EHF air-to-air terminals flight test.

(U) FY 1990 Planned Program:
- (U) Define the features and enhancement needed to make the tactical AJ internet a multi-level, multi-media, secure C3I system.
- (U) Complete detailed hardware design and waveform optimization for an AJ/LPI transceiver based on Acoustic Charged Transport (ACT) component. This effort will demonstrate an order of magnitude improvements in AJ radio signal processing.

(U) FY 1991 Planned Program:
- (U) Transition the Media Resource Controller to full scale engineering development for the Tactial Air Control Center.
- (U) Transition the speech enhancement technology to the Integrated Communications, Navigation, Identification Avionics full scale development program.

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

(U) Work Performed By: RADC manages this program. Current contractors are Litton, College Park, MD; Hughes Aircraft, Los Angeles, CA; and Gould, Glen Burnie, MD

Program Element: #0603789F Budget Activity: #2-Advanced Technology Development
PE Title: C3I Technology Development

(U) Related Activities:
- (U) PE 0603617F, C3 Applications
- (U) PE 0602702F, C3
- (U) There is no unnecessary duplication within the Air Force or DOD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

3. (U) Project 2747, Advanced Communication Network Techniques: Current communications networks can not withstand severe enemy electromagnetic jamming or node destruction. This project develops communications network techniques to insure the survivability of command and control capabilities in future threat environments.

(U) FY 1988 Accomplishments:
- (U) Complete software development for the automatic assessment of communications network vulnerability Assessment (CVA) software

(U) FY 1989 Planned Program:
- (U) Complete the design of a methodology for determining inherent vulnerabilities in distributed communications systems.

(U) FY 1990 Planned Program:
- (U) Complete test and evaluation of the communications network methodology software.
- (U) Complete the critical design of an vulnerability assessment multiple network interface controller.

(U) FY 1991 Planned Program:
- (U) Add threat generators to the in-house jammer simulator.
- (U) Complete the vulnerability assessment of the Defense Data Network.

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

(U) Work Performed By: RADC managed program. Current contractors are Harris Corp, Melbourne, FL; Georgia Institute of Technology, Atlanta, GA; Syracuse University, Syracuse, NY.

(U) Related Activities:
- (U) PE 0603617F, C3 Applications
- (U) PE 0602702F, C3
- (U) There is no unnecessary duplication within the Air Force or DOD.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

Program Element: #0603789F Budget Activity: #2-Advanced Technology Development
PE Title: C3I Technology Development

4. (U) Project 2748, Advanced High Frequency Technology: Today's Air Force long haul high frequency (HF) communications have limited data rate and voice capacity and are extremely vulnerable to electro-magnetic threats. This project designs, develops, tests and evaluates advanced HF communications technologies. This projects improves ground and airborne HF communications performance, connectivity and interoperability through advanced signal processing and antenna technologies, and through new HF network management techniques.

(U) FY 1988 Accomplishments:
- (U) Delivered the advanced development model (ADM) of the HF anti-jam modem for test and evaluation.
- (U) Simulated secure, encrypted, digital voice operation using the ADM modem with the Advanced Narrowband Digital Voice Terminal (ANDVT) and the ARC-190 airborne radio.

(U) FY 1989 Planned Program:
- (U) Complete modem laboratory testing.

(U) FY 1990 Planned Program:
- (U) Initiate modem flight tests with the ARC-190 radio.

(U) FY 1991 Planned Program:
- (U) Complete modem flight tests with the ARC-190 radio.
- (U) Transition HF modem to ARC-190 modification full scale development.

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

(U) Related Activities:
- (U) PE 0602702F, C3
- (U) There is no unnecessary duplication within the Air Force or DOD

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

5. (U) Project 3433, Advanced Communications Techniques (LASERCOM): The Air Force needs a long range, very high data rate satellite communications link. Current radio frequency technology cannot meet this requirement due to large antennas, high weight and power consumption, high cost, and poor reliability. This project will develop a brassboard laser communications system. The system will ground demonstrate an inter-satellite data relay capability that can reduce program-unique crosslink proliferation, reduce dependence on vulnerable and expensive overseas relay and tracking stations, and allow satellites to back up the crosslinking roles of other satellites. Follow-on applications will serve airborne or groundbased low probability of intercept and exploitation networks.

Program Element: #0603789F Budget Activity: #2-Advanced Technology Development
PE Title: C3I Technology Development

(U) FY 1988 Accomplishments:
- (U) Completed critical design of LASERCOM system.
- (U) Delivered flight-like laser transmitter.
- (U) Began receiver design and fabrication.

(U) FY 1989 Planned Program
- (U) Complete transmitter/receiver brassboard fabrication.
- (U) Begin fabrication of the LASERCOM brassboard.

(U) FY 1990 Planned Program:
- (U) Integrate high power laser source.
- (U) Develop moderate speed (1-300 Mbps) technology for reduced cost, weight (up to 50 percent), and telescope size (down to 2-3 inches).

(U) FY 1991 Plannned Program:
- (U) Demonstrate fast narrow beam acquisition and two dimensional electonic beam steering.
- (U) Develop ultra-high speed (1-5 Gbps) technology for lightweight power efficient package (less than 200 lb, 200 watts)

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

(U) Work Performed By: Air Force Technology Center,managed program. MIT-Lincoln Laboratories, Hanscom AFB. MA; Perkin-Elmer, Danbury CT does most of the optical subsystem.

(U) Related Activities:
- (U) Program Element #0603250F, Lincoln Laboratory
- (U) Program Element #0603401F, Advanced Spacecraft Technology.
- (U) Program Element #0603605F, Defense Sat Comm Sys (DSCS).
- (U) Program Element #0305110F, AF Satellite Control Network.
- (U) There is no unnecessary duplication within the Air Force or DOD

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603311F
PE Title: Advanced Strategic Missile Systems
Project Number: N/A
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title Advanced Strategic Missile Systems

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Advanced Strategic Missile Systems	129,193	141,768	99,352	99,272	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Advanced Strategic Missile Systems (ASMS) is an ongoing program for technology and advanced development. This Air Force program develops, proves, and applies ballistic missile technology by conducting advanced development for operational intercontinental ballistic missile (ICBM) system applications. Early development work is pursued to gain confidence in engineering feasibility of new technologies and concepts, to insure their readiness for full-scale development, and to provide timely solutions for identified ICBM mission changes and evolving threats. ASMS also conducts intercontinental range flight testing of exploratory reentry vehicles and penetration aid systems. Soviet deployments of mobile ICBM forces, their throwweight advantages, and their capability to field advanced anti-ballistic missile defenses, all point to a need for the United States to be prepared to upgrade the missile force with offsetting advanced weapon systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued advanced development and ground testing of the active decoy.
   - (U) Conducted Antenna Test Vehicle (ATV) flight on a Minuteman I.
   - (U) Completed aircraft-captive flight tests for the terminal fix sensor (TFS).
   - (U) Continued development of radiation hardened parts and advanced IMU.
   - (U) Continued ground testing in the Evader Replica Penetration Aid (ERPA) program and continued optical data collection.
   - (U) Explored advanced guidance concepts.
   - (U) Continued preliminary design effort on earth penetrator weapon.
   - (U) Provided DOD flight test support.
   - (U) Conducted ground testing of pyrotechnics penaid technology.

2. (U) FY 1989 Planned Program:
   - (U) Continue Pyro ground testing and initiate flight test phase.
   - (U) Continue optical data collection activities.
   - (U) Continue definition of concepts for systems to attack strategic relocatable targets.
   - (U) Conduct preliminary efforts to build and test potential candidates for attacking hard, deeply-buried, time-urgent targets.

Program Element: #0603311F Project Number: XXX1
PE Title: Advanced Strategic Missile Systems Budget Activity: #3 - Strategic Programs

- (U) Provide DOD flight test support.
- (U) Flight test maneuvering system technology (MaST) on a Minuteman I.

3. (U) FY 1990 Planned Program:
   - (U) Continue ERPA program with buildup of first Technology Test Vehicle.
   - (U) Continue Earth Penetrating Weapon program and select a concept for possible flight testing.
   - (U) Flight test Technology Development vehicles.
   - (U) Continue development of pyrotechnics penaid technology.
   - (U) Continue radiation hardened parts and advanced inertial measurement unit development.
   - (U) Conclude concept definition program for systems to attack strategic relocatable targets.
   - (U) Continue advanced boost phase guidance technology development.
   - (U) Provide DOD flight test support.

4. (U) FY 1991 Planned Program:
   - (U) Flight test Technology Development vehicles.
   - (U) Continue ERPA program with two flight tests of Technology Test Vehicles.
   - (U) Continue Earth Penetrating Weapon program.
   - (U) Continue radiation hardened parts and advanced inertial measurement unit development.
   - (U) Begin technology development and flight test program for ICBM weapon system to counter strategic relocatable targets.
   - (U) Continue advanced boost phase guidance technology development.
   - (U) Provide DOD flight test support.

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

D. (U) WORK PERFORMED BY: The responsible Air Force agency is the Ballistic Missile Office, Norton Air Force Base, CA. Major contractors include: McDonnell Douglas Astronautics, Huntington Beach, CA (maneuvering reentry vehicle technology); TRACOR Aerospace, Austin, TX (penetration aids); Textron Defense Systems, Wilmington, MA (advanced nosetip testing, optical penetration aids); Acurex Corporation, Mountain View, CA (radar and optical penetration aids); and the Boeing Company, Seattle, WA (integration and launch services). The ASMS program currently maintains contracts with 45 contractors and makes extensive use of Government laboratories.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

Program Element: # 0603311F
PE Title: Advanced Strategic Missile Systems
Project Number: XXX1
Budget Activity: #3 - Strategic Programs

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
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: ASMS is coordinated with activities of Army's Strategic Defense Command; Navy's Strategic Systems Program Office; Defense Advanced Research Projects Agency; Defense Nuclear Agency; Department of Energy, Military Applications; Strategic Defense Initiative Office; Government Laboratories and testing facilities; other agencies associated with ballistic missiles, reentry and penetration technologies, and assessments of basing modes for high survivability and endurance. Efforts are also coordinated with the program in Minuteman Squadrons (Program Element # 0101213F) and the program in ICBM Modernization (Program Element # 0604213F) for development of advanced reentry vehicles, penetration aids systems, advanced missile guidance, and demonstration launches. Efforts to develop an ICBM weapon to attack strategic relocatable targets are coordinated with efforts under Relocatable Target Capability Program (Program Element # 0603367F) through the Strategic Relocatable Targets Planning Group. Tri-Service and intra-Air Force coordination is achieved through annual program reviews and working level exchanges. 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: Not applicable.

J. (U) MILESTONE SCHEDULE: Not applicable since decisions have not been made to pursue full scale development, production, or deployment of these systems.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3368 Relocatable Target (RT) Capability (U)	9,859	19,534	6,398	6,972	Continuing	N/A

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 identify sensors and processing needed to meet this requirement to prosecute the growing Soviet RT threat.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) 3368 Relocatable Target (RT) Capability: This project develops technology to hold RTs at risk in the future. Three initiatives are being pursued: aircraft sensor test and evaluation, automatic target cueing applications, and weapon system operator performance evaluation.

(U) FY 1988 Accomplishments:
- (U) Computer simulations of concepts
- (U) Assessments on target sensor programs and data collection
- (U) Automatic target cueing algorithms

(U) FY 1989 Planned Program:
- (U) Flight test of target sensor candidates
- (U) Data collection and signature analysis
- (U) Auto target cueing development
- (U) Weapon system operator performance testing

(U) FY 1990 Planned Program:
- (U) Continuation of current year evaluations
- (U) Analysis of concept/operation validation results

Program Element: #0603367F Budget Activity: #3-Strategic Programs
PE Title: Relocatable Target (RT) Capability

(U) FY 1991 Planned Program:
- (U) Candidate sensor suite to undergo integration analysis
- (U) Utility study for a coordinated sensor design

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

(U) Work Performed By: Air Force Wright Aeronautical Laboratories, Rome Air Development Center, Aeronautical Systems Division, Human Systems Division, Defense Advanced Research Projects Agency.

(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 #0603260F, Recce Exploration
- (U) Program Element #0602702E, Target Acquisition and Weapons Technology
- (U) The Department of Defense Relocatable Target Steering Committee is insuring 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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Program	To Complete	Total Program
3820 Space Based Surveillance	0	0	4,968	9,928	Continuing	TBD

B. (U) 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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project Number and Title: 3820 Space-Based Surveillance

(U) Fiscal Year 1988 Accomplishments:
- (U) Completed Space Based Radar Concept Exploration studies.
- (U) Developed/validated Statement of Operational Need (SON).
- (U) Developed Draft Mission Needs Statement (MNS).
- (U) Established Joint Program Office Cadre.

(U) Fiscal Year 1989 Planned Program:
- (U) Approve MNS (Favorable Milestone 0 on December 12, 1988).
- (U) Develop Concept Definition Request for Proposal (RFP).
- (U) Resolve international participation/cost-sharing in Concept Definition phase of program.
- (U) Perform requirements analyses and technical/cost/performance tradeoffs and sensitivity analyses.

(U) Fiscal Year 1990 Planned Program:
- (U) Conduct joint Milestone I program review (with Navy).
- (U) Establish a Joint Space-Based Wide Area Surveillance Program Office at Air Force Space Division.
- (U) Conduct competitive source selection and award contracts for Concept Definition and demonstration/validation.

Program Element: #0603428F
PE Title: Space Surveillance Technology

Budget Activity: 3 - Strategic Programs

(U) Fiscal Year 1991 Planned Program:
- (U) Continue Concept Definition and demonstration/validation.
- (U) Develop preferred system concept(s).

(U) Program to Completion:
- (U) Posture for Milestone II Full Scale Development decision in Fiscal Year 1993.
- (U) This is a continuing program.

(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).

Two or more teams will be awarded competitive contracts for Concept Definition. 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.

(U) RELATED ACTIVITIES:
- (U) Air Defense Initiative (ADI), Program Element 0603741D, will partially fund FY 1989 space-based surveillance technology and concept definition efforts. 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. Beginning in FY 1990, no additional ADI funds will be used for space-based surveillance.
- (U) Additional FY 1989/1990 technology/Concept Definition funds may be provided by Nunn Amendment under Space Track, Project 3819 (Space-Based Surveillance), Program Element 0102424F.
- (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.

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

(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.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #064240F
PE Title: B-2 Advanced Technology Bomber
Project Number: N/A
Budget Activity: #3 Strategic Programs

Project Title: Advanced Technology Bomber (ATB)

POPULAR NAME: ATB

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			S/SAR		
Engineering Milestones		First Flight			
T&E Milestones			S/SAR		
Contract Milestones			S/SAR		
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	**Program Total** (To Complete)
Major Contract	S/SAR	1,991,692			
Support Contract	S/SAR	7,000			
In-House Support	S/SAR	10,300			
GFE/ Other	S/SAR	74,700			
Total	S/SAR	2,183,692			

00265

Program Element: #064240F
PE Title: B-2 Advanced Technology Bomber
Project Number: N/A
Budget Activity: #3 Strategic Programs

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

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Details of FY88 and prior are classified S/SAR.

2. (U) FY 1989 Planned Program:
   - (U)
   - (U)
   - (U) Continue facility construction at Whiteman AFB for beddown of the B-2.

3. (U) FY 1990 Planned Program:
   - (U)
   - (U)
   - (U) Continue facility construction at Whiteman AFB for beddown of the B-2.

4. (U) FY 1991 Plannned Program:
   - (U)
   - (U)
   - (U) Continue facility construction at Whiteman AFB for beddown of the B-2.

5. (U) Program To Completion:
   - (U) Required Assets Available (RAA) occurs in FY94
   - (U) Program complete with delivery of 132 aircraft

D. (U) WORK PERFORMED BY: The B-2 program is managed by the B-2 System Program Office, Aeronautical Systems Division, Wright-Patterson AFB, OH. Northrop Corporation, B-2 Division, Pico Rivera, CA is the B-2 prime contractor and has overall integration responsibility for the development and production of the B-2. Boeing Military Airplane Company, Seattle, WA and LTV, Dallas, TX are major subcontractors to Northrop. General Electric Company, Aircraft Engine Group, Cincinnati, OH is responsible for the development of the B-2

Program Element: #064240F
PE Title: B-2 Advanced Technology Bomber
Project Number: N/A
Budget Activity: #3 Strategic Programs

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech			
Sched	Previous descriptive summary classified S/SAR		
Cost			

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES:
2. (U) SCHEDULE CHANGES: Previous descriptive summary classified S/SAR
3. (U) COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC Requirements Document, Mar 85, Classified S/SAR
- (U) B-2 TEMP, Mar 88, Classified S/SAR

G. (U) RELATED ACTIVITIES:
- (U) The aircrew training devices for the B-2 are funded within the B-2 baseline. The aircrew training devices development and procurement costs

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

H. (U) OTHER APPROPRIATION FUNDS:

(TY$ in Millions)	FY88	FY89	FY90	FY91	To Complete
Procurement	S/SAR	3,017.6			TBD
(Quantity)	S/SAR	(4)			
Other Procurement	S/SAR	14			TBD
Military Construction	84	80			TBD
O & M	S/SAR	45			TBD
Personnel	S/SAR	7			TBD

Program Element: #064240F
PE Title: B-2 Advanced Technology Bomber
Project Number: N/A
Budget Activity: #3 Strategic Programs

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
	S/SAR	

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
First Flight	Early 1989	
	Remainder of test program S/SAR	

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604244F Project: 3182
PE Title: SRAM II 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones				MS IIIA Jul	MS IIIB FY92/4 IOC FY93/3
Engineering Milestones	PDR Nov	CDR May			
T&E Milestones			1st Flight Sept	8th Flight May	25th Flight FY 92/3
Contract Milestones				LRIP Jul	FRP LL FY92/3 FRP FY92/4
BUDGET	FY 1988	FY 1989	FY 1990	FY 1991	Program Total
Major Contract	99,032	82,670	55,543	48,050	TBD
Support Contract	28,150	64,000	92,400	103,400	TBD
In-House Support	1,791	9,815	10,496	7,265	TBD
GFE/ Other	10,982	40,533	58,572	54,044	TBD
Total	139,955*	197,018*	217,011	212,759	TBD

* Funds in PE #0603364F, SRAM II Advanced Development

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 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.

00263

Program Element: # 0604244F Project: 3182
PE Title: SRAM II Budget Activity: #3 - Strategic Programs

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:

(U) FY 1988 Program:
- (U) Received approval for full scale engineering development
- (U) Conducted preliminary design reviews on the missile, rocket motor, avionics software, and training equipment
- (U) Began full scale integration testing
- (U) Continued component testing of missile systems and subsystems
- (U) Continued prototype rocket motor test firings

(U) FY 1989 Planned Program:
- (U) Full scale engineering development activities will continue, leading to design completion of the air vehicle, its components and aircraft interface
- (U) Fabrication of flight test missiles will begin
- (U) Flight test plans will be completed

(U) FY 1990 Planned Program:
- (U) FSD activities will begin transition to system level testing of the fully integrated missile
- (U) Delivery of first flight test missile
- (U) Test SRAM II/B1-B integration and incorporate necessary changes
- (U) The first live test launch will be conducted
- (U) Long lead low rate initial production

(U) FY 1991 Planned Program:
- (U) Conduct seven DT&E and eight IOT&E test flights of the missile
- (U) Continue SRAM II/B-1B integration testing and incorporate changes
- (U) Rocket motor preliminary flight rating test complete
- (U) First Avionics Lifetime Durability Tests complete
- (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

(U) Program to Completion:
- (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

Program Element: # 0604244F Project: 3182
PE Title: SRAM II Budget Activity: #3 - Strategic Programs

D. (U) WORK PERFORMED BY: Boeing Aerospace, Seattle, WA, and McDonnellDouglas Astronautics, St. Louis, MO, responded to our request for proposals.Boeing Aerospace was announced as the winner of the competition. 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 FY1988 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

Change	System Capabilities	Schedule	FY 1990 Cost
Tech	None	None	0
Sched	None	None	0
Cost	None	None	0

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: Engineering Change Package (ECP) 10 increased missile diameter by 0.9 inches to accommodate revised warhead weight and dimension envelope. This precludes growth option to 12-missile carriage on the B-1B 180 inch rotary launcher. It does not affect B-1B 10-carry growth potential, nor B-2 carriage requirements.
2. (U) SCHEDULE CHANGES: N/A
3. (U) COST CHANGES: N/A

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

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).
- (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.

Program Element: # 0604244F Project: 3182
PE Title: SRAM II Budget Activity: #3 - Strategic Programs

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

	FY1990 Actual	FY1991 Estimate	Total Program
Missile Procurement, BA 4201			
Funds	10,791	83,228	TBD
Quantities		25	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: None

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Peacekeeper in Minuteman Silo	35,700	40,000	14,766	7,382	13,000	6,430,900
Peacekeeper Rail Garrison	322,847	581,447*	774,244	544,164	228,383	2,859,200
Small ICBM	700,000	250,000	0	0	0	3,072,000
Total	1,058,547	871,447*	789,010	551,546	241,383	12,362,100

* 350,000 withheld

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 Peacekeeper missiles in Rail Garrison.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title Peacekeeper in Minuteman Silo

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Peacekeeper in Minuteman Silo	35,700	40,000	14,766	7,382	18,300	6,430,900

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 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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued flight testing data reduction/analysis and support for Strategic Air Command Follow-on Test and Evaluation flights.
   - (U) Second source contract awarded to Rockwell Autonetics for production of the IMU beginning in FY 1988.

2. (U) FY 1989 Planned Program:
   - (U) Deployment of the 50th Peacekeeper in Minuteman Silos scheduled for December 1988.
   - (U) RDT&E required to accomodate changes identified during completion of deployment or as result of flight test data analysis.
   - (U) RDT&E for nuclear hardness testing and engineering support.
   - (U) Flight Test 18 - 1Q/CY 1989
   - (U) Flight Test 19 - 1Q/CY 1989
   - (U) Flight Test 20 - TBD

3. (U) FY 1990 Planned Program:
   - (U) Program Management Responsibility Transfer
   - (U) Continue Simulated Electronic Launch Peacekeeper (SELP) program
   - (U) Continue Specific Force Integrating Receiver (SFIR) improvement effort

4. (U) FY 1991 Planned Program:
   - (U) Continue Simulated Electronic Launch Peacekeeper (SELP) program

5. (U) Program to Completion:
   - (U) Missile production is projected to continue through FY 2004.

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: #3 - Strategic Programs

D. (U) WORK PERFORMED BY: The program is managed by the Ballistic Missile Office, 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, Anaheim, CA (Guidance and Control); Northrop Electronics Division, Hawthorne, CA (Inertial Measurement Unit); and Textron, Wilmington, MA (Reentry Vehicle/Reentry System).

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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)

G. (U) RELATED ACTIVITIES: Peacekeeper in Minuteman Silo Program is related to Program Element # 0101215F (Peacekeeper Squadrons) for Airborne Launch Control Center Modifications and to Program Element # 0101215F (Peacekeeper Squadrons) for Flight/Ground Test Support. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
- (U) Aircraft Procurement, BA 4						
Funds	21,065	0	0	0	0	
Quantity	6	N/A	N/A	N/A	0	
- (U) Missile Procurement, BA 4						
Funds	873,653	796,587	1,142,200	992,068	TBD	TBD
Quantity	12	12	12	12	97	235

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: #3 - Strategic Programs

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
- (U) Military Construction, BA Funds	5600	0	0	0		

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

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	II-05/88		III-04/90		IOC-4Q91; FOC-2Q94
Engineering Milestones	FSD-05/88; SDR-09/88; EIS-12/88	PDR-05/89	CDR-03/90		
T&E Milestones				1ST BVM-03/91	
Contract Milestones	MLC-05/88; LCS-05/88				
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	172,747	88,600 (345,000)	364,244	250,164	898,755 (92,600)
Support Contract	40,900	81,400 (83,200)	189,000	104,000	441,700 (22,000)
In-House Support	32,800	17,500 (56,400)	71,000	59,000	201,200 (53,000)
GFE/ Other	76,400	62,500 (115,400)	150,000	131,000	439,600 (107,000)
Total	322,847	250,000 + 350,000 withheld	774,244	544,164	2,859,200 (274,600)

00277

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:

FY 1988 Accomplishments:
- (U) Completed stationary vibration test, track launch load testing, shock tube testing, and Source Region Electromagnetic Pulse (SREMP) subsystem testing.
- (U) Entered Full Scale Development.
- (U) Conducted Defense Acquisition Board (DAB) Milestone II Review.
- (U) Awarded missile launch car contract, launch control contract, and BT&SS contract.
- (U) Completed Draft Environmental Impact Statement (EIS) and held public hearings.
- (U) Completed phases I and II of track characterization.
- (U) Conducted System Design Review of all subsystems and support equipment.

FY 1989 Planned Program:
- (U) Conduct system level SREMP, phase II land navigation, car assembly, launch, and rail car/train dynamics testing programs.
- (U) Continue prototyping of systems.
- (U) Conduct Preliminary Design Reviews.
- (U) Fabricate engineering models for developmental testing and initial system integration testing.
- (U) Release final EIS.
- (U) Construct facilities to test Rail Garrison concept at Vandenberg AFB.

FY 1990 Planned Program:
- (U) Conduct Critical Design Reviews.
- (U) DAB Milestone III Review.
- (U) Initiate systems testing at Vandenburg AFB.
- (U) Complete Phase II canister and launch testing program.
- (U) Complete Phase IIA and IIB land navigation testing.
- (U) Perform rail car and train dynamics testing.
- (U) Perform system SREMP testing.
- (U) Perform Launch Control Car/Missile Launch Car system integration tests.
- (U) Perform Missile Launch Car/locomotive system integration tests.
- (U) Perform Guidance & Control integration tests.
- (U) Achieve initial production capability of missile trains.
- (U) Construct facilities at F.E. Warren AFB.
- (U) Continue development of a dual frequency Minimum Essential Emergency Communications Network (MEECN) receiver

Program Element: #0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

FY 1991 Planned Program:

- (U) Continue subsystem and system developmental testing using engineering and initial operational models.
- (U) Launch first Basing Verification Missile (BVM).
- (U) Perform High Altitude Electromagnetic Pulse (HEMP) testing.
- (U) Award rail car production contract.
- (U) Complete development of a dual frequency MEECN receiver.

Program to Completion:

- (U) Conduct remaining BVM launches.
- (U) Achieve Initial Operational Capability (IOC) in June 1992.
- (U) Achieve Full Operational Capability (FOC) in June 1994.

D. (U) WORK PERFORMED BY: The program is managed by the Ballistic Missile Office, Norton Air Force Base, CA. Facilities at the Rail Transportation Test Center 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); the Missile Launch Car (MLC) contract was awarded to Westinghouse Electric in May 1988; the Launch Control System (LCS) contract was awarded to Rockwell Autonetics in May 1988; Peacekeeper aeronautical vehicle equipment contractors will provide missile components.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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, Nov 88 (U)
- (U) DCP, Mar 88 (S)
- (U) STAR, Mar 88 (S)
- (U) ILSP, Mar 88 (U)
- (U) TEMP, Apr 88 (S)

Program Element: # 0604312F
PE Title: ICBM Modernization
Project Number: N/A
Budget Activity: 3 - Strategic Programs

G. (U) RELATED ACTIVITIES: This program is related to Program Element # 0101215F (Peacekeeper Squadrons) for Airborne Launch Control Center Modifications, to Program Element # 0101215F (Peacekeeper Squadrons) for Flight/Ground Test Support, to Program Element # 0101215F (Peacekeeper Squadrons) for Peacekeeper missile production (shared), and to Program Element # 0604312F (ICBM Modernization) for Peacekeeper in Minuteman Silo missile development (shared). PE 0303131F, Minimum Essential Emergency Communications Network contains FY 89 development funding for dual frequency MEECN receiver.
There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
- (U) Missile Procurement, BA 4, PE 0101215F						
Funds	0	0	222,606	1,337,539	TBD	TBD
- (U) Military Construction, BA __, PE 0101215F						
Funds	0	0	204,950	302,340	132,400	639,690
- (U) Military Construction, BA __, PE 0808741F						
Funds	0	0	0	7,700	9,500	17,200
- (U) Military Construction, BA __, PE 0901211F						
Funds	0	13,200	14,150	14,760	14,600	83,110

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

FY 1990/FY 1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604361F Budget Activity: #3-Strategic Programs
PE Title: Air-Launched Cruise Missile

A. (U) RESOURCES ($ in thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ALCM	3,410	953	1,347	0	0	1,158,706

B. (U) BRIEF DESCRIPTION OF ELEMENT: 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. This forces the Soviets to devote substantial resources to their national air defenses to counter the threat of increased number of strategic weapons in our forces in the near term. This fact should convince the Soviets that their massive air defense efforts will not substantially blunt U.S. air breathing strike capabilities.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) ALCM: This project involves developing, integrating, and testing the capability to carry ALCM and the Short-Range Attack Missile (SRAM) onboard the B-1B aircraft. Initially, ALCMs will be carried on B-52G/H aircraft on external pylons and internally on launchers (B-52G external only, B-52H both external & internal). The B-1B aircraft will also be capable of carrying cruise missiles internally.

(U) FY 1988 Accomplishments:
- (U) Provided SAC with Operational Test Launch mission plan capability.
- (U) Developed mission planning terrain following altitude test.
- (U) Developed the ALCM/SRAM Operational Test Launch Test Set.
- (U) Revised mission planning software for navigation accuracy module.
- (U) Completed update of the missile software (new radar altimeter).
- (U) Initiated final phase of B-1B integration flight tests.
- (U) Completed Electronics System Test Set (ESTS) integration.

Program Element: #0604361F Budget Activity: #3-Strategic Programs
PE Title: Air-Launched Cruise Missile

(U) FY 1989 Planned Program:
- (U) Continue ALCM/B-1B internal certification.
- (U) Continue to develop, integrate/test mission planning improvements.
- (U) Continue incorporation of missile software changes.
- (U) Revise the mission planning software for navigation accuracy module.

(U) FY 1990 Planned Program:
- (U) Complete all mission planning improvements.
- (U) Complete all missile software changes.

(U) FY 1991 Planned Program: Not Applicable. Program completed in FY 1990.

(U) Program to Completion: Not Applicable.

(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 Navy Cruise Missiles Project Office (PDA-14). The AGM-86B ALCM R&D is managed by Aeronautical Systems Division, WPAFB OH.

(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 commonality in engine/navigation/guidance subsystems. The ALCM and SLCM share the common W-80 nuclear warhead developed by DOE. The B-52 Squadrons, PE 0101113F, relate to ALCM since the B-52 is the current cruise missile carrier.

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

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

	FY 1988 Prior	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(U) Missile Procurement	2,587,800	0	0	0	0	2,587,800
(Qty)	(0)	(0)	(0)	(0)	(0)	(1715)
(U) Military Construction	0	4,800	0	0	0	275,400

(U) Department of Energy*

(U) W-80 warhead cost based upon warheads.

(U) International Cooperative Agreements: This Technical Arrangement, signed 14 Feb 84 (revised 20 Feb 87), concerns authorization of overflights of the AGM-86B Air-Launched Cruise Missile (ALCM) over Canadian territory.

00282

FY 1990/FY 1991 BIENNIAL BUDGET 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3429 B-1B EMP Test	7,588	5,340	2,700	0	0	20,128
3763 S/V Assessment of Aerospace Systems	3,879	2,951	4,975	8,743	Continuing	N/A
TOTAL	11,467	8,291	7,675	8,743	Continuing	N/A

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3429 - B-1B EMP Test: Supports the EMP Design Verification Test (DVT) of the B-1B. Objectives of the test: to verify EMP design specifications, design implementation and safety margins; to establish an hardness maintenance/hardness surveillance (HM/HS) baseline for the B-1B maintenance concept; and to provide data to evaluate EMP hardening designs for future aircraft.

   (U) FY 1988 Accomplishments:
   - (U) Completed Phase I of the EMP DVT on a B-1B at the Air Force Weapons Laboratory at Kirtland Air Force Base, New Mexico (KAFB, NM).
   - (U) Completed planning and preparation for the Phase II test.
   - (U) Started phase II test on a B-1B production model at the Air Force high level EMP simulators, including the TRESTLE, at KAFB, NM to verify EMP design integrity.

Program Element: #0504711F Budget Activity: #3-Strategic Programs
PE Title: System Survivability (Nuclear Effects)

(U) FY 1989 Planned Program:
- (U) Complete the Phase II test and analyze test data
- (U) Begin planning for the 1990 Phase III retest.

(U) FY 1990 Planned Program:
- (U) Conduct the Phase III retest, examining EMP protection features at selected points on the Phase II test aircraft, measuring degradation, if any, of selected EMP protection features after two years ofaircraft operation and maintenance.
- (U) Analyze the Phase III test data to support the hardness maintenance baseline for the B-1B fleet.

(U) Work Performed By: The project is managed by the Aeronautical Systems Division B-1B System Program Office. Primary civilian contractors: North American Aviation Operation, Rockwell International, Los Angeles, CA; Boeing Military Aircraft Company, Seattle, WA; and Aircraft Engine Group, General Electric Corporation, Evandale, OH.

(U) Related Activities:
- (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.

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

(U) International Cooperative Agreements: Not Applicable

2. (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 1988 Accomplishments
- (U) Prototyped subsystem test equipment on a B-1B aircraft.
- (U) Applied the cable shield tester to provide quality checks on the Common Strategic Rotary Launcher production line.
- (U) Demonstrated the CW tester and transferred the technology to Oklahoma City Air Logistics Center (OC-ALC).

Program Element: #0604711F Budget Activity: #3-Strategic Programs
PE Title: System Survivability (Nuclear Effects)

(U) FY 1989 Planned Program
- (U) Complete development of the hand-held cable shield tester and transfer the technology to OC-ALC.
- (U) Start efforts to develop methods to diagnose unseen faults in aircraft EMP protection features for use by maintenance depots.

(U) FY 1990 Planned Program:
- (U) Complete upset testing of the inertial navigation system
- (U) Complete development of upset tolerant design techniques

(U) FY 1991 Planned Program:
- (U) Begin development of more realistic direct drive waveforms
- (U) Resume work on EMP standards and specifications, developing interim level standards

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

(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 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

NOTE: Picture is SECRET/SAR

(U) POPULAR NAME: ACM

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					
Engineering Milestones					
T&E Milestones					
Contract Milestones					
BUDGET ($000)	**FY 1988**	**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract	67,218	6,624			
Support Contract	29,398	49,962			
In-House Support	19,583	11,348			
GFE/ Other	30,511	29,510			
Total	146,711	96,950			

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

B. (U) 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 a

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

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments

- (U) Physical Configuration Audit Completed
- (U) Second Source Technology Transfer Completed
- (U) Second Source Qualification Begun
- (U) First Production Missile Delivered
- (U) Variant Risk Reduction Initiated

2. (U) FY 1989 Plan

- (U) Complete B-52 Qualification
- (U) Begin FOT&E
- (U) First Second Source Flight Test
- (U) Complete B-1B Environmental Qualification
- (U)

3. (U) FY 1990 Plan

- (U) Continue B-52 Integration
- (U) Initial Operational Capability
- (U) First Second Source Production Missile Delivery
- (U)

4. (U) FY 1991 Plan

- (U)

5. (U) Program Plan To Completion

- (U) PMRT (IOC + 2 Years)
- (U) Final Missile Delivery (FY 1996)

Program Element: #0101120F
PE Title: Advanced Cruise Missile

Project Number: N/A
Budget Activity: #3 Strategic

D. (U) WORK PERFORMED BY:

- (U) CONTRACTORS:

(U) 1. General Dynamics / Convair	San Diego, CA	Prime
(U) 2. McDonnell Douglas Astronautics	St. Louis, MO	Second Source
(U) 3. Williams International	Walled Lake, MI	Engine
(U) 4. Boeing Military Airplanes	Seattle, WA	B-52 integration
(U) 5. North American Rockwell	Los Angeles, CA	B-1 integration

Programs

- (U) MAJOR IN-HOUSE ORGANIZATIONS:

1. (U) ACM SPO (ASD/VC)	Wright Patterson AFB, OH
2. (U) Propulsion SPO (ASD/YZ)	Wright Patterson AFB, OH
3. (U) Air Force Flight Test Center	Edwards AFB, CA

E. (U) COMPARISON WITH FY88/89 DESCRIPTIVE SUMMARY:

	FY88	FY89	FY90	FY91	To Complete
(U) FY88/89 REQUEST	146,711	97,444			
(U) CURRENT REQUEST	146,711	97,444			
(U) DELTA	0	0			

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
(U) TECH	Adds capability	None	

NARRATIVE DESCRIPTION OF CHANGES:

(U)

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

F. (U) PROGRAM DOCUMENTATION:

	TYPE OF DOCUMENT	DATE
(U)	SAC Statement of Need	Aug 82
(U)	Program Baseline	May 84
(U)	LRIP (Sufficiency Review)	Jul 86
(U)	Statement of Need	Mar 87
(U)	ACM ILSP	Oct 87
(U)	ACM TEMP	Mar 88

G. (U) RELATED ACTIVITIES:

(U) PE #11101Z B-52 ACMI

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

H. (U) OTHER APPROPRIATION FUNDS:

		FY88	FY89	FY90	FY91	To Complete
(U)	3010 A/C Procurement	1,000	1,093			
(U)	3020 Missile Procurement	367,560	0			

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

(U) NONE.

J. (U) TEST AND EVALUATION DATA:

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

(U) Event	Date	Results
(U) B-52 Free Flights	Ongoing	
(U) B-52 Captive Carries	Ongoing	
(U) B-1B Jettison Tests	Ongoing	
(U) B-1B Captive Carries	Ongoing	
(U) Missile Environmental Testing	Ongoing	
(U) Functional Ground Testing	Ongoing	

00289

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

(S) T&E ACTIVITY (TO COMPLETION)

(U) Event	Planned Date	Results
(U) B-52 Free Flights		
(U) B-52 Captive Carries		
(U) B-1B Captive Carries		
(U) B-1B Jettison Tests		
(U) Functional Ground Testing		
(U) Drop Test Article Demonstration		
(U) Demonstration		
(U) Second Source Qualification Testing		
(U) B-1B Free Flights		

00290

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2214 Improved Aerial Refueling System (IARS) (U)	3,979	3,161	2,203	3,533	Continuing	N/A

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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

(U) FY 1988 ACCOMPLISHMENTS:
- (U) Design/development and production of refueling coupling insert.
- (U) Developed KC-135 Performance Interface Document.

(U) FY 1989 Planned Program:
- (U) Conduct KC-135R Low Altitude Air Refueling (LAAR) test.
- (U) Conduct KC-135R Wing Pod hose/drogue system demonstration.
- (U) Develop a Master Plan for the KC-135R Avionics Modernization Program (AMP).
- (U) Continue KC-135 Performance Interface Document.

(U) FY 1990 Planned Program:
- (U) Continuation of FY 1989 developments to include the Wing Pod and AMP programs.
- (U) Conduct Improved Boom Nozzle Light program.

(U) FY 1991 Planned program:
- (U) Continuation of AMP.
- (U) Conduct Improved Boom and Boom Operator Station Study.
- (U) Develop an Improved Refueling Nozzle.

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

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

(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:
- (U) A MOU is being developed with the French Ministry of Defense to allow them to participate in the hose/drogue refueling pod program.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
REACT	44,545	59,678	100,910	40,632	28,353	230,030

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. This project 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/Peacekeeper Launch Control Centers (LCCs) and their associated trainers, correcting 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 (WCS) provides significantly increased system capacity. The new console with dual workstations meets the legislative requirement for console commonality between Minuteman and all other LCCs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Began Systems Requirement Analyses for the REACT program.
   - (U) Updated the Category IV cost estimate.

2. (U) FY 1989 Planned Program:
   - (U) Begin process of REACT initial hardware and software development for LCC integration, rapid message processing, and rapid retargeting of ICBMs.
   - (U) Award the REACT full-scale development contract and begin designs leading to the Systems Design Review.

3. (U) FY 1990 Planned Program:
   - (U) Continue REACT hardware and software development through the preliminary design review.

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.

4. (U) FY 1991 Planned Program:
   - (U) Begin certification of first REACT Minuteman configurations at the Critical Design Review.
   - (U) Conduct source selection and award contracts for production of the first configuration.

5. (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: Contracts have not yet been awarded. The responsible Air Force agency is Air Force Systems Command's Ballistic Missile Office, Norton Air Force Base, CA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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 Targeting, 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: There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
- (U) Missile Procurement, BA 4						
Funds	0	0	0	97,646	205,822	303,468
Quantity	N/A	N/A	N/A	N/A	N/A	N/A

Program Element: # 0101213F
PE Title: Minuteman Squadrons

Project Number: 133B
Budget Activity: #3 - Strategic Programs

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

J. (U) MILESTONE SCHEDULE:

- (U) FSD Contract award	Apr 1989
- (U) ICBM REACT Kit Installation Begins	FY 1993
- (U) ICBM REACT Installation Complete	FY 1995

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Post Attack Command and Control System	927	1204	1186	1245	Continuing	TBD
TOTAL	927	1204	1186	1245	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: To provide a survivable command and control capability for the Single Integrated Operations 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) PROGRAM ACCOMPLISHMENTS AND PLANS: 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 1988 Accomplishments:
- (U) Initiated contract for major system test in FY 1990
- (U) Published plan for hardness maintenance/hardness surveillance
- (U) Continued survivability/vulnerability analysis of acquisition and modification programs

(U) FY 1989 Planned Program:
- (U) Continue planning activities, acquire long lead items for FY 1990 system test
- (U) Conduct 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

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

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

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

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0101313F Project: 3769
PE Title: War Planning ADP - SAC Budget Activity: #3 - Strategic Programs

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

Project Title / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SAC War Planning ADP						
Strategic Mission Data Preparation System (SMDPS)	20,321	15,168	13,811	15,779	TBD	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The War Planning Automated Data Processing (ADP) effort for the Strategic Air Command (SAC) focuses on the maintenance and modernization of the ADP equipment, software and communications links used for planning and executing the strategic bomber, intercontinental ballistic missile (ICBM) and sea launched ballistic missile (SLBM) components of the nuclear TRIAD.

This requirement applies equally to conventional wartime missions. The SMDPS project complements an ongoing upgrade to the force level war planning ADP. It will ensure the automated mission planning support equipment for strategic bomber platforms and weapons are fully integrated within the new hardware and software architecture of the Strategic War Panning ADP. This effort consolidates several independent mission planning efforts within ongoing strategic bomber/weapon acquisition programs (B-52, B-1B, B-2, Air Launched Cruise Missile, Advanced Cruise Missile, TACIT RAINBOW, Short Range Attack Missile II and other programs). The principal objective is to ensure that all of these programs will be compatible with SAC's new War Panning ADP. The common automated hardware and software architecture will facilitate system interoperability and decrease total acquisition costs for future weapon systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Boeing Military Airplane (BMA) is on contract under the SMDPS Phase II effort to develop, test and deliver annual updates to the existing mission planning software. These updates complement ongoing changes in the operational flight software for the B-52, B-1B, Advanced Cruise Missile (ACM) and Air Launched Cruise Missile (ALCM).
   - (U) BMA developed and delivered Tape 6, which incorporated the new Integrated Conventional Stores Management System (ICSMS) capability for gravity weapons and B-1B defensive system improvements.
   - (U) BMA also began development of Tape 7.

Program Element: # 0101313F Project: 3769
PE Title: War Planning ADP - SAC Budget Activity: #3 - Strategic Programs

- (U) BMA is managing the transition to SMDPS Phase III, the new standardized nuclear mission planning software and hardware architecture.
- (U) The Conventional Mission Planning and Production System (CMPPS), which is also tailored to the new mission planning hardware, completed both Preliminary and Critical Design Reviews.

2. (U) FY 1989 Planned Program:
   - (U) BMA will deliver SMDPS Phase II Tape 7, which incorporates ACM and B-1B defensive system updates, in April, following a year long development and test effort. This development is a sequential process which begins with software coding, transitions to the merging of individual software modules/initial integration testing, followed by iterative recoding/retesting of the software and culminates in a final "end-to-end" software verification test.
   - (U) BMA will begin development of Tape 8 upon delivery of Tape 7. Tape 8 will support SRAM II flight test activities.
   - (U) SMDPS Phase III effort will focus on managing the program to rehost existing Phase II software onto the new ADP hardware and developing the Interface Control Documents to integrate new weapon systems (SRAM II, B-2, other programs) into this new architecture.
   - (U) CMPPS will deliver the first ICSMS tape for the new ADP hardware and continue support for the integration and testing of additional weapons (TACIT RAINBOW and other programs).

3. (U) FY 1990 Planned Program:
   - (U) BMA will complete development of Tape 8 and begin development of Tape 9. Tape 9 will incorporate B-1B defensive avionics updates.
   - (U) SMDPS Phase III transition effort will support the procurement and delivery of new automated mission planning equipment to SAC bomber bases beginning in FY 1990.
   - (U) CMPPS will deliver a test tape to support integration and testing of additional conventional weapons.

4. (U) FY 1991 Planned Program:
   - (U) SMDPS Phase II effort will be completed with delivery of Tape
   - (U) SMDPS Phase III effort will continue the transition to new mission planning equipment at SAC bomber bases. It will incorporate ongoing changes to existing mission planning software driven by changes in weapon system software (ALCM, B-1B defensive avionics, ACM). It will continue to support the B-2 and SRAM II flight test programs.
   - (U) CMPPS will deliver a tape which incorporates TACIT RAINBOW and other conventional weapons.

Program Element: # 0101313F Project: 3769
PE Title: War Planning ADP - SAC Budget Activity: #3 - Strategic Programs

5. (U) Program to Completion:
   - (U) SMDPS Phase III will complete the transition to a common automated mission planning architecture in FY 1992. It will incorporate fact-of-life changes in mission planning software and will support the integration of developing strategic weapon systems (B-2, SRAM II) until each system achieves its respective initial operational capability (IOC) milestone.

D. (U) WORK PERFORMED BY: The primary contractor for integrating the conventional strategic weapons mission planning requirements is Boeing Military Airplane of Wichita, Kansas. BMA is also on contract to support the transition to the new mission planning architecture concurrent with integrating new strategic weapon systems.

E. (U) COMPARISON WITH FY1988 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

Change	System Capabilities	Schedule	FY 1990 Cost
Tech	None	None	0
Sched	None	None	0
Cost	None	None	0

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: N/A
2. (U) SCHEDULE CHANGES: N/A
3. (U) COST CHANGES: N/A

F. (U) PROGRAM DOCUMENTATION: SAC SON 13-87, SECRET, Feb 1988

G. (U) RELATED ACTIVITIES:
   - (U) This project consolidates the automated war planning support efforts within numerous strategic programs. These programs 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.

Program Element: # 0101313F Project: 3769
PE Title: War Planning ADP - SAC Budget Activity: #3 - Strategic Programs

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

	FY1990 Actual	FY1991 Estimate	Total Program
Other Procurement			
Funds	24,100	24,500	TBD
Quantities	12	12	49

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

1. (U) CMPPS Contract Award	Dec 87
2. (U) SMDPS Phase III Contract Award	Apr 88
3. (U) SMDPS Phase III IOC	Jan 90
4. (U) SMDPS Phase II Completion	Apr 90
5. (U) CMPPS IOC	Special Access Required

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3876	Communications System Segment-Replacement (CSS-R)					
	26,713	38,884	47,754	19,720	Cont	TBD
3877	Granite Sentry					
	17,309	18,368	9,816	20,568	Cont	TBD
3878	Survivable Communications Integration System (SCIS)					
	11,845	12,368	4,275	4,759	Cont	TBD
3879	Command Center Processing and Display System Replacement (CCPDS-R)					
	* 29,050	* 26,417	35,423	36,241	Cont	TBD
3880	Space Defense Operations Center (SPADOC)					
	** 26,226	** 22,540	18,354	18,486	Cont	TBD
3881	Integrated TW/AA System					
	*** 2,226	*** 2,521	2,698	2,795	Cont	TBD
TOTAL	109,496	123,620	118,320	102,569	Cont	TBD

* In PE 12436F, Command Center Processing and Display System

** In PE 12311F, NCMC Space Defense Systems

*** In PE 12313F, Ballistic Missile TW/AA Systems

B. (U) BRIEF DESCRIPTION OF ELEMENT: The FY89 Appropriations Bill directed the Defense Acquisition Board to consolidate the individual computer upgrades at Cheyenne Mountain Complex (included in four different PE's) into a single integrated program. All appropriations in PE 12311F, NCMC Space Defense Systems, and PE 12436F, Command Center Processing and Display System, as well as RDT&E

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System
Budget Activity: #3 - Strategic Programs

appropriaions from PE 12313F, Ballistic Missile TW/AA Systems, have been moved to PE 12310F, renamed "CMC TW/AA Systems." PE 12310F funds the replacement systems for the TW/AA command, control, and communications (C^3) system centralized within the Cheyenne Mountain Complex (CMC). This replacement program is designed to incrementally upgrade and replace the current operational systems and facilities in accordance with the Joint Chiefs of Staff approved Integrated TW/AA architecture which responds to a flexible, coordinated, (missile, space, and air) threat. An integrated systems approach will provide survivable, correlated processing of threat events, standard processing and displays for users, and a capable alternate TW/AA Correlation Center. This program is divided into the following six major efforts: (1) the Communications System Segment-Replacement (CSS-R) subsystem which will replace current computers and software that process all communications into and out of the CMC; (2) Granite Sentry which will provide a replacement for the NORAD Command Post facility and will modernize supporting computers and software in the Air Defense Operations Center, the Battle Staff Support Center, and the Weather Center; (3) the Survivable Communications Integration System (SCIS) which will provide for the transmission of pre-attack and trans-attack survivable communications from missile warning sensors, the receipt at and transmission from the CMC and Offutt Processing and Correlation Center (OPCC), and the receipt at other designated command centers; (4) the Command Center Processing and Display System-Replacement (CCPDS-R) which will purchase new hardware and software to replace the CCPDS (missile warning processor) at CMC, Headquarters Strategic Air Command (SAC) Command Post, National Military Command Center (NMCC), and the alternate NMCC and will acquire computer hardware and software for the OPCC; (5) the Space Defense Operations Center Phase 4 (SPADOC IV) project which will provide new computer hardware and software to automate the SPADOC's assessment and warning functions and to improve the capability to perform space surveillance functions; (6) and the Integrated TW/AA System project which will provide the management framework through which the Air Force applies coordinated oversight of the acquisition and interface of all programs comprising the integrated TW/AA system. These projects will provide the Commander-In-Chief, United States Space Command (USCINCSPACE), the National Command Authorities, the Joint Chiefs of Staff, and other commanders with timely and reliable C^3 systems which are capable of meeting the TW/AA needs of the United States into the next century.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System
Project Number: 3876
Budget Activity: #3 -Strategic Programs

A. (U) RESOURCES ($ In Thousands)
Project Title: Communications System Segment-Replacement

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
CSS-R	26,713	38,884	47,754	19,720	Cont.	TBD

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

The Cheyenne Mountain Complex (CMC) upgrade and replacement of TW/AA systems will provide automated and modularized computer based systems. One of the major efforts involved is the CSS-R, a program for the design, procurement, installation, and testing of hardware and software to replace the existing CSS in the CMC. The CSS-R will handle message processing, formatting, technical control, line code conversion and routing of internal and external messages. The CSS-R will improve reliability, maintainability, capacity, and flexibility of the CSS through installation of up-to-date comm processing which provides distribution of data between the CMC mission areas (ballistic missile, air, and space) and external sensors and users.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Block 1 completed formal qualification testing (FQT).
- (U) Block 2 completed system Preliminary Design Review (PDR)
- (U) Continued software development in preparation for Critical Design Review (CDR) in FY 1989.

(U) FY 1989 Planned Program:
- (U) Block 2 will begin hardware/software integration
- (U) Complete software development, conduct two progress demonstration tests.
- (U) Conduct CDR

(U) FY 1990 Planned Program:
- (U) Complete hardware/software integration and in-plant FQT.
- (U) Begin initial installation and checkout (I&CO) in the Test Development and Training Center (TDTC).
- (U) Conduct TDTC testing for Block 2.
- (U) Begin site surveys and preparation of CMAFS for Blocks 1 & 2 installation.

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System
Project Number: 3876
Budget Activity: #3 -Strategic Programs

(U) FY 1991 Planned Program:
- (U) Complete testing in the TDTC
- (U) Complete I & CO in the Cheyenne Mountain Complex (CMC).
- (U) Complete Operational test and evaluation (OT&E).
- (U) Declare Initial Operational Capability.

(U) Program to completion:
- (U) This is a continuing project.
- (U) CSS-R will achieve Final Operational Capability (FOC) during 3QTR FY 1992.

D. (U) WORK PERFORMED BY: CSS-R is managed by Air Force Systems Command's (AFSC) Electronic Systems Division (ESD), Hanscom AFB, MA. Prime contractor is GTE, Needham, MA. Technical support is provided by MITRE, Bedford, MA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-0-
Schd	None	None	-0-
Cost	None	None	-0-

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: None
3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) ADCOM SON 1-81, Dec 81
- (U) SRD, Jan 82

G. (U) RELATED ACTIVITIES:
- (U) PE 0102423F, Ballistic Missile Early Warning System.
- (U) PE 0102424F, SPACETRACK

Program Element: #0102310F Project Number: 3876
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: #3 - Strategic Programs

- (U) PE 0102432F, Sea Launched Ballistic Missile Early Warning System (Pave Paws).
- (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:

Milestones	Dates
Concept Definition Contract Award	Jul 83
Development Contract Award	Jun 84
Block 1 PDR	Dec 84
Block 1 CDR	Jul 85
Block 2 Start	Feb 87
Block 2 PDR	Aug 88
Block 2 CDR	Jan 89
IOC	FY 91
FOC	FY 92

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F Project Number: 3877
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)
Project Title: Granite Sentry

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Granite Sentry	17,309	18,368	9,816	20,568	Cont	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Granite Sentry will provide a replacement for the North American Aerospace Defense Command (NORAD) Command Post (NCP) facility and modernize supporting computers and software in the Air Defense Operations Center (ADOC), the Battle Staff Support Center, and the Weather Center. It stresses commonality in order to reduce the cost of operations, training, and maintenance by using common processor hardware, workstations, and display devices. Granite Sentry replaces the outdated existing system with modular operator's stations consisting of available off-the-shelf (COTS) components. Granite Sentry will display integrated missile, space and air TW/AA information in the NCP and generate correlated output messages to forward users.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Conducted a Critical Design Review (CDR) and completed coding for the Air Defense Operations Center (ADOC) upgrade.
- (U) Conducted Software Specification Review (SSR) and System Design Review (SDR) for the NORAD Command Post (missile warning) upgrade.

(U) FY 1989 Planned Program:
- (U) Complete ADOC upgrade development, test and evaluation (DT&E) and operational test and evaluation (OT&E).
- (U) Declare initial operational capability (IOC) for ADOC.
- (U) Conduct PDR, CDR and complete coding for the NORAD Command Post (missile warning) upgrade.

(U) FY 1990 Planned Program:
- (U) Complete DT&E, OT&E and declare IOC for the NORAD Command Post (missile warning) upgrade.
- (U) Conduct System Requirements Review (SRR) and Software Specification Review (SSR) for the NORAD Command Post (space defense) upgrade.

Program Element: #0102310F Project Number: 3877
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: #3 - Strategic Programs

(U) FY 1991 Planned Program:
- (U) Complete DT&E, OT&E and declare IOC for the NORAD Command Post (space defense) upgrade.
- (U) Begin transition of completed systems to the newly operational Communications System Segment-Replacement (CSS-R).

(U) Program to completion:
- (U) This is a continuing project.
- (U) Battle Staff Support Center (BSSC) upgrade and Weather Center upgrade will reach IOC during 1QTR FY 1994.
- (U) System final operational capability (FOC) will occur during 4QTR FY 1994.

D. (U) WORK PERFORMED BY: Granite Sentry is managed by Air Force Systems Command's (AFSC) Electronic Systems Division (ESD), Hanscom AFB, MA. Technical support is provided by Computer Technology Associates (CTA), Burlington, MA. The development hardware contractor is Digital Equipment Corporation (DEC), Colorado Springs, CO. Air Force Space Command is developing application software with the assistance of Martin Marietta Corporation, Englewood, CO. under ESD management. Systems engineering is provided by MITRE, Bedford, MA.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-0-
Schd	None	None	-0-
Cost	Cost	None	-0-

1. Technical Changes: None
2. Schedule Changes: None
3. Cost Changes: None

F. (U) PROGRAM DOCUMENTATION:
- (U) AFSPACECOM SON 03-84, Granite Sentry, Jun 85

Program Element: #0102310F Project Number: 3877
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: #3 - Strategic Programs

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

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Other Procurement (BA 63)	2,270	4,328	3,711	6,887	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

Milestones	Dates
FSD/Deployment	Feb 88
ADOC Initial Operational Capability (IOC)	Feb 89
NORAD Command Post-CDR	
Missile	2QTR FY89
Space	2QTR FY90
NCP IOC	
Missile	1QTR FY90
Space	1QTR FY91
Battle Staff Support and Weather Center IOC	1QTR FY94
System Final Operational Capability	4QTR FY94

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) (TW/AA) System
Project Number: 3878
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)
Project Title: Survivable Communications Integration System

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SCIS	11,845	12,368	4,275	4,759	Cont	TBD

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

SCIS will provide a timely, error free communication system for missile warning information over the tactical warning/attack assessment (TW/AA) sensor network to the Cheyenne Mountain Complex (CMC) and the Offutt Processing and Correlation Center (OPCC), and receipt at other designated command centers. It will do this by using fault tolerant commercial equipment acting as a communication message processor during the pre-, trans-, and post-attack phases of nuclear war. SCIS will take various communication media and automate the capability to broadcast missile warning information at various data rates in discrete and summary standard survivable message formats.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Conducted Critical Design Review (CDR).
- (U) In-plant development test and evaluation (DT&E) initiated.

(U) FY 1989 Planned Program:
- (U) Complete in-plant testing.
- (U) Complete Coding and integration.
- (U) Install and test equipment at the Test, Development and Training Center (TDTC).
- (U) Begin initial training.

(U) FY 1990 Planned Program
- (U) Conduct IOT&E at 6 sites.
- (U) Declare Limited Operational Capability (LOC).

(U) FY 1991 Planned Program:
- (U) Conduct DT&E/IOT&E at 15 sites worldwide.
- (U) IOC will be achieved.

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System

Project Number: 3878
Budget Activity: #3 -Strategic Programs

(U) Program to Completion:
- (U) This is a continuing project.
- (U) FOC will be achieved during 4QTR FY 1994.

D. (U) WORK PERFORMED BY: SCIS is managed by Air Force Systems Command's (AFSC) Electronic Systems Division (ESD), Hanscom AFB, MA. Prime contractor is E Systems Inc., St. Petersburg, FL. Technical support is provided by MITRE, Bedford, MA.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY FOR PE 0102310F:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-0-
Schd	None	None	-0-
Cost	None	None	-0-

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: None
3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) USAF SON 5-85, May 85
- (U) SRD, May 85

G. (U) RELATED ACTIVITIES:
- (U) PE 0102423F, Ballistic Missile Early Warning System.
- (U) PE 0102424F, SPACETRACK.
- (U) PE 0102432F, Sea Launched Ballistic Missile Early Warning System (Pave Paws).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0 3310F Project Number: 3878
PE Title: Cheyenne M intain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: #3 - Strategic Programs

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

	FY 1988 ACTUAL	FY 1989 ESTIMATE	FY 1990 ESTIMATE	FY 1991 ESTIMATE	TOTAL PROGRAM
Other Procurement: (BA 63)	10,442	8,119	0	0	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

Milestones	Dates
Development Contract Award	Aug 86
PDR	Aug 87
CDR	Feb 88
LOC (6 sites)	FY 90
IOC	FY 91
FOC	FY 94

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F Project Number: 3879

PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) Systems Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title: Command Center Processing and Display System-Replacement

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
CCPDS-R	* 29,050	* 26,417	35,423	36,241	Cont.	TBD

* In PE 12436F

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

A Command Center Processing and Display System-Replacement (CCPDS-R) is necessary to correct current CCPDS deficiencies and provide needed information for tactical warning. CCPDS-R consists of new computer hardware, software, display devices, and consoles for receipt and processing of ballistic missile tactical warning/attack assessment (TW/AA) information at the Cheyenne Mountain Complex (CMC) missile warning center and command post, the Offutt Processing and Correlation Center (OPCC), and the Headquarters SAC command post. This will enable the Commander-in-Chief, United States Space Command (CINCSPACE) and CINC North American Aerospace Defense Command (CINCNORAD) to provide tactical warning assessments to the National Command Authority (NCA) and enable CINCSAC to protect US strategic forces. Common display of attack data will be provided to the NCA, CINCNORAD, CINCSAC, CINCSPACE and other CINCs through the Processing and Display System (PDS) at the NORAD command post, OPCC, SAC command post, National Military Command Center, Alternate National Military Command Center, and other command centers. CCPDS-R and PDS are essential to commanders and the NCA in making decisions related to nuclear force survival, execution of US strategic forces through the Single Integrated Operation Plan, and the use of strategic reserve forces during peacetime, pre-attack, and trans-attack phases of conflict.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:

- (U) Developed standard Integrated Tactical Warning and Attack Assessment displays.
- (U) Completed Common (Cheyenne Mountain Complex (CMC) and Offutt Processing and Correlation Center (OPCC)) subsystem hardware Critical Design Review (CDR).

(U) FY 1989 Planned Program:

- (U) Complete System Preliminary Design Review (PDR) for Common subsystem.
- (U) Complete CDR for common subsystem
- (U) Complete Preliminary Design Review (PDR) for SAC unique subsystem.

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Program Element: #0102310F Project Number: 3879
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) Systems Budget Activity: #3 - Strategic Programs

(U) FY 1990 Planned Program:
- (U) Conduct DT&E for the common subsystem in the Test, Development, and Training Center (TDTC).
- (U) Conduct PDR for PDS
- (U) Conduct DT&E in Development Test Facility (DTF)

(U) FY 1991 Planned Program:
- (U) Install missile warning systems in the TDTC; CMC; and the OPCC.
- (U) Complete CDR for SAC unique subsystem
- (U) Conduct SAC unique DT&E.
- (U) Install and Checkout (I&CO) equipment in the SAC Development and Testing Facility (DTF) and the SAC Command Center (CC).

(U) Program to Completion:
- (U) This is a continuing program.
- (U) The CCPDS-R upgrade at Cheyenne Mountain Complex (CMC) is scheduled for completion in FY 1992.
- (U) The Strategic Air Command (SAC) unique subsystem will be completed during FY 1993.

D. (U) WORK PERFORMED BY: CCPDS-R is managed by Air Force Systems Command's (AFSC) Electronic Systems Division (ESD), Hanscom AFB, MA. The prime contractor is TRW, Redondo Beach, CA. Technical support is provided by MITRE, Bedford, MA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	NONE	NONE	- 0 -
Schd	NONE	NONE	- 0 -
Cost	NONE	Delay IOC and FOC 10 months	- 0 -

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: Delay IOC and FOC 10 months due to funding limitations and to reduce schedule risk of CMC integration.
3. COST CHANGES: None

Program Element: #0102310F Project Number: 3879
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) Systems Budget Activity: #3 - Strategic Programs

F. (U) PROGRAM DOCUMENTATION:
- (U) SAC SON 1-80, May 80, for CCPDS-R
- (U) AF Space Command SON 10-85, Nov 86, for AWPDS

G. (U) RELATED ACTIVITIES:
- (U) Ballistic Missile Early Warning System (PE0102423F).
- (U) Sea Launched Ballistic Missile Early Warning System - PAVE PAWS (PE 0102432F).
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Other Procurement: (BA 63)	0	0	15,858	0	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

- (U) CCPDS-R FSD/Production Contract Award	Jun 87
- (U) Common subsystem Preliminary Design Review (PDR)	Oct 88
- (U) Common subsystem Critical Design Review (CDR)	Aug 89
- (U) SAC unique PDR	Sep 90
- (U) SAC unique CDR	Feb 91
- (U) Common subsystem Initial Operational Test and Evaluation (IOT&E)	Feb 92
- (U) SAC unique IOT&E	Feb 93
- (U) Initial Operational Capability (IOC)	4th Qtr 92
- (U) Full Operational Capability (FOC)	3rd Qtr 93

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F Project Number: 3880
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: # 3- Strategic Programs

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

Project Title: Space Defense Operations Center (SPADOC)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SPADOC	** 26,226	** 22,540	18,354	18,486	Cont.	TBD

** In PE 12311F

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

A Space Defense Operations Center (SPADOC) is needed to satisfy Presidential and Secretary of Defense directives to improve the capability of the United States to monitor space activities, inform appropriate decision makers, and protect U.S space assets. SPADOC is not part of the anti-satellite (ASAT) program. Current operations lack real-time response and cannot satisfy threat assessment in the Integrated Tactical Warning/Attack Assessment (TW/AA) architecture. This program element supports the development to upgrade and integrate into the existing Space Defense Operations Center (SPADOC) the activities of the AF Space Command Space Surveillance Center (SSC) for cataloging of space objects, orbit parameter computation, and associated interfaces to communications networks; and to perform the necessary definition, planning, implementation and testing to ensure an integrated space defense capability. Completion of this program is essential to replacing unsupportable computer systems in the Cheyenne Mountain Complex (CMC).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Conducted SPADOC IV Block B (SSC Upgrade) CDR.
- (U) Began Block B installation and checkout (I&CO) in the CMC.
- (U) Completed the SPADCCS Owner/Operator Communications System (SOCS) terminal upgrade CDR and achieved Initial Operational Capability (IOC).

(U) FY 1989 Planned Program:
- (U) SPADOC IV Block A (SPADOC Upgrade) will reach IOC.
- (U) Begin system test for the SPADOC IV Block B (SSC upgrade).

(U) FY 1990 Planned Program:
- (U) Complete DT&E and IOT&E of Block B.
- (U) Complete detailed specifications and scheduling of the final phase of SPADOC IV, Block C (SSC replacement).
- (U) Award Block C contract.
- (U) Block B achieve IOC.

Program Element: #0102310F Project Number: 3880
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: #3- Strategic Programs

(U) FY 1991 Planned Program:
- (U) Continue design and development for Block C.
- (U) Complete Block C Preliminary Design Review.

(U) Program to Completion:
- (U) This is a continuing program.
- (U) SPADOC IV will achieve Full Operational Capability in FY 1994.

D. (U) WORK PERFORMED BY: SPADOC is managed by Air Force Systems Command's (AFSC) Electronic Systems Division (ESD), Hanscom AFB, MA. Ford Aerospace Communications Corporation, Colorado Springs, CO, is the prime contractor. IBM, Houston, TX, is the major hardware subcontractor. System engineering is provided by MITRE, Bedford, MA.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY FOR PE 0102311:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	NONE	NONE	-0-
Schd	NONE	+ 9 months (Block A) + 9 months (Block B and C)	-0-
Cost	NONE	NONE	-0-

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None.

2. SCHEDULE CHANGES: Failure of contractor to deliver Block IV A system and delays in Initial Operational Test and Evaluation (IOT&E) have delayed Block A Initial Operational Capability (IOC) by 9 months which in turn has affected Block B IOC and Block C contract award dates. Block B and C schedules have been further perturbated by failure to complete Block B Critical Design Review.

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System

Project Number: 3880
Budget Activity: #3- Strategic Programs

3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
- (U) ADCOM SON 03-79, Dec 80
- (U) SOC, Jan 85

G. (U) RELATED ACTIVITIES:
- (U) This program does not provide any antisatellite (ASAT) funding.
- (U) SPACETRACK, (PE 0102424F).
- (U) Consolidated Space Operations Center, (PE 0305130F).
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Other Procurement: (BA 63)	0	5,602	15,991	0	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

- (U) SPADOC IV B Contract Award	Jun 86
- (U) SPADOC IV B Critical Design Review (Conducted)	Dec 87
- (U) SPADOC IV A Initial Operational Capability (IOC)	Feb 89
- (U) SPADOC IV C Contract Award	4QTR FY 90
- (U) SPADOC IV B IOC	4QTR FY 90
- (U) SPADOC IV C Preliminary Design Review (PDR)	FY 91
- (U) SPADOC IV C IOC and System Full Operational Capability (FOC)	FY 94

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0102310F
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System
Project Number: 3881
Budget Activity: #3 - Strategic Programs

A. (U) RESOURCES ($ In Thousands)
Project Title: Integrated TW/AA System

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
TW/AA	*** 2,226	*** 2,521	2,698	2,795	Cont	TBD

*** In PE 12313F

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

This program provides the management framework through which the Air Force will apply coordinated oversight of the acquisition and interface of integrated TW/AA programs. 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.

C. (U) Program Accomplishments and Plans:

(U) FY 1988 Accomplishments:
- (U) Develop the initial technical analysis and cost estimate (TA/CE) for the integrated TW/AA system.

(U) FY 1989 Planned Program:
- (U) Develop integrated C3 program baseline for Cheyenne Mountain Complex (CMC) development programs.

(U) FY 1990 Planned Program:
- (U) System engineering efforts will ensure on-going programs are meeting defined system requirements
- (U) Monitor overall system baseline performance.

(U) FY 1991 Planned Program:
- (U) Provide system engineering and integration support to the Communications System Segment-Replacement (CSS-R) program and the Survivable Communications Integration System (SCIS) program as these new programs are integrated into the CMC.

Program Element: #0102310F Project Number: 3881
PE Title: Cheyenne Mountain Complex (CMC) Tactical Warning/Attack Assessment (TW/AA) System Budget Activity: #3 - Strategic Programs

(U) Program to Completion:
- (U) This is a continuing program.
- (U) Integrate Granite Sentry, CCPDS-R, SPADOC 4, SCIS, and CSS-R into CMC.

D. (U) Work Performed By: Air Force Systems Command's Electronic Systems Division (ESD), Hanscom AFB, MA, Acquisition Integration Office. Technical Support provided by MITRE, Bedford, MA.

E. (U) Comparison with Amended FY 1988/1989 Descriptive Summary for PE 0102313:

Type of Change	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-0-
Schd	None	None	-0-
Cost	None	None	-0-

Narrative Description of Changes

1. Technical Changes: None
2. Schedule Changes: None
3. Cost Changes: None

F. (U) Program Documentation:
- (U) SOC, Jan 85

G. (U) Related Activities:
- (U) Ballistic Missile Early Warning System (PE0102423F), Sea Launched Ballistic Missile Early Warning System (PAVE PAWS) (PE0102432F), and SPACETRACK (PE0102424F).
- (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:

- (U) Technical Analysis/Cost Estimate FY88
- (U) Integrated C3 program Baseline FY89

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

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

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Program	To Complete	Total Program
2976 Atmospheric Tactical Warning Connectivity	1,173	836	771	804	Continuing	TBD
2996 FAA/AF Radar	946	853	855	870	Continuing	TBD
TOTAL	2,119	1,689	1,626	1,674	Continuing	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) PROGRAM ACCOMPLISHMENTS AND PLANS: 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 Relocatable Over-the-Horizon Radar (ROTHR) into the JSS Region and Sector Operations Control Centers (ROCCs/SOCCs).

1. (U) Project 2976, Atmospheric Tactical Warning Connectivity:

(U) Fiscal Year 1988 Accomplishments:
- (U) Initial ROCC/SOCC computer memory and port expansion.
- (U) Initial development prototyping (proof of concept) for ROCC/SOCC interface control unit for OTH-B and ROTHR.

(U) Fiscal Year 1989 Planned Program:
- (U) Complete initial ROCC/SOCC computer upgrades/integration.
- (U) Continue OTH-B and ROTHR integration/evaluation.
- (U) Prepare procurement documentation and specifications.
- (U) Initiate competitive procurement of ROCC/SOCC integration hardware and software for OTH-B and ROTHR.

(U) Fiscal Year 1990 Planned Program:
- (U) Continue procurement of integration hardware/software.
- (U) Begin installation of integration hardware and software.

(U) Fiscal Year 1991 Planned Program:
- (U) Continue installation and check-out.

(U) Program to Completion:
- (U) Complete ROCC/SOCC integration in Fiscal Year 1993.

(U) Work Performed By: Air Force program management for the Region and Sector Operations Control Centers is by Air Force Logistics Command, Wright-Patterson AFB, OH. The prime contractor for the ROCCs/SOCCs is Hughes Aircraft Corporation, Fullerton, CA. Management of Atmospheric Tactical Warning Connectivity is by 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTHER PROCUREMENT: (BA 63)	37,256	58,915	89,389	58,027	Continuing	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.

1. 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 1988 Accomplishments:
- (U) Joint specification developed.
- (U) Request for Proposals released and joint source selection conducted.
- (U) Multi-year contract awarded to Westinghouse in July 1988.

(U) Fiscal Year 1989 Planned Program:
- (U) Continue post-award engineering support to the Joint Program Office (JPO) to include resolution of site-specific implementation issues.

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

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

(U) Program to Completion:
- (U) Continue site preparation, radar production, installation, test, and system check-out.
- (U) Complete system acceptance and declare Full Operational Capability by Fiscal Year 1995.

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

Budget Activity: 3 - Strategic Programs

(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.

(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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTHER PROCUREMENT: (BA 63)	37,256	58,915	89,389	58,027	Continuing	TBD

(U) International Cooperative Agreements: N/A

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2980 North Atlantic Defense Sys (NADS)	4,270	794	5,093	7,198	Continuing	TBD
3159 Caribbean Basin Radar Net (CBRN)	866	772	1,283	1,000	Continuing	TBD
TOTAL FOR PROGRAM ELEMENT	5,136	1,566	6,376	8,198	Continuing	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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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

Supports US Commander-in-Chief Atlantic (USCINCLANT) and the North Atlantic Treaty Organization (NATO) Supreme Allied Commander Atlantic (SACLANT).

(U) FY 1988 Accomplishments:
- (U) Continued Iceland NATO Radar Program
- (U) Invitation for Bids for NATO Control and Reporting Center/ Communications (CRC/COMM) released to potential NATO contractors

(U) FY 1989 Planned Program:
- (U) NATO NADS CRC/Comm contract award using NATO Funds
- (U) NATO NADS software development will continue.
- (U)

(U) FY 1990 Planned Program:
- (U)
- (U) CRC/Comm development continues

(U) FY 1991 Planned Program:
- (U) CRC/Comm development continues

(U) Program to Completion:
- (U) NATO NADS Initial Operational Capability achieved in
- (U) This is a continuing program

00324

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 Syste,
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	1,122	0	0	0	Continuing	TBD

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: NADS is 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 1988 Accomplishments:
- (U) Site surveys conducted for 2 Columbian locations and initial site offers made to remaining host nations
- (U) Site 1 IOC/FOC and Region Operations Center austere C^3 capability achieved

(U) FY 1989 Planned Program:
- (U) Continues CBRN Program Office support

(U) FY 1990 Planned Program:
- (U) Continues CBRN Program Office support

(U) FY 1991 Planned Program:
- (U) Continues CBRN Program Office support

(U) Program to Completion:
- (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; Electromagnetic Compatibility Analysis Center, Annapolis, MD. Westinghouse Corp, Baltimore MD is the CBRN Contractor.

(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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	7,051	30,223	45,106	20,671	Continuing	TBD

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

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2710 North Warning System	8,333	0	0	2,847	9,036	140,172
Total	8,333	0	0	2,847	9,036	140,172

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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

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 1988 Accomplishments:
- (U) Eleven LRRs installed at existing DEW Line sites
- (U) Three prototype SRRs delivered and integrated for testing
- (U) SRR Development Test & Evaluation (DT&E) began in September 1988
- (U) NWS IOC was achieved in September 1988

(U) FY 1989 Planned Program:
- (U) No RDT&E Funds are requested
- (U) Initial Operational Test & Evaluation will be conducted beginning in December 1988 (funded with remaining FY 1988 funds)
- (U) A production decision on the SRR will be made by 30 June 1989 and the first increment of SRRs (17) procured
- (U) Remaining LRRs installed at newly constructed Canadian sites

00327

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

(U) FY 1990 Planned Program:
- (U) No RDT&E Funds are requested
- (U) The second increment of SRRs (20) will be procured

(U) FY 1991 Planned Program:
- (U) Delivery and installation of SRRs begin
- (U) Three prototype SRRs refurbished to production configuration
- (U) Small-target detection capability improvements will be initiated for the LRR

(U) Program to Completion
- (U) Remaining SRRs will be installed in FY 1992
- (U) NWS will achieve Full Operational Capability in FY 1992
- (U) RDT&E funds complete LRR small-target capability development

(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 SRR, 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTHER PROCUREMENT:						
Funds (BA63)	2,812	221,667	207,518	7,315	0	541,551
Quantities						
SRR Controllers		1	2	0	0	3
Short Range Radar		17	20	0	0	37

(U) International 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 1990/1991 BIENNIAL 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 / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTH-B	28,076	18,479	20,399	18,145	Continuing	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 1988 Accomplishments:
   - (U) Completed integration of East Coast Radar System (ECRS) sectors.
   - (U) Completed the Environmental Impact Statement and issued a Record of Decision on the Central Radar System
   - (U) Conducted Small Target Test Program
   - (U) Procured third and final sector of the West Coast Radar System

2. (U) FY 1989 Planned Program:
   - (U) Perform DT&E on the integrated ECRS
   - (U) Continue system improvements for small target detection
   - (U) Award contract for Alaskan Radar System (ARS), 1st sector

3. (U) FY 1990 Planned Program:
   - (U) Conduct IOT&E on the ECRS
   - (U)
   - (U) Procure the second sector of the ARS
   - (U) Continue system improvements for small target detection

4. (U) FY 1991 Planned Program:
   - (U) Complete development of improvements for small target detection
   - (U) Begin procurement of the Central Radar System

5. (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

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

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.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	+1 year	- 96
Cost	Reduced Coverage-2 fewer CRS Sectors	+1 year	

NARRATIVE DESCRIPTION OF CHANGES

1. (U) *TECHNICAL CHANGES: None*
2. (U) SCHEDULE CHANGES: Program restructured to procure one sector/year vice two/year/Central Radar System reduced from four sectors to two.
3. (U) COST CHANGES: Scheduling change above decreases cost for FY 1990.

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

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.

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

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OTHER PROCUREMENT: Funds (BA63)	123,685	168,666	212,419	220,848	Continuing	TBD
Quantity (60 deg sector)	1	1	1	1	1	10
MILCON	7,300	17,500	5,677	41,600	0	107,277

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

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) Initial Operational Capability (IOC)-East	
- (U) IOC - West	
- (U) IOC Alaskan Radar System	
- (U) Full Operational Capability (FOC Central Radar System	

00331

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
BMEWS	18,904	24,806	19,314	22,962	Continuing	TBD
Total	18,904	24,806	19,314	22,962	Continuing	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

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Began the Fylingdales upgrade effort with software development, system engineering, and equipment fabrication.
   - (U) Conducted major design reviews and in-plant testing for hardware/software at the component and subsystem level.
   - (U) Began structural design efforts.

2. (U) FY 1989 Planned Program:
   - (U) Complete software development reviews and in-plant development testing at the system level for the Fylingdales upgrade.
   - (U) Begin facility construction and install radar hardware, begin testing and discrepancy resolution for the facility.
   - (U) Complete computer and radar equipment installation and check-out.

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

- (U) Complete structural design efforts and start the UK-funded facility construction by a UK firm under subcontract to the US prime contractor.

3. (U) FY 1990 Planned Program:
   - (U) Complete software development reviews and in-plant development testing at the systems level.
   - (U) Continue facility construction and radar hardware installation into the facility structure.
   - (U) Begin on-site system component testing.

4. (U) Fy 1991 Planned Program:
   - (U) Complete facility construction.
   - (U) Complete computer and radar installation.
   - (U) Initiate integration testing of on-site equipment and facilities.

5. (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 1988 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	Delays upgrade to match Thule capabilities	Upgrade delayed 19 months	Defer $2M to FY 92
Cost	None	None	+$7,359M

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: Contract award experienced delays in procurement start because of extensive preliminary negotiation with the United Kingdom and contractor. Contract was awarded 30 June 88.
3. COST CHANGES: Funding of $11M was added in the AF POM to correct

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

funding shortfalls. Due to the late contract award and to correctly phase contract liability costs, $3.6M has been deferred to FY 1992.

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 (SECRET).

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.

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

Other Procurement Funds (BA 63)

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
4,328	2,413	6,262	715	Cont.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:
- (U) 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).
- (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:

- (U) Thule Initial Operational Capability (IOC)	June 1987
- (U) Fylingdales Radar Upgrade Contract Award	June 1988
- (U) Fylingdales Radar IOC	FY 1993

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2295 Ground-Based Electro-Optical Deep Space Surveillance System	1,400	1,400	1,100	800	Continuing	TBD
2296 Space Surveillance Network Improvement Program	5,275	4,695	5,247	1,120	Continuing	TBD
3202 Air Force Maui Optical Station	3,226	3,200	3,400	3,600	Continuing	TBD
3887 ASAT Surveillance Support	0	0	6,000	10,000	Continuing	TBD
3793 Project HAVE GAZE	0	3,000	0	0		
Total	9,901	12,295	15,747	15,520	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: (U) SPACETRACK is a worldwide space surveillance network of ground sensors. The current system has limited resources - most of which were adapted from other missions/ programs.

the network requires modest enhancements to ensure adequate surveillance and tracking.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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) FY88 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.
- (U) Continued "caretaker-only" status of the GEODSS Test Site (GTS) which houses the equipment to be delivered to the

C0335

5th site once the facility is built and environmentally capable of handling the operational equipment.

(U) FY89 Planned Program:
- (U) Continues minimal essential SPO support for deployment of site 5.
- (U) Continue negotiations with the Portuguese government on the technical and facility agreements for the 5th site.
- (U) Continue "caretaker-only" status of the GEODSS Test Site (GTS).
- (U) Continue 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 (funded from separate P.E. in FY88).

(U) FY90 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) FY91 Planned Program:
- (U) Continues minimum essential SPO support for deployment of site 5.
- (U) Continues with implementing agreements Portuguese government for installation of site 5.
- (U) Continues reduced GEODSS ETS operations.

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

(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 #0604406F, Space Defense System
- (U) Program Element #0102450F, Space Defense Operations
- (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:

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

Other Procurement (BA 63)

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1570	598	6,514	598	Continuing	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.

(U) FY88 Accomplishments:
- (U) Continued refurbishment and modernization of the Saipan Radar.
- (U) Continued development of the Haystack Processing and Control System (PACS) upgrade.
- (U) Continue low level technology development for the Integrated Tasking and Control System (INTACS).
- (U) Initiated efforts to begin prototype development for INTACS.

(U) FY89 Planned Program:
- (U) Begins installation of the PACBAR III equipment into the Saipan facility.
- (U) Begins preliminary testing and check-out of the Saipan Radar System.
- (U) Completes the installation and check-out of the Haystack PACS.
- (U) Continues low level technology development on INTACS.
- (U) Begins INTACS subsystem prototype installation for initial test and evaluation.

(U) FY90 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) FY91 Planned Program:
- (U) Evaluate INTACS operation in CMC.
- (U) Tasks required but not funded - will be held as unfunded requirements.

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

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

(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. General systems engineering and technical support is provided by Aerospace Corporation, Los Angeles, CA.

(U) Related Activities:
- (U) Program Element #0604406F, Space Defense System
- (U) Program Element #0102450F, Space Defense Operations
- (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 Appropriated Funds:

Other Procurement (BA 63)

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1570	598	6,514	598	Continuing	TBD

(U) International Cooperative Agreements: None

3. (U) Project 3202 Air Force Maui Optical Station: The Air Force Maui Optical Station (AMOS) is a unique national resource R&D 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) FY88 Accomplishments:
- (U) Provided minimum essential core funding for basic operations.

(U) FY89 Planned Program:
- (U) Provide basic core funding for minimum site operations.
- (U) Provide some deferred maintenance.

(U) FY90 Planned Program:
- (U) Provides basic core funding for minimum site operations.
- (U) Provides some deferred maintenance.

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

(U) FY91 Planned Program:
- (U) Provides basic core funding for minimum site operations.
- (U) Provides essential recurring maintenance.

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

(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 #0604406F, Space Defense System
- (U) Program Element #0102450F, Space Defense Operations
- (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:

Other Procurement (BA 63)

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1570	598	6,514	598	Continuing	TBD

(U) International Cooperative Agreements: None

4. (U) Project 3887 ASAT Surveillance Support: This project provides for development of an ASAT Mission Operations Center (MOC), including hardware and software necessary to perform ASAT targeting, command, and control; collection of infrared target signatures for support of ASAT targeting; improvement in communications connectivity between surveillance sites and the MOC to decrease targeting time; and develops an ASAT support capability in the SPADOC. Will participate in space surveillance exercises to assess network capability to support a ground-based ASAT system.

(U) FY88 Accomplishments: Not applicable.

(U) FY89 Accomplishments: Not applicable.

(U) FY90 Planned Program:
- (U) Begins development of Mission Operations Center
- (U) Initiates improvements in the INTACS and UCT processing efforts specific to ASAT support

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

(U) FY91 Planned Program:
- (U) Continues development of MOC for ASAT support
- (U) Continues improvements in INTACS and Uncorrelated Target (UCT) processing
- (U) Begins improvements in communication connectivity between surveillance sites and the MOC
- (U) Begins collection of IR target signatures from the AMOS electro-optical site

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

(U) Work Performed By: Contracts have not been awarded at this time. Program will be managed by Air Force System Command's Electronic Systems Division.

(U) Related Activities:
- (U) Program Element #0604406F, Space Defense System
- (U) Program Element #0102450F, Space Defense Operations
- (U) Program Element #0102311F, Cheyenne Mountain Complex Tactical Warning/Attack Assessment System.

(U) Other Appropriation Funds:

Other Procurement (BA 63)

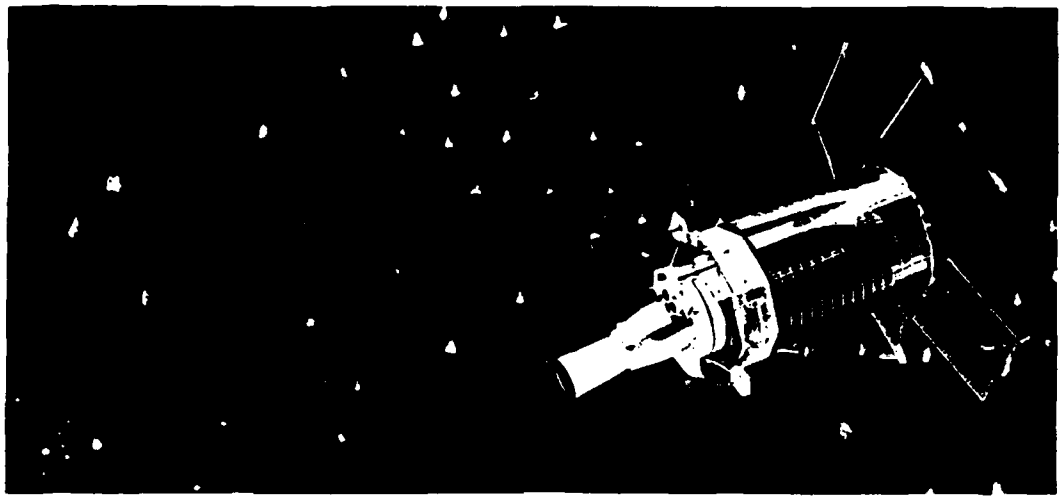
FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1570	598	6,514	598	Continuing	TBD

(U) International Agreements: None

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones					Transition to BSTS
Enginerng Milestones			Grnd. Sta. Upgrd. PDR	Grnd. Sta. Upgrd. CDR	Continuing
T&E Milestones	Comm. Sys. Upgrd. OT&E		MGS-14 DT&E/OT&E		
Contract Milestones		Sat 14-15 Delivery		Sat 16-19 Delivery	Sat 20-25 Delivery
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	62151	78945	109044	45933	TBD
Support Contract	8719	6086	15660	6360	TBD
In-House Support	5290	2288	2176	2800	TBD
GFE/ Other	11096	9660	7122	6423	TBD
Total	87256	96979	134004	61516	TBD

CLASSIFIED BY: DSP SCG, 31 AUG 83
DECLASSIFY ON: OADR

00341

Program Element: # 0102431F Project: # 3624
PE Title: DEFENSE SUPPORT PROGRAM 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 multipurpose facility, and a ground communications network (GCN). DSP's primary mission is to provide tactical warning and limited attack assessment of a ballistic missile attack.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments
- ( ) the second Sensor Evolutionary Development satellite.
- ( ) Continued launch vehicle (Titan IV) and upper stage (Inertial Upper Stage) integration to support SP-14 launch using Titan IV.
- (U) Continued Mobile Ground System (MGS) upgrades to make processing and communications hardware compatible with DSP-I.
- (U) Continued to revise ground station software architecture.

2. (U) FY 1989 Planned Program:
- (U)

- (U) Complete launch support transition from AF Consolidated Space Test Center to the Consolidated Space Operations Center.
- (U) Continue MGS and ground station hardware and software upgrades to ensure DSP-I compatibility.
- (U) Redesign 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) Complete secure satellite commanding system hardware for MGS to control DSP-I satellites.
- (U) Demonstrate the ability to process data from two satellites simultaneously to achieve a "stereo viewing" capability.

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

3. (U) FY 1990 Planned Program:
   - (U) DSP-15 will carry the first laser crosslink subsystem.
   - (U) Complete construction and check-out of the Laser Ground Station (LGS) at Port Malabar, FL. The LGS will provide for the on-orbit check-out of the laser crosslink subsystem.
   - (U) Continue MGS and ground station hardware and software upgrades to ensure DSP-I compatibility.

4. (U) FY 1991 Planned Program:
   - (U) Complete MGS and ground station hardware and software upgrades to ensure DSP-I compatibility.
   - (U) providing the first operational laser crosslink with DSP-15.
   - (U) demonstrating dual launch capability and assured access to space.

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 MGS and satellite upgrades, and insuring ground station data accuracy.
   - (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 Division is responsible for system development and acquisition.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	+ 12 months	-37,551

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES:
2. SCHEDULE CHANGES: Delays the mobile communication survivability improvements and development of the satellite command capability

00343

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

of the Mobile Ground System

3. COST CHANGES: Reduction in RDT&E funds due to general Air Force budget reduction.

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

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Missile Procurement Funds (BA 45)	369,243	432,832	372,225	488,938	TBD
Quantity (satellites)	1	2	1	1	
Other Procurement Funds (BA 63)	24,885	5,264	109,714	69,351	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2887 PAVE PAWS	11,178	9,980	4,599	3,891	Cont.	TBD
Total	11,178	9,980	4,599	3,891	Cont.	TBD

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 2887,PAVE PAWS:

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

(U) FY 1988 Accomplishments:

- (U) Acquired new automated data processing (ADP) equipment for the NE and NW sites for system-wide commonality.
- (U) Conducted system engineering software development, and in-plant testing to support these upgrades.

00345

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

(U) FY 1989 Planned Program:
- (U) Continue 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.

(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) Program to Completion:
- (U) This is a continuing program. Subsequent efforts will be implemented as necessary to accommodate evolving Tactical Warning and Attack Assessment needs.

(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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	5,593	1,769	2,760	2,991	Continuing	TBD

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

A. (U) RESOURCES ($ in Thousands)

Project Number	Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1	NUDET Detection System (NDS)	7,272	10,806	6,735	3,131	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT:

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 re-establishing 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 cross-linked to other GPS/NDS satellites which act as relay points. This cross-linking 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, other Unified and Specified Commands) will receive NUDET data, direct from the spacecraft, on the precise location, yield, count, time, and height of burst.

This program element compliments PE 0301357F which provides for the integration of these NDS sensors on GPS spacecraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project XXX1, NUDET Detection System:

Program Element: 0102433F Budget Activity: 3 - Strategic Programs
PE Title: NUDET Detection System (NDS)

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. It also provides multiple redundancy of the data transmission for increased system availability and survivability.

(U) FY 1988 Accomplishments:
- (U) Continued integration efforts for the NDS payload on the GPS production spacecraft.
- (U) Continued G/AIT and EMP sensor development and DT&E.
- (U) Began the NDS terminal reliability improvement program.
- (U) Initiated G/AIT procurement for high priority users.
- (U) Completed satellite-to-satellite crosslink development.

(U) FY 1989 Planned Program:
- (U) Begin engineering development and requalification of the NDS payload for the GPS replenishment satellites.
- (U) Begin aircraft integration/modification activities to support Development Test and Evaluation (DT&E) of the G/AIT.
- (U) Install FSD G/AIT at SAC's Proof-of-Concept/Experimental Testbed (POC/ET) and DCA's Modular Building Block (MBB) to support testing for the ground configuration.
- (U) Continue the G/AIT reliability improvement program.
- (U) Insert/retrofit new antenna technology into G/AITs.
- (U) Perform enhancements to FSD software for final production configuration.
- (U) Continue production activities.

(U) FY 1990 Planned Program:
- (U) Conclude G/AIT development and continue production to satisfy user requirements.
- (U) Continue integration/testing activities of FSD G/AITs.
- (U) Continue integration engineering for NDS airborne user terminal and start DT&E on E-4B NEACP aircraft.
- (U) Complete engineering development and start requalification of NDS sensors for installation into GPS Block IIR satellites.
- (U) Complete FSD software enhancements and new antenna technology insertion/retrofit for G/AITs.

(U) FY 1991 Planned Program:
- (U) Continue integration, field testing, ard preoperational support of FSD G/AITs.
- (U) Begin development of fixes for deficiencies identified during DT&E.
- (U) Begin development of required operational improvements.

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

(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 DT&E and required system operational improvements.

(U) Work Performed By: System development and procurement is accomplished by Air Force Systems Command's Space Division, Los Angeles AFB, CA

Rockwell International, Seal Beach, CA, integrates the NDS sensors on GPS satellites and produces the EMP sensor. 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 and will produce the G/AIT. E-Systems, Garland, TX, is developing the EMP receiver/processor for the satellite.

(U) Related Activities:
- (U) Program Element #0305165F, Global Positioning System (GPS) Space Segment.
- (U)
- (U) Program Element #0301357F, NUDET Detection System (NDS).
- (U) Program Element #0305999F, Data Analysis.
- (U) Program Element #0302015F, NEACP/E-4B Class V Modifications.
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	11,900	0	0	18,112	Continuing	TBD
Quantity	4	0	0	0	Continuing	TBD
Other Procurement, BA 83						
Funds	14,170	0	0	0	Continuing	TBD
Quantity	2	0	0	0	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2832 Very Low Frequency/Low Frequency (VLF/LF) Improvements	35,986	21,424	14,699	2,421	Cont.	TBD
2834 Ground Wave Emergency Network (GWEN)	13,694	18,996	1,099	249	6,285	266,205
Total	49,680	40,420	15,798	2,670	Cont.	TBD

B. (U) 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 disturbed environment.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 2834 Ground Wave Emergency Network: This project defines, develops, tests, and deploys a proliferated ground wave communications system. This system provides U.S. strategic forces with the ability to maintain critical continental United States (CONUS) long-range command and control communications connectivity despite ionospheric disturbances caused by high altitude nuclear detonations. The network will handle low speed data messages (100 words per minute) for tactical warning, CINCNORAD assessment, positive control launch of the bomber forces, and emergency actions message dissemination to CONUS commanders, and bomber 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) is the prototype network and interconnects national command centers, warning sites, and strategic bomber/tanker bases and contains 56 relay nodes. Initial Operational Capability is scheduled for late FY 1989. The follow-on phase, called the Final Operational Capability (FOC),

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

expands the total number of relay nodes to 96 and adds additional users with a planned completion in the mid-1990's. Strategic force commanders and units (equipped with EMP-hardened, secure radio equipment) interact with nearby relay nodes for participation in the network.

(U) FY 1988 Accomplishments:
- (U) IOT&E of the system was completed and development of airborne command post terminals progressed.
- (U) Development of peculiar support equipment and integration kits to be used with airborne command post terminals began.
- (U) Development planning for portable receive-only terminals for SAC dispersal bases began.
- (U) Production decision to proceed with the Final Operational Capability network was made.

(U) FY 1989 Planned Program:
- (U) Development for a new dual frequency MEECN receiver begins.
- (U) Development of airborne terminals and their integration kits completes, peculiar support equipment continues, and portable terminals begin.

(U) FY 1990 Planned Program:
- (U) Previous efforts and their associated testing will be completed and production of EC-135C airborne terminals begins.

(U) FY 1991 Planned Program:
- (U) Completion of residual tasks is planned and procurement of portable terminals occurs.

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

(U) Work Performed By: Air Force Systems Command's Electronic Systems Division, located at Hanscom AFB, MA, has managerial responsibility for the described project. Major contractors are General Electric, Camden, NJ and Contel, Fairfax, VA. Mitre Corporation, Burlington, MA, provides system engineering support.

(U) Related Activities: PE 0101312F, PACCS/WWABNCP System EC-135 Class V Modifications, contains funding for GWEN EC-135C aircraft modification. There is no unnecessary duplication of effort within the Air Force or the Department of Defense. PE 0604312F, ICBM Modernization (Rail Garrison), contains funding for completion of dual frequency MEECN receiver development.

(U) Other Appropriation Funds:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Other Procurement, BA 83 Funds	36,100	5,199	5,614	25,812	113,580
Aircraft Procurement, BA 5 Funds			6,200	6,000	12,200

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303131F Project Number: 2832
PE Title: Minimum Essential Emergency Communications Network (MEECN) Budget Activity: 3- Strategic Programs

A. (U) RESOURCES ($ In Thousands)

Project Title: Very Low Frequency/Low Frequency (VLF/LF) Improvements Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
VLF/LF Improvements	35,986	21,424	14,699	2,421	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: 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)]. Project also provides Air Force on-going support to JCS MEECN improvements requirements. System improvements are based upon validated requirements of the Strategic Air Command and the other Single Integrated Operational Plan Commanders-in-Chief system deficiencies as reported by the Defense Communications Agency, and priorities of the Joint Chiefs of Staff.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Development of MRT and depot support equipment continued, and MRT flight test and IOT&E of B-52H and B-1B was completed.
- (U) Development of Joint Navy/Air Force HPTS continued with design and beginning fabrication of EC-135 engineering development models.
- (U) DRE development continued with fabrication and testing of engineering development models.

(U) FY 1989 Planned Program:
- (U) HPTS development continues and includes prototype testing and prototype installation into EC-135 aircraft.
- (U) MRT depot support equipment development and reliability testing completes and B-1B and B-52H production begins.
- (U) Air Force support to MEECN improvements requirements continues and DRE development and testing completes.

(U) FY 1990 Planned Program:
- (U) HPTS development and Initial Operational Test and Evaluation (IOT&E) for EC 135 will complete and development of E-4B begins.
- (U) Air Force support to on-going MEECN improvements requirements continues.

Program Element: #0303131F Project Number: 2832
PE Title: Minimum Essential Emergency Communications Network (MEECN) Budget Activity: 3- Strategic Programs

(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 EC-135 production begins and MRT B-52H production continues.

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

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

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	YES		
Schd		YES	
Cost			+5919

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: Development of the HPTS for the E-4B has been added to original HPTS program and will provide a more reliable and logistically supportable system to replace the current system.
2. (U) SCHEDULE CHANGES: Previous Descriptive Summary shows MRT production Contract Award as Jul 1988 vs 2nd Qtr FY 89 and B-1B FOC as Apr 1991 vs TBD. MRT production has been delayed due to a slip in completion of reliability testing at the contractor facility. B-1B FOC is delayed due to higher than estimated contract cost for group A retrofit (racks, cabling, and antenna installation) of aircraft 2-31. Aircraft 32-100 group A's were installed in aircraft production line and are awaiting production of group B. Aircraft 8-31 Group A and B are also funded, but aircraft 2-8 MRT completion is deferred until funding issue is resolved. Previous Descriptive Summary shows completion of DRE Development, Test, and Evaluation (DT&E) in Nov 88 but that is now projected to slip to July 1989. Delay is due to design and manufacturing problems.

Program Element: #0303131F Project Number: 2832
PE Title: Minimum Essential Emergency Communications Network (MEECN) Budget Activity: 3- Strategic Programs

3. (U) COST CHANGES: Cost change due to addition of HPTS FSD for E-4B aircraft in FY 1990.

F. (U) PROGRAM DOCUMENTATION:

SAC ROC 7-71, 22 Apr 1971
MRT TEMP, 1 Mar 1986
MROC 2-80, 3 Feb 1983
MROC 18-83, 31 Aug 1983

G. (U) RELATED ACTIVITIES:
- PE 0101126F, B-1B Squadrons, contains funding for MRT retrofit modification.
- PE 0101312F, PACCS/WWABNCP System EC 135 Class V Modifications, contains funding for HPTS aircraft modification.
- 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.
- There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Aircraft Procurement,					
Funds BA 5 (B-1B MRT)	0	10,600	0	0	55,300
Funds BA 5 (B-52H MRT)	0	13,100	14,801	14,768	68,700
Funds BA 5 (EC-135 HPTS)	0	0	0	19,000	136,000

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

J. (U) MILESTONE SCHEDULE:

- (U) MRT Milestones
  - Production Contract Award — 2nd Qtr FY 89
  - B-1B FOC — TBD
  - B-52H FOC — FY 96
- (U) HPTS Milestones
  - FSD Contract Award — Apr 1987
  - Delivery of first eng development models — 2nd Qtr FY 1989
  - Air Force Production Decision — 2nd Qtr FY 90
- (U) DRE Milestone
  - In-plant Development Test and Evaluation — Jul 1989

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303152F Budget Activity: C3 Programs
PE Title: USAF WWMCCS Information System (AFWIS)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3155 USAF WWMCCS Information System	5,020	2,307	3,435	3,700	2,658	17,120
Total	5,020	2,307	3,435	3,700	2,658	17,120

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Air Force WIS (AFWIS) program implements the Joint WIS modernization program at Air Force WWMCCS sites. This includes the purchase and fielding of Local Area Networks, Lan Control Centers/Security Monitors, Automated Message Handlers and Joint Mission Processing Equipment.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3155, USAF WWMCCS Information System: Implements Joint WIS Modernization Program at Air Force sites.

(U) FY 1988 Accomplishments:
- (U) Initiated major site planning and design activities
- (U) Defined common Air Force interfaces
- (U) Installed and integrated hardware at the Operational Test Site

(U) FY 1989 Planned Program:
- (U) Complete site planning and design for AF sites
- (U) Start installation of local area networks and workstations at AF operational sites

(U) FY 1990 Planned Program:
- (U) Complete installation of local area networks and workstations at AF operational sites
- (U) Install automated message handling system at the AF operational test site.
- (U) Determine site requirements for the implementation of the joint application software

(U) FY 1991 Planned Program:
- (U) Start installation of automated message handling system at AF operational sites
- (U) Install database machine at the AF operational test site

Program Element: #0303152F Budget Activity: C3 Programs
PE Title: USAF WWMCCS Information System (AFWIS)

(U) Work Performed By: Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. The Engineering and Integration contractor is GTE Systems, Billerica, Massachussetts.

(U) Related Activities:
- (U) Program Element #0303154F, WIS Joint Program.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

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

Other Procurement:

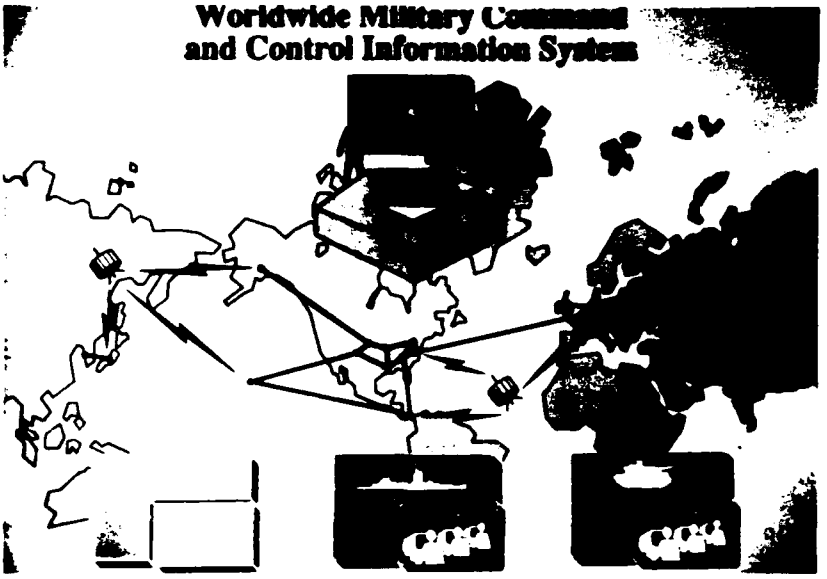
	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	9,729	20,414	22,074	103,941	156,158

(U) International Cooperative Agreements: Not applicable.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0303154F Project Number: 6322931.
PE Title: WWMCCS Information System (WIS) Joint Program Management Office (JPMO) Budget Activity: #3.

Project Title: WIS.



POPULAR NAME: WIS JPMO

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	TO COMPLETE
Program Milestones	N/A	Blk B MS II-Sep89		AMHS Decision	Blk C MS II-TBD
Engineering Milestones	Blk A AMH CDR-Jun88	Blk B R1 PDR-Dec88, CDR-May89		Blk B R2 Design & RFP	Blk B R2&3 & Blk C FSD-TBD JMPE Award-TBD
T&E Milestones	N/A	LAN EOA-Jun89 LAN DT&E-Apr89	Blk B R1 DT&E	Blk B R1 EOA Blk A IOT&E	Blk B&C DT&E, IOT&E-TBD
Contract Milestones	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	PROGRAM TOTAL (TO COMPLETE)
Major Contract	9,200	31,227	51,742	54,106	1,055,596
Support Contract	7,600	25,500	16,134	9,644	199,478
In-House Support	1,000	1,900	1,466	1,378	28,497
GFE/ Other	1,324	5,812	3,667	3,444	142,484
TOTAL	19,124	64,439	73,009	68,572	1,424,000 (845,728)

00357

Program Element: #0303154F Project Number: 6322931 .
PE Title: WWMCCS Information System (WIS) Joint Program Management Office (JPMO) Budget Activity: #3 .

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This project includes tasks to modernize the data collection and processing (automatic data processing (ADP)) element of the Worldwide Military Command and Control System (WWMCCS) to provide command and control (C2) information for the National Command Authorities (NCA); support strategic and conventional planning and control of forces; provide an effective crisis action management system; support execution planning and monitoring; and provide supportability and sustainability of the information system for command and support of forces. The program is divided into three incremental blocks. The first increment, Block A, provides a much needed automated message handling facility, a local area network (LAN), and powerful desk-top workstations which multiply the effectiveness and timeliness of the operational staffs. The next increment, Block B, fields the initial joint mission applications software and modernized hardware. This phase focuses on supporting deployment of military forces and execution of military operations under time-urgent conditions. Block B will be developed in three releases. Release 1 will provide the initial single user-view of the numerous disparate Joint Operations Planning and Execution Systems (JOPES) for forces planning. Release 2 will continue the modernization and integration of the systems, and will provide a modern data base management environment to the WWMCCS standard ADP environment. Release 3 will complete the modernization and field JOPES, Increment 1, and a new hardware environment (if sizing requirements justify the need). The third increment of WIS, Block C, will bring significant new capabilities (JOPES, Increment 2) to the Unified and Specified Commands and Joint Staff for strategy determination, development of suitable military options, and identification/evaluation of courses of action to carry out military options.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) AMHS Critical Design Review completed.
- (U) Continue LAN and AMHS DT&E.
- (U) Completed installation of LANs at the Operational Test Sites.
- (U) Continued Block B Release 1 design and prototyping.

(U) FY 1989 Planned Program:
- (U) Complete LAN DT&E.
- (U) Conduct LAN Integrated Systems Test (IST).
- (U) Conduct LAN Early Operational Assessment.
- (U) LAN purchase decision based on Early Operational Assessment.
- (U) Deploy Workstations.
- (U) Conduct Block B Release 1 Preliminary and Critical Design Reviews.
- (U) Conduct Block B Defense Acquisition Board (DAB) Milestone II review.

Program Element: #0303154F Project Number: 6322931.
PE Title: WWMCCS Information System (WIS) Joint Program Management Office (JPMO) Budget Activity: #3.

(U) FY 1990 Planned Program:
- (U) Install LANs at operation sites.
- (U) Complete AMHS DT&E and IST.
- (U) Complete DT&E Block B, Release 1.
- (U) Start IST Block B, Release 1.

(U) FY 1991 Planned Program:
- (U) Conduct Block A IOT&E.
- (U) AMHS decision from IOT&E.
- (U) Continue to deploy LANs.
- (U) Complete IST Block B, Release 1.
- (U) Deploy Block B, Release 1.
- (U) Release RFP Block B, Release 2.
- (U) Contract Award Block B, Release 2.
- (U) Begin Design Block B, Release 2.
- (U) Begin Block C Definition.
- (U) Analyze hardware sizing requirements.

(U) Program to Completion:
- (U) Deploy AMHS.
- (U) Begin Design Block B, Release 3.
- (U) Complete Block B Release 2 and 3 full-scale development, operational testing and deployment.
- (U) Release 3 joint mission processing environment contract awarded.
- (U) Block C DAB Milestone II, FSD, OT and deployment.

D. (U) WORK PERFORMED BY: The major contractors are: GTE, Billerica, MA; IBM, Gaithersburg, MD; the major support contractors are: MITRE, McLean, VA/Bedford, MA; and RMS Technologies, Trevose, PA.

E. (U) COMPARISON WITH FY 1988 DESCRIPTIVE SUMMARY:

Type of Change	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost($000)
Tech	NONE	NONE	NONE
Sched	NONE	+12 Months	NONE
Cost	YES	YES	-21,503

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: NONE

2. (U) SCHEDULE CHANGES: Block A, IOT&E and AMHS decision from IOT&E slips 9 months. Block B, Release 2, and Block C definition slip 12 months.

00359

Program Element: #0303154F Project Number: 6322931 .
PE Title: WWMCCS Information System (WIS) Joint Program Management Office (JPMO) Budget Activity: #3 .

3. (U) COST CHANGE: Previous Descriptive Summary shows $94,512 thousand in FY90 vs current $73,009 thousand. This reduces program concurrency and will result in a one year delay of Block B, Release 2 and 3 fielding. In an effort to meet operational capability requirements, an ASD(C3I) initiative to satisfy WIS requirements using commercial-off-the-shelf products and an integration strategy is being considered by the C3I Systems Committee of the Defense Acquisition Board and may result in a change of the executive agency from the Air Force to the Defense Communications Agency in mid-FY89.

F. (U) PROGRAM DOCUMENTATION:

JMENS - Feb 82
MROC - Sep 83
OIR Including JOPES ROC - Jul 83.
COEA - Mar 85
ILSP - May 85
TEMP - Jun 85
DCP - Sep 85
TEMP - Sep 87
DCP - Sep 87
DCP - Mar 88
TEMP - Sep 88

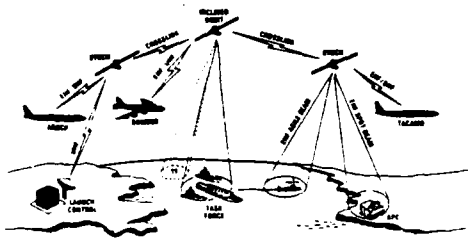
G. (U) RELATED ACTIVITIES:
- (U) Program Element(PE) #0303151F Worldwide Military Command and Control System (WWMCCS).
- (U) PE #0303152F Air Force WIS.
- (U) PE #0303152A Army WIS.
- (U) PE #0303152N Navy WIS.
- (U) PE #0303152K Defense Communications Agency WIS.
- (U) PE #0303152H Defense Nuclear Agency (WWMCCS ADP).
- (U) PE #0901119M Marine Corps (Management Headquarters (Admin)).
- (U) Coordination and Guidance is processed through the WIS JPMO.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	N/A	N/A		Terminal MS IIIB FY 92
Engineering Milestones		Complete FCA/PCA	System End-to-End Test	N/A	N/A
T&E Milestones	Interoper-ability Demos	C-18 Flight Tests	N/A	N/A	System IOT&E, 3rd Qtr, FY 92
Contract Milestones	Ongoing	MS IIIA LRIP Contract Award	Ongoing	Last Year LRIP	MS IIIB Contract Award
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	127,056	228,875	125,693	45,015	Continuing
Support Contract	7,300	15,100	11,800	11,200	Continuing
In House Support	15,400	9,600	7,500	6,400	Continuing
GFE/ Other	46,400	49,400	65,200	49,300	Continuing
Total	196,156	302,975	210,193	104,915	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 1988 Accomplishments:

- (U) Began installation of force element and command post dual modem and radio upgrades
- (U) Successfully demonstrated interoperability between Air Force, Navy and Army terminals
- (U) Installed/ground tested C-18 terminal flight testbed against on-orbit Fleet Satellite (FLTSAT) EHF package
- (U) Successfully tested terminal against Design Verification Satellite
- (U) Continued terminal Functional Configuration Audit/Physical Configuration Audit (FCA/PCA) activity
- ( ) Continued fabrication and deployment of Engineering Development Model (EDM) terminals for EC-135C aircraft and selected ground sites to support
- (U) Completed Independent Cost Analysis (Briefed OSD 15 Nov 88)
- (U) Began Full Scale Development of Low Volume Force Element (LVFE) terminal

2. (U) FY 1989 Planned Program:

- (U) Continue installation of force element and command post dual modem and radio upgrades
- (U) Complete terminal FCA/PCA
- (U) Continue C-18 flight test program
- (U) Continue fabrication and installation of EDM terminals for EC-135C aircraft and selected ground sites
- (U) Begin facility modifications of Mission Control Complex (MCC) at the Consolidated Space Operations Center at Falcon AFS, Co.
- (U) Begin terminal Low Rate Initial Production (Milstone IIIA)
- (U) Continue interoperability testing with Enhanced Design Verification Model (EDVM) satellite
- (U) Continue LVFE efforts

3. (U) FY 1990 Planned Program:

- (U) Continue installation of force element and command post dual modem and radio upgrades

PE: #0303601F Project: #2847
PE Title: Milstar Satellite Communication System (Air Force Terminals) Budget Activity: 3 - Strategic Programs

- (U) Complete C-18 flight test program
- (U) Continue fabrication and installation of EDM terminals for EC-135C aircraft and selected ground sites
- (U) Complete MCC facility modifications of MCC at Consolidated Space Operations, Falcon AFB, Co
- (U) Continue Low Rate Initial Production
- (U) Continue LVFE effort

4. (U) FY 1991 Planned Program:

- (U) Complete installation of force element and command post dual modem and radio upgrades
- (U) Complete fabrication and installation of EDM terminals for EC-135C aircraft and selected ground sites
- (U) Complete Low Rate Initial Production (Full Scale Production begins, Milestone IIIB, FY 92)
- (U) Continue LVFE development

5. (U) Program to Completion:

- (U) Begin Full Scale Production (Milestone IIIB)
- (U) Complete development and begin production of LVFE
- (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 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	-9,038

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None

2. (U) SCHEDULE CHANGES: None

3. (U) COST CHANGES: Department of Defense reductions

F. (U) PROGRAM DOCUMENTATION:

- (U) Joint Milstar Communications, Control and Operations Concept (JMCCOC), Volume I (May 1985) and Volume II (Mar 1988)

PE: #0303601F
PE Title: Milstar Satellite Communication System (Air Force Terminals)

Project: #2487
Budget Activity: 3 - Strategic Programs

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.

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

	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Aircraft Procurement (BA 10)					
Funds (PE 0302015F)	N/A	26,900	12,200	9,000	48,100
Initial Spares	N/A	652	0	0	Continuing
Quantity (Terminals)	N/A	2	1	1	4
Funds (PE 0101312F)	N/A	12,800	34,600	31,900	Continuing
Initial Spares	N/A	2,200	4,942	512	Continuing
Quantity (Terminals)	N/A	1	4	4	Continuing
Funds (PE 0303601F)*	N/A	0**	53,000	20,900	Continuing
Initial Spares	N/A	0	11,765	2,097	Continuing
Quantity (Term/HHM/TDS)	N/A	0/0/0**	0/649/29	1/125/8	Continuing
Other Procurement* (BA 16)					
Funds	N/A	73,101**	102,352	176,056	Continuing
Initial Spares	N/A	3,570	11,523	13,143	Continuing
Quantity (Term/HHM/TDS)	N/A	4/103/7	9/79/7	21/0/0	Continuing
Military Construction (BA 14)					
Funds	N/A	4,000***	330	3,550	Continuing

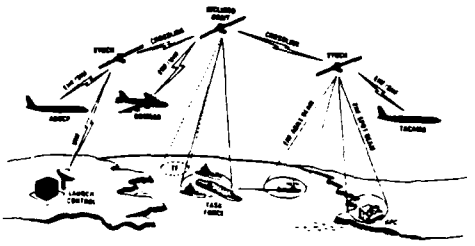
I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

*Procures EHF/UHF Terminals as well as Handheld Modules/Time Distribution Subsets (HHM/TDS) for AFSATCOM Upgrade
**Approp Conf zeroed FY89 PB request ($20.5M APAF) to procure 254 HHM and 11 TDS, and re-instated ($8.923M) to procure 103 HHM and 7 TDS.
***Funds inadvertently placed in PE 030605F, Air Force Satellite Terminals

00364

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	N/A	N/A	MCE: MS IIIA Jan, FY 91;	MCE: MS IIIB, 1st Qtr, FY 92; Satellite: MS III, 1st Qtr, FY 92
Engineering Milestones	MCE CDR		System End-to-End Test	N/A	N/A
T&E Milestones	N/A	N/A	N/A	MCE EOA, Oct, FY 91	System IOT&E, 3rd Qtr, FY 92
Contract Milestones	Ongoing	Ongoing	Ongoing	MCE LRIP	Complete FSD
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	358,452	246,583	374,637		Continuing
Support Contract	23,000	23,000	23,000		Continuing
In-House Support	795	844	844		Continuing
GFE/ Other	2,532	2,351	1,611		Continuing
Total	384,779	272,778	400,092		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 1988 Accomplishments:

- (U) Continued final bus assembly for Developmental Flight Satellite #1 (DFS-1) and initial integration of the payload onto the spacecraft
- (U) Continued fabrication of DFS-2 and DFS-3, and ordered long lead parts for DFS-4
- (U) Conducted compatibility testing between communications payload and Service terminals
- (U) Conducted system level CDR for MCE
- (U) Continued IOT&E planning for MCE
- (U) Completed MCE platform study and conducted platform design for future installation of engineering development model MCEs
- (U) Continued launch system integration efforts
- (U) Initiated Mission Control Segment integration at Consolidated Space Operations Center
- (U) Completed Independent Cost Analysis

2. (U) FY 1989 Planned Program:

- (U) Continue DFS-1 hardware and software integration
- (U) Complete bus integration
- (U) Deliver DFS-1 payload to prime contractor
- (U) Continue launch vehicle integration
- (U) Continue qualification testing and system level acceptance testing
- (U) Conduct enhanced compatibility testing between communications payload and all three Service terminals
- (U) Continue fabrication of DFS-2 and DFS-3 and start DFS-4
- (U) Continue acquisition of long lead parts for DFS-4
- (U) Complete planning for Mission Control Complex (MCC) at the Consolidated Space Operations Center at Falcon AFS, CO, and begin activation
- (U) Begin installation of engineering development model MCEs

3. (U) FY 1990 Planned Program:

- (U) Complete assembly of DFS-1

00356

Program Element: #0303603F Project: #2932
PE Title: Milstar Satellite Communications System (Space and Mission Control) Budget Activity: 3 - Strategic Programs

- (U) Continue fabrication of DFS-2 and DFS-3, and exercise fabrication option for DFS-4
- (U) Order long lead parts for DFS-5
- (U) Conduct system level end-to-end testing using DFS-1, MCE and terminals of all Services
- (U) Continue activation of Milstar Master Control Center (MMCC) and Mission Control Center (MCC) at Consolidated Space Operations Center (CSOC)
- (U) Conduct IOT&E of MCE
- (U) Continue installation of development model MCEs

4. (U) FY 1991 Planned Program:

- ( )
- ( )
- ( )
- ( )
- ( )
- (U) Order long lead parts for first production satellite, #6
- (U) Award MCE Low Rate Initial Production (LRIP) contract
- (U) Activate MMCC and MCC at CSOC
- (U) Continue integration of engineering development model MCEs
- (U) Conduct detailed planning for Milstar system-level IOT&E
- (U) Conduct MCE IOT&E

5. (U) Program to Completion

- (U) Complete development work on satellite and MCE
- (U)
- (U) Begin Full Scale Production (FSP) 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) Attain Initial Operational Capability in
- (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 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 (payload subsystem); General Electric Co., Valley Forge, PA (data handling subsystem); and Ford Aerospace Communications Corporation, Palo Alto, CA (crosslink receivers). The Aerospace Corporation, El Segundo, CA, provides general system engineering and integration.

Program Element: #0303603F Project: #2932
PE Title: Milstar Satellite Communications System (Space and Mission Control) Budget Activity: 3 - Strategic Programs

E. (U) COMPARISON WITH FY 1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	+41,686

NARRATIVE DESCRIPTION OF CHANGES

1. (U) ENGINEERING CHANGES: None

2. (U) SCHEDULE CHANGES: None

3. (U) COST CHANGES: Zero base transfer of funds and Department of Defense reductions.

F. (U) PROGRAM DOCUMENTATION:

- (U) Joint Milstar Communications, Control and Operations Concept (JMCCOC), Volume I (May 1985) and Volume II (Mar 1988).
- (U) Test and Evaluation Master Plan (TEMP), 9 Aug 1988.

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):

	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Missile Procurement (Space and Other Support (Advanced Procurement))(BA 14)					
Funds	N/A	N/A	N/A		Continuing
Quantity	N/A	N/A	N/A	Long lead	Continuing
Other Procurement (Electronics and Telecommunications Equipment) (BA 63)					
Funds	N/A	N/A	N/A		Continuing
Initial Spares	N/A	N/A	N/A		Continuing
Quantity	N/A	N/A	N/A	6	Continuing

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

00369

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603230F Budget Activity: # 4 - Tactical Programs
PE Title: Advanced Tactical Fighter (ATF)

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

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2472 Advanced Tactical Fighter	85,273	181,800	438,300	81,200	0	865,173
2878 Advanced Tactical Fighter Engine	345,982	393,766	349,292	41,363	0	1,584,458
2995 Critical Subsystems Development	61,000	109,000	323,900	84,000	0	635,500
Total	492,255	684,566	1,111,492	206,563		3,085,131

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Advanced Tactical Fighter (ATF) program will develop the next generation air superiority fighter for introduction in the mid-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), hardware demonstrations and risk reduction efforts will be accomplished in a 50-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 will develop and test advanced propulsion systems with the efficiency and reliability required for the ATF mission, and Project 2995 (Critical Subsystems Development) which will mature key avionics/armament technologies required to achieve ATF capability objectives with respect to situational awareness, offensive lethality, and threat warning/countermeasures.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603230F
PE Title: Advanced Tactical Fighter (ATF)
Project Number: 2472
Budget Activity: # 4 - Tactical Programs

Project Title: ATF

POPULAR NAME: ATF

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Preliminary System Spec			DAB II	
Engineering Milestones	Begin fabr of proto components	Assemble proto a/c. Safety rvws			
T&E Milestones		First flight safety reviews	Proto vehicle FF/compl fligl c test	Final flight test reports	
Contract Milestones			FSD RFP	FSD SS & Contract award	
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	80,000	175,000	405,000	75,000	802,000 (0)
Support Contract	0	0	0	0	0
In-House Support	2,971	4,200	7,000	0	22,540 (0)
GFE/ Other	2,302	2,600	26,300	6,200	40,633 (0)
Total	85,273	181,800	438,300	81,200	865,173 (0)

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Program Element: #0603230F
PE Title: Advanced Tactical Fighter
Project Number: 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 1988 Accomplishments:
   - (U) Continued detailed design and fabrication of ATF prototype aircraft.
   - (U) Performed material tests of critical subassemblies, e.g. flight control actuators, canopies, wing carry through structures, empennage, etc.
   - (U) Began fabrication of full-scale radar cross section (RCS) measurement models and conducted radar cross section tests on full-scale components.
   - (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) Assembled partial and full-scale advanced composite components, and performed strength, durability, and RCS tests.
   - (U) Initiated development of FSD/production acquisition strategy.

2. (U) FY 1989 Planned Program:
   - (U) Continue subscale wind tunnel tests on aerodynamic model components, engine inlets and ducting, aft body sections, wing planforms, and weapons bay separation functions.
   - (U) Complete fabrication of prototype flight vehicles and initiate integration of propulsion, flight control subsystems, and flight test instrumentation.
   - (U) Conduct technical and safety reviews to clear prototype air vehicles for flight test.
   - (U) Qualify prototype escape systems.
   - (U) Continue development of FSD/production acquisition strategy.

3. (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.

Program Element: #0603230F
PE Title: Advanced Tactical Fighter
Project Number: 2472
Budget Activity: # 4 - Tactical Programs

- (U) Conduct first flights on each aircraft/engine combination.

4. (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).

5. (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 Dem/Val phase. As a result of 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:
   - (U) TAF SON 304-83, 9 Nov 84.
   - (U) TAF 304-83-I/IIA, SORD for ATF, 4 Dec 87.
   - (U) ATF TEMP, 2 Feb 88.

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).

Program Element: #0603230F
PE Title: Advanced Tactical Fighter
Project Number: 2472
Budget Activity: # 4 - Tactical Programs

- (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: Not Applicable.

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	

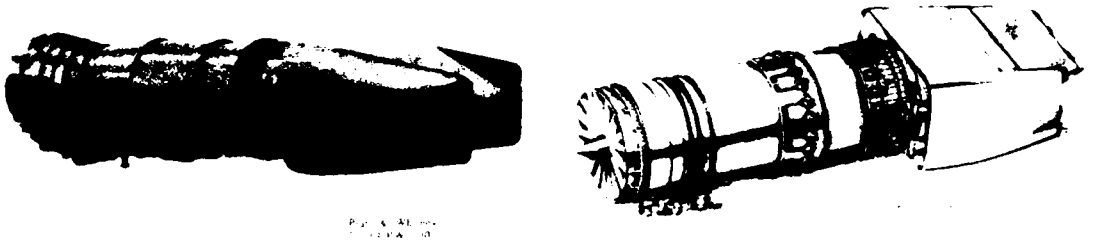
T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Escape system qualification tests	4Q/FY 1989	
Full scale model signature tests	2Q/FY 1990	
Prototype aircraft first flight	2Q/FY 1990 (contract)	

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603230F
PE Title: Advanced Tactical Fighter (ATF)
Project Number: 2878
Budget Activity: # 4 - Tactical Programs

Project Title: ATF Engine



POPULAR NAME: ATF Engine

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Engine Requirement Document	Preliminary System Spec		DAB II	
Engineering Milestones	Cont. demo eng test/ Assemble proto engs	Develop eng PDR/Compl. demo engine test	Sys Spec SDR/Proto eng IFR/ Dev eng DDR	DDR for FSD	
T&E Milestones	Begin proto engine grnd. tests	Continue proto grnd. tests	Proto FF Comp test	First dev. engine to test	
Contract Milestones	Proto eng contract awards	Dem/Val II eng contract award	FSD RFP	FSD SS & contract award	
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	333,612	367,666	331,892	27,963	1,498,437 (0)
Support Contract	0	0	0	0	0
In-House Support	0	0	0	0	0
GFE/ Other	12,370	26,100	17,400	13,400	86,021 (0)
Total	345,982	393,766	349,292	41,363	1,584,458 (0)

00374

Program Element: #0603230F
PE Title: Advanced Tactical Fighter
Project Number: 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 1988 Accomplishments:
   - (U) Awarded contracts to General Electric (GE) and Pratt & Whitney (P&W) for the competitive development of engines for the prototype air vehicles.
   - (U) Began fabrication of the prototype engines and initiated sea level performance and operability control tests.
   - (U) Continued testing of the ground-based demonstrator engines and nozzles.

2. (U) FY 1989 Planned Program:
   - (U) Complete testing of the ground-based demonstrator engines and nozzles.
   - (U) Conduct performance and durability tests in support of flight clearances on the prototype engines.
   - (U) Initiate IFR for the prototype engines.
   - (U) Accomplish Preliminary Design Review (PDR) of the development engines.
   - (U) Complete PDR of the flight test nozzle designs, tailored for each individual contractor's ATF vehicle design.
   - (U) Award Contracts to GE and P&W for development/fabrication efforts to protect the weapon system FSD schedule.

3. (U) FY 1990 Planned Program:
   - (U) Obtain Initial Flight Release of the prototype engines and support prototype flight tests.
   - (U) Complete detailed design review of the development engines and nozzles, and initiate fabrication.
   - (U) Prepare and release requests for proposal for the development and test of FSD engines/nozzles.

4. (U) FY 1991 Planned Program:
   - (U) Complete source selection for a single FSD engine contractor in first quarter FY 1991.
   - (U) Award FSD engine contract in second quarter of FY 1991 (see PE #0604239F).

Program Element: #0603230F | Project Number: 2878
PE Title: Advanced Tactical Fighter | Budget Activity: # 4 - Tactical Programs

5. (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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-83, Nov 84.
- (U) TAF 304-83-I/IIA, SORD for ATF, 4 Dec 87.
- (U) ATF TEMP, 2 Feb 88.

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: Not Applicable.

Program Element: #0603230F
PE Title: Advanced Tactical Fighter
Project Number: 2878
Budget Activity: # 4 - Tactical Programs

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	Jun 87	Sensitive)
Two-dimensional nozzle thrust vectoring demonstrated		
- Pratt & Whitney	Feb 88	Successful
- General Electric	May 88	Successful

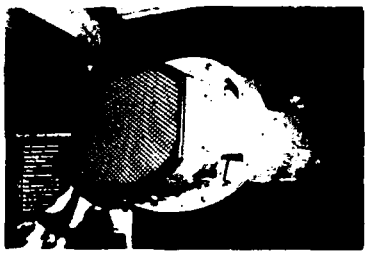
T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
First prototype engine to test	2Q/FY 1989	
Preliminary design review of development engine	2Q/FY 1989	
First prototype engine delivery	1Q/FY 1990	
Initial flight release of prototype engine	1Q/FY 1990	
Detailed design review of development engine	1Q/FY 1990	
Prototype aircraft/engine first flight	2Q/FY 1990	

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0603230F
PE Title: Advanced Tactical Fighter (ATF)
Project Number: 2995
Budget Activity: # 4 - Tactical Programs

Project Title: Critical Subsystems Development



POPULAR NAME: Critical Subsystems

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Preliminary System Review		AGP & AFL	DAB II	
Engineering Milestones	AGP architect (core) complete	Complete proto. sensor fabr	System Spec SDR AGP demo		
T&E Milestones		Begin AGP demos and proto tests	Fault-tol tsts/Sensor flt demos	Complete AGP & AFL demos	
Contract Milestones				FSD contract award	
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	57,000	100,000	311,000	78,000	603,600 (0)
Support Contract	0	0	0	0	0 (0)
In-House Support	0	0	0	0	0 (0)
GFE/ Other	4,000	9,000	12,900	6,000	31,900 (0)
Total	61,000	109,000	323,900	84,000	635,500 (0)

00378

Program Element: #0603230F
PE Title: Advanced Tactical Fighter

Project Number: 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, advanced integrated avionics subsystems, and weapons systems 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 1988 Program:
   - (U) Began delivery of initial avionics components and continued development of avionics ground prototypes (AGP) with initial integration tests and simulations.
   - (U) Integrated breadboard and advanced development modules (ADM) of avionics components and subsystems (e.g. 1750 data processors, high speed data bus, common signal processor modules, etc.) and demonstrated as an operating system.
   - (U) Designed and fabricated prototype sensor components.

2. (U) FY 1989 Planned Program:
   - (U) Incorporate additional ADM hardware into the avionics ground prototype, including components derived from the Integrated Electronic Warfare System/Integrated Communications, Navigation, Identification Avionics effort (PE #0603109F).
   - (U) Conduct partial demonstrations of the avionics prototypes.
   - (U) Complete fabrication of prototype sensor, electronic combat, and comm/nav/ident components.
   - (U) Begin sensor ground and rooftop tests.

3. (U) FY 1990 Planned Program:
   - (U) Perform tests to verify fault isolation/fault tolerance and other buy 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.

Program Element: #0603230F
PE Title: Advanced Tactical Fighter
Project Number: 2995
Budget Activity: # 4 - Tactical Programs

- (U) Incorporate avionics requirements in FSD request for proposals and in source selection evaluation for a single prime contractor.

4. (U) FY 1991 Planned Program:
   - (U) Complete Dem/Val avionics data collection and analysis through early FY 1991.
   - (U) Complete FSD source seclection and award contract (see PE #0604239).

5. (U) Program to Completion: Not Applicable (Completes in FY 1991).

D. (U) WORK PERFORMED BY: Total ATF weapon system responsibilities, including avionics integration, rest with the prime contractors, Lockheed-California and Northrop. 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:
   - (U) TAF SON 304-83, 9 Nov 84.
   - (U) TAF 304-83-I/IIA, SORD for ATF, 4 Dec 87.
   - (U) ATF TEMP, 2 Feb 88.

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.

Program Element: #0603230F
PE Title: Advanced Tactical Fighter
Project Number: 2995
Budget Activity: # 4 - Tactical Programs

- (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: Not Applicable.
J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Avionics Ground Prototype (AGP) specifications released	Aug 1987	

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Initial avionics prototype core demonstrations	1Q/FY 1989	
Begin flying avionics test bed demonstrations	FY 1989	
Final avionics prototype demonstrations	FY 1990	
Complete flying avionics test bed demonstrations	FY 1990	

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3479 Advanced Sensor Exploitation	1,274	1,292	1,606	1,765	Continuing	TBD
3480 Automated Imagery Exploitation	1,384	1,891	1,992	2,154	Continuing	TBD
3481 Knowledge Based Technology for Intelligence	965	1,692	1,886	2,039	Continuing	TBD
3482 Scientific & Technical Intelligence Methodologies	350	94	1,215	1,315	Continuing	TBD
Total	3,973	4,969	6,699	7,273	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: IAD 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 element 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 1988 Accomplishments:
- (U) Implemented sensor management module.
- (U) Implemented data base merge/purge module.

(U) FY 1989 Planned Program:
- (U) Implement situation assessment module.
- (U) Implement generic sensor simulator.
- (U) Implement target analysis module.
- (U) Operationally test preliminary predictive intelligence capability (Rapid Application of Airpower).
- (U) Implement enhanced correlation environment.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

- (U) Port 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 intensity conflict situations.
- (U) Develop correlation/fusion evaluation subsystem using expert system approach.
- (U) Initiate development of predictive intel prototype.

(U) FY 1991 Planned Program:
- (U) Continue knowledge-based exploitation development.
- (U) Implement predictive intel prototype at operational site.
- (U) Develop low intensity conflict intelligence processor.
- (U) Develop advanced planning system intelligence support module.

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.

(U) FY 1988 Accomplishments:
- (U) Intelligence image compression.
- (U) Improved transmission of imagery through band limited channels.
- (U) Reduction of image degradation.
- (U) Initiated efforts on intel/information reformatter technology for real-time acceptance of multi-sensor imagery and reformatting into a common standard, the Reconnaissance Data Exchange Standard.
- (U) Developed algorithms for automated multisensor target detection.

(U) FY 1989 Planned Program:
- (U) Complete Air Order of Battle (AOB) automated change detection task.
- (U) Complete Geopositioning Demonstration System (GDS), a module to demonstrate positioning concepts at Air Force field sites.
- (U) Begin to define, develop and integrate software onto Rome Air Development Center (RADC) Image Processing Laboratory (IPL) to perform automated change detection of fixed military targets.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

- (U) Continue reformatter technology task (Nunn Amendment funding programmed).

(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 on the IPL using an improved man-machine interface (MMI).
- (U) Identify factors/parameters inherent to Unattended Aerial Reconnaissance Vehicles (UARV) which affect image quality.
- (U) Develop algorithms and display methods to aid the photointerpreter in using multi-sensor/spectral imagery for target identification.

(U) FY 1991 Planned Program:
- (U) Award contract for UARV image quality effort.
- (U) Start effort for multi-spectral/pixel interaction analysis for camouflage, concealment and deception applications.
- (U) Start effort for application of multi-sensor/spectral imagery for detection and identification of Strategically Relocatable Targets.

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 his/her tasks.

(U) FY 1988 Accomplishments:
- (U) Developed prototype computer subsystem modules to provide warning and assessment of foreign space and missile activity.
- (U) Developed computer software to assist EW analysts in near-real-time ELINT analysis and reprogramming capability.
- (U) Developed image based software for the Air Force Intelligence Agency to assist analysts in rapid detection and monitoring of foreign denial and deception activities for air defense.

(U) FY 1989 Planned Program:
- (U) Continue/complete prior efforts.
- (U) Initiate computer expert system software to accelerate analysis of foreign aircraft tactics/capabilities and provide timely dissemination to the tactical commands.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

(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) FY 1991 Planned Program:
- (U) Develop knowledge-based expert system for space object identification.
- (U) Develop rule bared capability for countering denial and deception techn'ques associated with mobile missiles.

4. (U) Project 3482, Scientific and Technical Intelligence Methodologies: The objective is to conduct research on intelligence methodologies and develop operational employment simulation models.

(U) FY 1988 Accomplishments:
- (U) Provided Foreign Technonogy Division (FTD) a functional requirements document to define a model of a foreign communications/avionics/navigation system and a foreign ground attack fighter penetrating U.S. airspace.
- (U) Developed prototype workstation to test various user interface concepts in support of the Red Mission Analysis (RMA).

(U) FY 1989 Planned Program:
- (U) Developing the ELINT Analysis Expert System (EATS) to provide direct automated analysis of signal waveforms.

(U) FY 1990 Planned Program:
- (U) Develop a model management system and data base coupling software to support RMA activity at FTD.
- (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) Continue RMA support.
- (U) Continue STRIPS.
- (U) Develop a man-machine interface to various models and software to couple models existing in different branches at FTD.

Program Element: #0603260F Budget Activity: #4 - Tactical Programs
PE Title: Intelligence Advanced Development (IAD)

D. (U) PROGRAM TO COMPLETION: This is a continuing program.

E. (U) WORK PERFORMED BY: The program is managed by Air Force Systems Command, 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.

F. (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, WWNCCS 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.

G. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

H. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Currently being negotiated with NATO for the Imagery Reformatter under Project 3480.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3018 Air Base Operability	2,640	2,593	2,145	2,842	Continuing	TBD
3140 Camouflage, Concealment, and Deception	1,496	2,480	650	990	Continuing	TBD
Total	4,136	5,073	2,794	3,832	Continuing	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 survive an enemy attack allowing air power to be continuously and effectively employed throughout the conflict.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 1988 Accomplishments:
- (U) Provided advanced development efforts for active and passive defense, base recovery, and command, control and communication survivability.
- (U) Funded integration, planning and technology demonstration activities of ABO Systems Management Office (SMO), responsible for integrating ABO activities AFSC-wide.
- (U) Prepared for demonstration of survivable communications.
- (U) Continued development of utility survivability model.
- (U) Performed analyses to support Base Operability Annual Analysis/Base Capabilities Acquisition Plan (BOAA/BCAP) process.
- (U) Expanded effectiveness modeling to include Southwest Asia.
- (U) Tested improved Explosive Ordnance Disposal equipment.
- (U) Initiated operation of the ABO Data Center.
- (U) Demonstrated survivable communications and air base ground defense detection equipment and procedures.

(U) FY 1989 Planned Program:
- (U) Continue analyses for the BOAA/BCAP process, the utility survivability model and theatre level effectiveness modeling of multiple air bases.
- (U) Continue efforts to improve ABO communications and base communications survivability.

Program Element: #0603307F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability Advanced Development

- (U) Focus efforts at improving utility survivability and recovery techniques.
- (U) Operate the ABO Data Center.

(U) FY 1990 Planned Program:
- (U) Continue to develop and refine modeling approaches to identifing and satisfying the most critical ABO needs.

(U) FY 1991 Planned Program:
- (U) Continue ABO integration efforts.

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

(U) Work Performed By: Softech Incorporated, Alexandria VA; and TRW Defense Systems Group, Redondo Beach CA (all working on Air Base Survivability, Project 3018). In-house development organizations are Armament 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; and Electronic Systems Division, Hanscom AFB MA.

(U) Related Activities: The Full Scale Development efforts that follow this Advanced Development work are provided in PE 0604617F, Air Base Operability. 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 Cooperation Agreements: None.

2. (U) Project 3140, Camouflage, Concealment and Deception (CCD): Includes Advanced Development work on decoys, obscuration concepts, and optical and electronic sensor deception.

(U) FY 1988 Accomplishments:
- (U) Initiated advanced development work on decoys, light weight camouflage nets, obscuration concepts, large area smoke screens and optical and electronic sensor deception.
- (U) Transitioned aircraft decoys to full scale development.
- (U) Continued studies to identify how different techniques affect vision or visual perception and identify the best technologies for that purpose. Transitioned them to full scale development.
- (U) Initiate advanced CCD efforts (CCD Phase II) to determine cost effective measures that will address deception of electronic sensors through active and passive means.

Program Element: #0603307F Budget Activity: #4
PE Title: Air Base Operability Advanced Development

(U) FY 1989 Planned Program:
- (U) CCD Phase II will continue to study the areas of radio frequency, infrared, and ultraviolet sensor deception for promising techniques for further development.

(U) FY 1990 Planned Program:
- (U) Continue CCD Phase II with emphasis on technology that could transition to Full Scale Development.

(U) FY 1991 Planned Program:
- (U) CCD Phase II continues through FY 1991. As suitable techniques are developed they will transition to full scale development.

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

(U) Work Performed By: Ball Corp., Systems Engineering Division, San Diego, CA. In-house development organizations are Armament Division, Eglin AFB FL; Aeronautical Systems Division and Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB OH.

(U) Related Activities: The Full Scale Development efforts that follow this Advanced Development work are provided in PE 0604617F, Air Base Operability. 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 Cooperation Agreements: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603320F Budget Activity: #4 - Tactical Programs
PE Title: Lower Cost Antiradiation Seekers

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
LCS	13,325	12,391	7,632	-0-	-0-	76,836

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides funds for the development of the High Speed Antiradiation Missile (HARM) Lower 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. A variety of antiradiation weapon concepts are under consideration to accomplish this goal. The LCS is a US Navy derivative concept of the US Army Antiradiation Projectile design which provides an opportunity to meet increased HARM performance requirements at lower unit costs. HARM is being acquired by the Navy and Air Force to meet an immediate need for an upgraded capability against current threats. The F-4G Wild Weasel represents the only dedicated lethal defense suppression weapon system in the Air Force inventory and HARM is its primary weapon. The F-16C/D models are also being equipped with HARM for its "hunter/killer" mission in conjunction with the F-4G.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) LCS: (No Project Number)

(U) FY 1988 Accomplishments:
- (U) Started Full Scale Development (FSD)
- (U) Started 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 (DT&E)

(U) FY 1989 Planned Program:
- (U) Continue DT&E
- (U) Start manufacture of 45 production prototype models
- (U) Complete transfer of software design and responsibility from NWC to the contractor

Program Element: #0603320F Budget Activity: #4 - Tactical Programs
PE Title: Lower Cost Antiradiation Seekers

(U) FY 1990 Planned Program:
- (U) Complete delivery of 45 production prototype models
- (U) Complete Development Test and Evaluation (DT&E)
- (U) Conduct Initial Operational Test and Evaluation (IOT&E)
- (U) Start fabricating production units

(U) FY 1991 Planned Program: Not Applicable

(U) Program to Completion: Not Applicable

(U) Work Performed By: The Air Force program management is provided by the Armament 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 two primary contractors who performed work for this program effort were Ford Aerospace and Communications Corporation, Newport Beach CA and Raytheon Company, Missile Systems Division, Lowell MA. Ford Aerospace was competitively selected to complete full scale development.

(U) Related Activities: Program Element (PE) 0207162F High Speed Antiradiation Missile (HARM). LCS is the new lower cost seeker for HARM. Texas Instruments (HARM contractor) is funding development of an upgrade seeker (Block IV) in parallel with LCS. PE 0207136F, F-4G Wild Weasel Squadrons. The APR-38 Radar Homing and Warning Receiver is being optimized for use with the HARM missile.

(U) Other Appropriation Funds: Procurement funding for the HARM missile with the lower cost seeker will be under a separate Program Element (PE 0207317F).

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MISSILE PROCUREMENT (BA 4):						
Cost	-0-	-0-	19,903	45,303	-0-	65,206
Quantity			50	200	-0-	250

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
Title: Command, Control & Communications (C3) APPLICATIONS

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2314* Tactical Air Surveillance	0	0	1,163	1,668	Continuing	N/A
2317* Tactical Information Distribution	0	0	1,806	1,775	Continuing	N/A
2321* Tactical Battle Information Management	0	0	3,065	3,433	Continuing	N/A
3804* Tactical Air Forces System Integration	0	0	1,842	1,140	Continuing	N/A
Total	0*	0*	7,876	8,016	Continuing	N/A

* 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:

(U) Project: 2314, Tactical Air Surveillance: Develops advanced technology and demonstrates equipment and/or procedures supporting improvements to the Tactical Air Control System (TACS). The goal is to provide continuous air surveillance and current depiction of the friendly and hostile airspace. Specific areas include detection of air activity, continuous tracking of all detected objects, passive detection, identification and classification of targets (cooperative and non-cooperative), and sensor track correlation.

(U) FY 1988 Accomplishments:
- (U) Completed detailed radar system trade-off studies including the very low cross section threat.
- (U) Completed investigation and design concepts for dual frequency radar to counter the low visibility threat.

(U) FY 1989 Planned Program:
- (U) Perform a cost/performance trade-off analysis for an improvement program for the AN/TPS-75 radar versus development of a new microwave frequency radar.

00392

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
Title: Command, Control & Communications (C3) APPLICATIONS

- (U) Investigate non-radar and/or adjunct radar sensors to address surveillance, detection, and tracking requirements generated by the TAF which are not satisfied by an active radar.

(U) FY 1990 Planned Program:
- (U) Provide to the TAF the 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) Include major technical milestones and programmatics to include cost, schedule, and acquisition strategy.
- (U) Prototype non-radar and/or adjunct radar sensors resulting from the previous investigations.

(U) FY 1991 Planned Program:
- (U) Start risk reduction efforts to prototype enhancements resulting from the trade-off analysis for an improvement program for the AN/TPS-75 radar versus development of a new microwave radar.
- (U) Continue prototype efforts for non-radar and/or adjunct radar sensors resulting from the previous investigations.

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

(U) Work Performed By: The Rome Air Development Center, Griffiss AFB, NY, conducts project efforts. MITRE Incorporated, Bedford, MA, provides engineering support. RCA Aerospace, Moorestown, N.J.; Westinghouse Electric, Baltimore, Md; UNISIS, Long Island, NY; ITT Gilfillan, Van Nuys, Ca, supported the radar trade-off studies.

(U) Related Activities:
- (U) PE #0603789F, Tactical Command, Control, and Communications Advanced Development.
- (U) PE #0603742F, Combat Identification Technology.
- (U) PE #0207411F, Overseas Air Weapons Control Systems.
- (U) PE #0207412F, Tactical Air 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: Not Applicable.

(U) Project: 2317, Tactical Information Distribution: This project transitions Advanced Communications Technology to the TACS. Multilevel computer security efforts are directed towards developing a real time capability for computers at various security levels to transfer data up to the security level of the receiving computer. A system for real time sensor netting of TPS-75 radars will be investigated.

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
Title: Command, Control & Communications (C3) APPLICATIONS

(U) FY 1988 Accomplishments:
- (U) Completed TAF-wide analysis and requirements definition for multi-level secure communications.
- (U) Prepared to prototype an Enhanced Multinet Gateway (EMG) for multilevel security.

(U) FY 1989 Planned Program:
- (U) Start prototype efforts for the EMG for a multi-level secure data switch.
- (U) Plan for a TAF-like test and evaluation environment.
- (U) Complete definition of sensor netting architectural framework.

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

(U) Work Performed By: The Rome Air Development Center, 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 System.
- (U) PE #0207423F, Advanced Communication Systems.
- (U) PE #0603790D, NATO Research & 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.

(U) Project: 2321, Tactical Battle Information Management. This project prototypes an Advanced Planning System (APS) decision aid for rapid air task order generation and electronic combat planning. APS will improve on and integrate capabilities from

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
Title: Command, Control & Communications (C3) APPLICATIONS

Tactical Expert Mission Planner (TEMPLAR), Force Level Automated Planning System (FLAPS), C3 Countermeasures Battle Management Decision Aid (C3CMBMDA), Weather Tactical Decision Aids (TDAs) and the Improved Many on Many (IMOM) simulation.

(U) FY 1988 Accomplishments:
- (U) TAF identified the decision aids to incorporate into APS.
- (U) Started prototype efforts for APS.
- (U) Prototyped a C3CM Planning Analysis (CPA) decision aid to provide deception and protection planning assistance.
- (U) Prototyped an Identification of C2 Nodes (ICON) decision aid for the Limited Enemy Situation Correlation Element.

(U) FY 1989 Planned program:
- (U) Deliver CPA and ICON to the TAF for evaluation.
- (U) Complete APS Phase I.

(U) FY 1990 Planned program:
- (U) Initiate APS Phase II.
- (U) Integrate CPA and ICON into APS if required.

(U) FY 1991 Planned program:
- (U) Continue prototype efforts for APS.

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

(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 #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 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.

(U) Project Number 3804 TAF System Integration: This project provides system integration and engineering support for Tactical Air Force Battle Management programs. The project assists the TAF in

Program Element: #0603617F Budget Activity: #4 - Tactical Programs
Title: Command, Control & Communications (C3) APPLICATIONS

evaluating the results of prototype efforts and off-the-shelf technology to provide effective and supportable solutions to TAF deficiencies. Specific efforts focus on the TAF Standard Wing Command and Control System prototype, unit level intelligence prototype, the Force Level Automated Testbed, the Contingency TACS Automated Planning System, Weather Command and Control Systems integration, Mission Planning Theater Integration, and the TACS Data Base configuration management. This is a new start in FY 1989.

(U) FY 1988 Accomplishments: Not Applicable.

(U) FY 1989 Planned program:
- (U) Provide system level analysis of network security issues.
- (U) Analyze hardware and software architectural options for Battle Management programs.

(U) FY 1990 Planned program:
- (U) Provide options to achieve desired network security capabilities including system-wide interface requirements.
- (U) Provide system interoperability requirements for architectural options selected.
- (U) Support systems integration of on-going prototype efforts.

(U) FY 1991 Program Plans:
- (U) Analyze theater force management data bases for consistency with on-going prototype efforts and identify changes.
- (U) Analyze new data element requirement from planned decision aids and recommend data base or decision aid modifications.

(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 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: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2597 Noncooperative Identification Subsystems	0	1640	1759	1773	Continuing	TBD
3765 Joint-Service Noncooperative ID Techniques	0	300	200	200	Continuing	TBD
Total	00	1940	1959	1973	Continuing	TBD

NOTE: FY88 funding was included in the Consolidated Electronic Warfare PE at the direction of Congress.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element develops, demonstrates, and transitions, new, promising combat identification technologies to provide

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2597, Noncooperative Identification Subsystems: Engineering development and demonstration of advanced noncooperative recognition (NCTR) techniques/technologies for current/future USAF platforms, including

Many of these efforts are jointly funded.

(U) FY 1988 Accomplishments:

- (U) Published coordinated Program Research and Development Announcements (PRDAs) to exploit advanced NCTR technologies. Received over 100 proposals from industry and awarded several contracts to the most promising.
- (U) Awarded contract to analyze the feasibility of merging the

- (U) Awarded contract to analyze the feasibility of exploiting for combat NCTR. Includes data collection and analysis, demonstration of

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Program Element: #0603742 Budget Activity: #4 - Tactical Programs
PE Title: Combat Identification Technologies

performance against various aircraft, and study of the feasibility of incorporating

- (U) Awarded contract to develop and demonstrate multi-sensor target feature fusing to provide target identification.
- (U) Awarded contract to investigate and demonstrate using a laser radar to detect unique aircraft vibration signatures.
- (U) Awarded contract to investigate and demonstrate incorporating combat identification capabilities into the
- (U) Awarded contract to improve and demonstrate passive bistatic IFF target tracking.
- (U) Awarded contract to investigate and perform a laboratory demonstration of
- (U) Awarded contract to investigate and demonstrate the feasibility of

(U) FY 1989 Planned Program:
- (U) Supports the continuation of the above NCTR technology investigations and demonstrations for tactical combat identification.

(U) FY 1990 Planned Program:
- (U) Supports the completion of the above NCTR technology demonstrations and the selection of the most promising techniques for further development and transition.

(U) FY 1991 Planned Program:
- (U) Supports technology transition development to baseline advanced NCTR techniques into specific tactical weapon systems.

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

(U) Work Performed By: Managed by the Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson AFB, OH; and by Rome Air Development Center, Griffiss AFB, NY. Contractors include: Veda Incorporated, Dayton, OH; Scope Electronics, Reston, VA; Westinghouse Electronics, Baltimore, MD; Raytheon Co., Bedford, MA; Boeing, Seattle, WA.

(U) Related Activities:
- (U) PE #0604725F, Combat Identification Systems.
- (U) PE #0603267N, NATO Future Identification Systems.
- (U) PE #0603515N, Advanced Identification Techniques.
- (U) PE #0603706A, Identification Friend or Foe (IFF) Developments.
- (U) PE #0604211N, Air Traffic Control Radar Beacon System/Mark XII.
- (U) PE #0604709A, IFF Equipment.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0603742 Budget Activity: #4 - Tactical Programs
PE Title: Combat Identification Technologies

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

2. (U) Project 3765, Joint-Service Noncooperative ID Technologies: Supports the Tri-Service Target Identification Program (TRI-TIP). This project supports various joint-service advanced NCTR development efforts.

(U) FY 1988 Accomplishments:
- (U) TRI-TIP Program Implementation Plan developed and approved. Joint plan for Tri-service improvement programs to exploit for improved combat ID capability.
- (U) Tri-service Memorandum of Understanding for Tri-service combat ID information exchange and coordination.
- (U) National industry-government NCTR symposium held.

(U) FY 1989 Planned Program:
- (U) Funds the USAF share of the data base.
- (U) Investigate methods to obtain

(U) FY 1990 Planned Program:
- (U) Continues the USAF share of the data base.

(U) FY 1991 Planned Program:
- (U) Continues support for the data base.

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

(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 Aeronautical Laboratories/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 #0603267N, NATO Future Identification Systems.
- (U) PE #0603515N, Advanced Identification Techniques.
- (U) PE #0603706A, Identification Friend or Foe (IFF) Developments.
- (U) PE #0604211N, Air Traffic Control Radar Beacon System/Mark XII.
- (U) PE #0604709A, IFF 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.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604201F
PE Title: Aircraft Avionics Equipment Development

Budget Activity: #4-Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2257 Standard Avionics and Joint Services Review Committee (JSRC) Initiatives	3,149	3,800	4,761	5,626	Continuing	N/A
2258 Standard Inertial Navigation Unit (INU)	2,623	2,900	1,000	1,017	Continuing	N/A
2297 Embedded Computer Software Standardization	2,040	1,800	2,000	2,200	Continuing	N/A
2519 Airborne Radar Improvements	408	130	0	0	Continuing	N/A
2560 JOVIAL Language Control Facility	622	450	600	700	Continuing	N/A
2658 Avionics Architecture Implementation and Support	777	550	250	900	Continuing	N/A
3264 Standard Flight Data Recorder	7,022	9,901	5,946	2,500	3,630	29,098
Total	16,641	19,531	14,557	12,943	Continuing	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element develops standard avionics architectures and equipment to reduce support costs, increase weapon system availability, and foster technology evolution and insertion to provide operational force improvements. Reliability and Maintainability (R&M) considerations play a major role in the identification of specific development efforts within this program. Joint avionics development efforts are pursued through participation in and support of the Joint Service Review Committee (JSRC). Current JSRC initiatives undergoing development at this time include a Ground Collision Avoidance System and a Standard Flight Data Recorder. This program also supports generic radar applications to improve performance, reliability and maintainability of current Air Force airborne fire control radars. Development, enhancement, and maintenance of MIL-STD-1750/1B15 embedded computer software support tools is also supported by this PE. Finally, this program funds necessary ongoing support activities to ensure a credible standardization program is maintained.

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Program Element: #0604201F
PE Title: Aircraft Avionics Equipment Development
Budget Activity: #4-Tactical Programs

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 2257, Standard Avionics, and Joint Services Review Committee (JSRC) Initiatives. Identifies/develop potential Air Force systems and subsystems for standardization. Through JSRC identifies systems and subsystems for potential joint services application. Maintains and updates Air Force Avionics Roadmap

(U) FY 1988 Accomplishments:
- (U) Develop, maintain avionics data base
- (U) Develop, publish annual Avionics Master Plan
- (U) Initiate Modular Avionics Systems Architecture (MASA) Program
- (U) Initiates Standard Central Air Data Computer Program
- (U) Develop, enhance, and maintain Standardization Evaluation Program (STEP) life cycle cost model

(U) FY 1989 Planned Program:
- (U) MASA/LRM FSD definition work will continue with development of standards and specifications for LRMs and other key elements.
- (U) Evaluation of the standardization potential of single point keying technology will be performed.
- (U) Initiate New Technology Compass Program

(U) FY 1990 Planned Program:
- (U) Continue providing the front-end activity needed to determine the feasibility of standardizing selected avionics systems/subsystems identified through the Air Force and Joint Service avionics planning process.
- (U) Continue support of JSRC initiatives to incorporate Ground Collision Avoidance capability in cargo/bomber aircraft
- (U) Continue New Technology Compass development
- (U) Initial potential standard line replaceable module
- (U) Begin development of standards deriving from single point keying technology.
- (U) Evaluate the potential development of a family of standard power supplies.
- (U) Maintain/update Air Force Avionics Roadmap

(U) FY 1991 Planned Program:
- (U) Continue support of Joint Service Review Committee (JSRC) initiatives
- (U) Continue line replaceable module (RM) efforts
- (U) Initiate Standard Power Supply Program (SPSP)
- (U) Enhance Single Point Keying Program
- (U) Complete New Technology Compass Program
- (U) Continue to maintain/update Air Force Avionics Roadmap

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

Program Element: #0604201F
PE Title: Aircraft Avionics Equipment Development

Budget Activity: #4-Tactical Programs

(U) Worked Performed By: Program management is provided through Air Force Systems Command by Aeronautical Systems Division, Wright Patterson AFB, OH. Major contracts are with; Draper Labs, Cambridge Mass.

(U) Related Activities:
- (U) Program Element 0603109F, INEWS/ICNIA
- (U) Program Element 0603253F, Advanced Avionics Integration
- (U) Program Element 064203N (US Navy)
- (U) Program Element 64201A (US Army)

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

(U) Project 2258, Standard Inertial Navigation Unit (INU): Develops an Air Force Standard Form, Fit, Function (F3) INU. Applies Ring Laser Gyro (RLG) technology to the Air Force standard F3 medium accuracy (0.8nm/hr) INU's. Development effort for a precision accuracy (0.2nm/hr) INU. Targeted F3 INU aircraft are the F4, F/FB/FF-111, A-7, C-130, HH53, OV-10. Targeted RLG INU aircraft (medium acuracy) are the F-15/A-D (retrofit) F-15E production. Targeted precision accuracy INU aircraft are the Special mission C-130 (Combat Talon I and II) and AC-130 Gunship Aircraft

(U) FY 1988 Accomplishments:
- (U) F3 and F-15 RLG INU flight demonstration/verification conducted
- (U) F3 RLG INU transparency demonstrations performed
- (U) F3 Qualification testing completed
- (U) Development of integration/engineering changes to the F3 INU and F-15E Standard INU
- (U) Precision Accuracy RLG INU qualification testing completed

(U) FY 1989 Planned Program:
- (U) F-15 RLG INU qualification testing will be completed

(U) FY 1990 Planned Program:
- (U) Begin PMRT of standard INU to Air Force Logistics Command.
- (U) Update specification of INU to include potential follow-on aircraft (F-16, A-10, CV-22).

(U) FY 1991 Planned Program:
- (U) Complete PMRT of standard INU.
- (U) Complete specification updates for F-16, A-10, CV-22.

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

(U) Worked Performed By: Program management is provided through Air Force Systems Command by Aeronautical Systems Division, Wright Patterson AFB, OH. Major contracts are with; Litton Systems, Inc., Woodland Hills CA; Singer Kearfott Corp., Little Falls, NJ; and Honeywell, Minneapolis MN.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

(U) Related Activities:
- (U) Program Element 0603109F, INEWS/ICNIA
- (U) Program Element 0603253F, Advanced Avionics Integration
- (U) Program Element 0602204F, Aerospace Avionics

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

(U) Project 2297, Embedded Computer Software Standardization: Maintains Embedded Computer Standardization Program Office. Develops support software that permits implementation of standardization efforts such as; MIL-STD-1589 (JOVIAL J73), MIL-STD-1815 (Ada), and MIL-STD-1750, 16 bit computer instruction set architecture

(U) FY 1988 Accomplishments:
- (U) Development of a production quality Ada/MIL-STD-1750 compilation system was initiated in October 1985
- (U) Production of an initial production quality compilation system (PQACS) scheduled to take place the end of FY88 (Phase II)

(U) FY 1989 Planned Program:
- (U) Version release of the JOVIAL/MIL-STD-1750 related software are scheduled to continue into FY89
- (U) Start development of the Ada/MIL-STD-1750 Debugger (Phase IV)
- (U) Continue study efforts (Phase V) to determine necessary Ada tool set enhancements
- (U) Enhance the JOVIAL tool set to accommodate MIL-STD-1589D

(U) FY 1990 Planned Program:
- (U) Completion of the symbolic debugger (Phase IV) will complete the Ada tool set in FY 90
- (U) Continue study efforts (Phase V) to determine necessary Ada tool set enhancements
- (U) Follow-on Ada tool set support/enhancement contract (Phase V) will be awarded in FY90

(U) FY 1991 Planned Program:
- (U) Continue to collect Software Problem Reports (SPRs) against the Ada tool set as a part of the support/enhancement effort in preparation for PMRT of the tool set to AFLC
- (U) Continue study efforts (Phase V) to determine necessary Ada tool set enhancements
- (U) Support and enhance the Ada tool set under the Phase VI contract

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

(U) Worked Performed By: Program management is provided through Air Force Systems Command by Aeronautical Systems Division, Wright Patterson AFB, OH. Major contracts are with; Boeing Military Airplane Company (BMAC), Wichita, KS.

Program Element: #0604201F Budget Activity: #4-Tactical Programs
PE Title: Aircraft Avionics Equipment Development

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics
- (U) Program Element 0603226F, DOD Common Programming Language, Advanced Development

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

(U) Project 2519, Airborne Radar Improvements. Develops generic radar improvements for current Air Force airborne fire control radar systems. Emphasis is on improved reliability and maintainability. Coordinates radar development between Air Force laboratories and aircraft system program offices

(U) FY 1988 Accomplishments:
- (U) Transition of electronic counter-countermeasures (ECCM) technology continued with emphasis on ECCM applications
- (U) F-15 Radar Built-In-Test (BIT) improvement and Coolanal contamination investigations were completed
- (U) F-16 and B-1B Radar Roadmaps were completed

(U) FY 1989 Planned Program:
- (U) Porter Data Systems scheduled for completion

(U) FY 1990 Planned Program:
- Project will be delayed due to funding reductions.

(U) FY 1991 Planned Program:
- (U) Project will be delayed due to funding reductions.

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

(U) Worked Performed By: Program management is provided through Air Force Systems Command by Aeronautical Systems Division, Wright Patterson AFB, OH. Major contracts are with; Hughes Aircraft Corp., Culver City, CA; Westinghouse Electric Corp, Baltimore, MD.

(U) Related Activities:
- (U) Program Element 0603203F, Advanced Avionics for Aircraft
- (U) Program Element 0603253F, Advanced Avionics Integration
- (U) Program Element 0602204F, Aerospace Avionics

(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

(U) Project 2560, JOVIAL Language Control Facility (LCF): Controls and maintains the JOVIAL J73 language standard. Supports DOD Ada language standardization organizations. Performs JOVIAL and Ada compiler validations. Provides technical assistance to JOVIAL J73 users. Performs HOL training to meet the needs of the embedded computer systems. Disseminates JOVIAL and Ada related information via an LCF newsletter

(U) FY 1988 Accomplishments:
- (U) Conducted over 80 JOVIAL J73 compiler validations
- (U) Provided JOVIAL J73 training to over 800 government and contractor personnel
- (U) Published 32 issues of the LCF Newsletter
- (U) Coordinated publication of JOVIAL J73 MIL-STD-1589B and -1589C
- (U) Provided technical support to AFWAL/POOC-1, Fault Tolerant Electrical Power system (FTEPS) Program; B-52 Weapon System Trainer SPO; F-16 SPO; Advanced Cruise Missile (ACM) SPO; and SRAM II SPO

(U) FY 1989 Planned Program:
- (U) Validate approximately 8 JOVIAL compilers
- (U) Complete development of a JOVIAL J73 Computer Aided Instruction course
- (U) Publish three issues of the LCF Newsletter
- (U) Coordinate publication of the MIL-STD-1589D
- (U) Continue technical support to other AF organizations

(U) FY 1990 Planned Program:
- (U) Validate approximately 6 JOVIAL compilers
- (U) Publish three issues of the LCF Newsletter
- (U) Continue technical support to other AF organizations

(U) FY 1991 Planned Program:
- (U) Validate approximately 6 JOVIAL compilers
- (U) Publish three issues of the LCF Newsletter
- (U) Continue technical support to other AF organizations

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

(U) Worked Performed By: Program management is provided through Air Force Systems Command by Aeronautical Systems Division, Wright Patterson AFB, OH.

(U) Related Activities:
- (U) Program Element 0602204F, Aerospace Avionics
- (U) Program Element 0603226F, DOD Common Programming Language. Advanced Development

(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

(U) Project 2658, Avionics Architecture Implementation and Support (AAIS): Support Systems Engineering Avionics Facility which provides/develops avionics architectural standards such as MIL-STD-1553B and MIL-STD-1760A. Does validation testing and engineering support for new and existing architectures. Investigates/develops new standards

(U) FY 1988 Accomplishments:
- (U) MIL-STD-1553B testing for 22 subsystems
- (U) MIL-STD-1750 testing for 37 computers
- (U) MIL-STD-1760 Notice 2 Published
- (U) MIL-STD-1760 Notice 3 Published
- (U) Draft Amendment to NATO STANAG 3838 completed
- (U) MIL-STD-1553B Handbook completed
- (U) NATO and Air Standardization Coordinating Committee (ASCC) adopted MIL-STD-1750

(U) FY 1989 Planned Program:
- (U) MIL-STD-1553B testing for 10 subsystems
- (U) MIL-STD-1750 testing for 14 computers
- (U) Publish MIL-STD-1553B Handbook

(U) FY 1990 Planned Program:
- (U) MIL-STD-1553B testing for 3 subsystems
- (U) MIL-STD-1750 testing for 3 computers
- (U) MIL-HDBK-1750 development
- (U) MIL-STD-1750 Verification Software Update

(U) FY 1991 Planned Program:
- (U) MIL-STD-1553B testing for 8 subsystems
- (U) MIL-STD-1750 testing for 10 computers
- (U) MIL-HDBK-1750 development continued
- (U) High Speed Data Bus Handbook development

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

(U) Worked Performed By: Program management is provided through Air Force Systems Command by Aeronautical Systems Division, Wright Patterson AFB, OH.

(U) Related Activities:
- (U) Program Element 0603226F, DOD Common Programming Language. Advanced Development

(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

(U) Project 3264, Standard Flight Data Recorder (SFDR): Develops a standard crash survivable flight data recorder which is a JSRC sponsored initiative.

(U) FY 1988 Accomplishments:
- (U) Interface Control Documentation defined for SFDR installations for 17 AF production and retrofit aircraft and one Navy retrofit aircraft
- (U) SFDR full scale development contract awarded for application to 18 different aircraft types, including F-15E, F-16A/B Air Defense Fighter (ADF), YA-7F, C-17, and AFLC's ASIP flight recorder retrofit program

(U) FY 1989 Planned Program:
- (U) Flight testing of trial integration units on operational aircraft will be conducted and production deliveries for F-16A/B ADF and C-17 SFDRs will begin

(U) FY 1990 Planned Program:
- (U) Flight testing of trial integration units on operational aircraft will be conducted and production deliveries for C-130, C-141, T-38, and F-15E SFDRs will begin

(U) FY 1991 Planned Program:
- (U) Flight testing of trial integration units on operational aircraft will be conducted and production deliveries for T-43, F-15A/B, E-3, B-52, and RC-135 SFDRs will begin

D. (U) Work Performed By: Program management is provided through Air Force Systems Command by the Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contracts are with; Smith Industries, Grand Rapids, MI.

(U) Related Activities: Not Applicable

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1926 Aircraft Windshield Development	2,826	1,134	2,481	2,869	Continuing	N/A
Total	2,826	1,134	2,481	2,869	Continuing	N/A

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 utilizes advanced state-of-the-art technology to develop windshield systems with improved hazard resistance and reduced cost of ownership.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(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 1988 Accomplishments:

- (U) Completed OT&E of T-38 windshield; completed DT&E and began OT&E of A-7 windshield; began OT&E of F/RF-4 windshield.
- (U) Supported air logistics centers in fleet retrofits of A-7, T-38, and F/RF-4 windshields.
- (U) Continued evaluation of alternate transparency designs for the B-1B; initiated evaluation of causes for structural degradation of F-111 and F-16 canopies; began feasibility study for mission compatible A-7 and F-16 canopies.

(U) FY 1989 Planned Program:

- (U) Complete OT&E of A-7 windshield.
- (U) Begin development of F-111 transparency system to correct flight safety hazards caused by service life structural degradation.
- (U) Continue to monitor the operational evaluation of F/RF-4 and T-38 windshields.
- (U) Continue design tradeoff studies for mission compatible transparency systems for the B-1B, F-16, and A-7.

Program Element: #0604212F Budget Activity: #4 - Tactical Programs
PE Title: Aircraft Equipment Development

(U) FY 1990 Planned Program:
- (U) Fabricate and test full-scale alternative windshield system for the B-1B and canopy for the F-16.
- (U) Evaluate subscale version of A-7 improved canopy.
- (U) Perform operational evaluation of F-111 improved transparency system.
- (U) Evaluate technology advancements for cost-of-ownership enhancements to the T-38, F/RF-4, and A-7 windshields.

(U) FY 1991 Planned Program:
- (U) Continue operational evaluation of F-111 improved transparency system.
- (U) Begin flight evaluation of B-1B alternative windshield system and F-16 improved canopy.
- (U) Fabricate and test full-scale alternative A-7 canopy.

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

(U) Work Performed By: The contractors are Pittsburgh Plate Glass Co., Huntsville, AL, and the University of Dayton Research Institute, Dayton, OH. The program manager is 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: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604218F Budget Activity: #4 - Tactical Programs
PE Title: Engine Model Derivative Program (EMDP)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Engine Model Derivative Program	956	953	994	994	Continuing	TBD
Total	956	953	994	994	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 demonstrated technology and advanced components from government funded programs and contractor Independent Research and Development. EMDP demonstrates technology in performance, durability, operability, supportability, reliability, maintainability, and other 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Engine Model Derivative Program (EMDP) (No Project Number): Develops and demonstrates performance growth in existing baseline engines.

(U) FY 1988 Accomplishments:
- (U) Initiated Conventional Cruise Missile (CCM) trade studies
- (U) Initiated Controls and Accessories (C&A) study activities
- (U) Completed general engine roadmaps with six (6) engine contractors through the Task Ordering contract method

(U) FY 1989 Planned Program:
- (U) Evaluate advanced technology requirements for more reliable and maintainable C&A for current and future engine systems
- (U) Initiate conceptual axisymmetric vectored nozzle design for current and future Increased Capability Engines (ICE)

(U) FY 1990 Planned Program:
- (U) Complete C&A evaluation
- (U) Complete conceptual axisymmetric vectored nozzle design activity
- (U) Initiate ICE design which includes thrust growth, axisymmetric vectored nozzle, advanced C&A and Low Observable (LO) capability for tactical aircraft

Program Element: #0604218F Budget Activity: #4 - Tactical Programs
PE Title: Engine Model Derivative Program (EMDP)

(U) FY 1990 Planned Program:
- (U) Complete C&A evaluation
- (U) Complete conceptual axisymmetric vectored nozzle design activity
- (U) Initiate ICE design which includes thrust growth, axisymmetric vectored nozzle, advanced C&A and Low Observable (LO) capability for tactical aircraft

(U) FY 1991 Planned Program:
- (U) Continue ICE design which includes thrust growth, axisymmetric vectored nozzles, advanced C&A and LO capability

(U) Program to Completion:
- (U) An ICE will demonstrate axisymmetric nozzle, advanced controls, increased thrust and LO capabilities.
- (U) EMDP is a continuing effort. The level of funding for EMDP is derived from bottom up estimates of the cost to conduct the demonstrations and objectives for each EMDP effort.

(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 Aircraft (P&W), West Palm Beach FL (F100, F117, and V2500); General Electric Company (GE), Evendale OH (F101, F108, F110, F118); Williams International, Walled Lake MI (FJ44, F107); Allison, Indianapolis IN (RB211-535E4, 250 propfan); Teledyne CAE, Toledo OH (235 propfan, J69); and Garrett Corporation, Phoenix AZ (F109, 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 1990/FY 1991 BIENNIAL BUDGET 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
5708 Nuclear Weapons Support	4,666	2,167	2,246	2,311	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Provides funds for salaries of the Air Force Weapons Laboratory (AFWL) civilian nuclear weapon specialists who provide technical guidance to the Department of Energy (DOE) and direction to the North Atlantic Treaty Organization for fulfillment of Air Force (AF) 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 5708, Nuclear Weapons Support: Funds AFWL civilians to technically support all new and fielded USAF Nuclear Systems.

(U) FY 1988 Accomplishments:

- (U)
- (U) Start FSD of SRAM II (W89) and
- (U) B53 strategic bomb
- (U)
- (U) Continued Phase 2 studies on Advanced EPW

00412

Program Element: #064222F Budget Activity: #4 - Tactical Program
PE Title: Nuclear Weapons Support

- (U) Initiated SRAM T Phase 2/2A warhead studies

- (U) W84 GLCM return from Europe begins

(U) FY 1989 Planned Program:

- (U)

- (U)

- (U) W84 (GLCM) warhead continues return to inactive reserve

- (U) W89 enter Phase 4 Production Engineering

- (U) Advanced EPW and SRAM T will continue in Phase 2 study

- (U) Maintain and update all documentation supporting nuclear stockpile and DOE/DOD agreements.

(U) FY1990 Planned Program:
- (U) Continue at the same level of effort.

(U) FY1991 Planned Program:
- (U) Continue at the same level of effort

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

(U) Work Performed By: Air Force Weapons Laboratory

(U) Related Activities:

-(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) Other Appropriation Funds: DOE nuclear weapon RD&T, production, and surveillance for AF systems are funded separately in DOE TOA at over $1/3 Billion per year.

(U) International Cooperative Agreements: Not Applicable

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
AFE	74,688	27,811	63,758	4,977	-0-	537,150

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 1988 Accomplishments:
   - (U) Conducted 300 hours sea level development tests
   - (U) Conducted 200 hours altitude tests at Arnold Engineering Development Center
   - (U) Initiated 4000 cycle Accelerated Mission Test (AMT) for qualification
   - (U) Flight tested Initial Flight Release (IFR) IPE configuration
   - (U) Flight tested a CEB-configured F-15E with F100-PW-220s

2. (U) FY 1989 Planned Program:
   - (U) Complete residual tasks from the qualification effort
   - (U) Continue FSD for the IPEs with full life testing of the preproduction configurations including another 4000 cycle AMT
   - (U) Update technical data for the F100 and F110 IPEs and support integration flight test for IPEs in the F-15 and F-16 programs
   - (U) Complete F-15E CEB testing
   - (U) Complete flight test of IFR configuration IPEs

3. (U) FY 1990 Planned Program:
   - (U) Continue Operational Capability Release (OCR) testing on production configured engines
   - (U) Perform AMT on production engines to verify full engine life
   - (U) Support F-16 performance/qualification flight testing
   - (U) Perform F-15E/IPE performance qualification flight testing
   - (U) Conduct update of engine maintenance and support procedures
   - (U) Perform sea level and altitude development testing to support Field Service Evaluation (FSE)

Program Element: #0604223F Project Number: N/A
PE Title: Alternate Fighter Engine (AFE) Budget Activity: #4 - Tactical Programs

4. (U) FY 1991 Planned Program:
   - (U) Complete F-15E/IPE performance qualification

5. (U) Program to Completion: Not Applicable, IPE program complete

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: GE, 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	+7	None
Cost	None	None	+19,925

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: ISR milestones extended to allow for redesign and test to solve technical problems discovered in development testing. No impact to deployment milestone.
3. (U) COST CHANGES: Funding was reallocated from PE #0604268F, Aircraft Engine Component Improvement Program, to fund work on the IPEs which is more properly budgeted in the AFE PE.

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.

Program Element: #0604223F Project Number: N/A
PE Title: Alternate Fighter Engine (AFE) Budget Activity: #4 - Tactical Programs

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.

J. (U) MILESTONE SCHEDULE:

	F100-PW-229	F110-GE-129
1. (U) Contract Go Ahead	Jun 85	Jun 85
2. (U) Preliminary Design Review	Nov 85	Nov 85
3. (U) Critical Design Review	May 86	May 86
4. (U) Initial Flight Release	Mar 88	Apr 88
5. (U) Production Readiness Review	Jun 88	May 88
6. (U) Initial Service Release	May 89	Apr 89
7. (U) Functional Configuration Audit	May 89	Aug 89
8. (U) 1st Engine for Field Service Evaluation	Jan 90	Dec 89
9. (U) Physical Configuration Audit	Jan 90	Jan 90
10. (U) Operational Capability Release	Dec 90	Dec 90
11. (U) 1st Production Engine for F-15s/F-16s	Jan 91	Jan 91

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604231F
PE Title: C-17 Program
Project Number: N/A
Budget Activity: # 4

Project Title: C-17

POPULAR NAME: C-17

A. (U) SCHEDULE/BUDGET INFORMATION ($ IN THOUSANDS)

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	IIIA Jan 89	N/A	N/A	2nd Qtr IIIB FY 93
Engineering Milestones	CDR Aug 88	N/A	N/A	N/A	N/A
T&E Milestones	N/A	N/A	1st Flight Aug 90	Comp DT&E IOT&E Apr 92	N/A
Contract Milestones	Lot 1 2A/C Jan 88	Lot 2 4A/C Mar 89	Lot 3 6A/C Jan 90	Lot 4 10A/C Oct 90	Remaining Lots
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Major Contract	R&D1,081,286 Pro 665,200	R&D 872,253 Pro1,053,400	R&D 797,900 Pro1,799,800	R&D 426,036 Pro2,460,600	R&D 476,700 Pro 24,435,800
Support Contract	N/A	N/A	N/A	N/A	N/A
In-House Support	R&D 5,144	R&D 18,078	R&D 12,300	R&D 7,700	R&D 20,300
GFE/ Other	R&D 4,109 Pro 1,000	R&D 41,691 Pro 45,871	R&D 105,027 Pro 179,481	R&D 64,690 Pro 135,093	R&D 108,050 Pro 962,000
Total	R&D1,090,539 Pro 666,200	R&D 932,022 Pro1,099,271	R&D 915,227 Pro1,979,281	R&D 498,426 Pro2,595,693	R&D 605,050 Pro 25,397,800

Program Element: #0604231F Project Number: N/A
PE Title: C-17 Program Budget Activity: # 4

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 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 1988 Accomplishments:
   - (U) Full-scale development and tooling activity continues
   - (U) Fabrication for the three full-scale test RDT&E articles and the first two production aircraft began
   - (U) Assembly of the flight test aircraft began 24 Aug 88
   - (U) Subsystem development testing continues
   - (U) Systems simulator development for flight control
   - (U) The 90 percent structural drawing release milestone complete
   - (U) Air vehicle hardware critical design reviews were completed
   - (U) Peculiar support equipment design and Support Equipment Recommendation Data (SERDs) submitted
   - (U) Training systems and equipment efforts continue
   - (U) Continue logistics support analysis, technical publications, maintainability and support studies and analyses
   - (U) First F-117 FSED engine delivered
   - (U) Avionics/software integration began

2. (U) FY 1989 Planned Program:
   - (U) Assembly of the durability test article, static test article, and first two production aircraft will begin
   - (U) The tooling effort to support low-rate production requirement will continue
   - (U) The organizational and intermediate support equipment preliminary design review will be completed
   - (U) Planning for the RDT&E flight test aircraft air loads calibrations will be completed
   - (U) Engineering design and drawing releases will be completed
   - (U) Development of detailed text 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 will be continued
   - (U) Continue flight test aircraft assembly
   - (U) Avionics/software integration continues
   - (U) Low rate initial production (Milestone IIIA) approved 18 Jan 89

Program Element: #0604231F Project Number: N/A
PE Title: C-17 Program Budget Activity: # 4

3. (U) FY 1990 Planned Program:
   - (U) Complete assembly of durability article
   - (U) Begin durability testing
   - (U) Complete assembly of static article
   - (U) Complete assembly of test aircraft (T-1)
   - (U) First flight (Aug 90)
   - (U) Avionics/software integration continues
   - (U) Complete O&I level support equipment critical design reviews

4. (U) FY 1991 Planned Program:
   - (U) Functional Configuration Audit/Physical Configuration Audit
   - (U) Complete one life of durability testing
   - (U) Static article ultimate strength testing
   - (U) Begin IOT&E
   - (U) Complete technical order validation
   - (U) Deliver maintenance/aircrew trainers

5. (U) Program to Completion:
   - (U) Flight/Weather Testing Completed
   - (U) Complete 2nd life durability test
   - (U) Operational Readiness Evaluation Conducted

D. (U) WORK PERFORMED BY: Douglas Aircraft Company.

E. (U) COMPARISON WITH FY 1988 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	FY 1990 Cost
Eng	None	None	None
Sched	None	None	None
Cost - RDT&E	None	None	+299,927
Proc	None	None	(-110,419)

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: RDT&E: FY 1990 increase (+$299,927 thousand) results from recovering FY 1988/1989 OSD Congressional and undistributed reductions and includes for Live Fire Testing. PROCUREMENT: FY 1990 decrease (-$110,419 thousand) resulted from revised initial spares estimate and revised inflation.

F. (U) PROGRAM DOCUMENTATION:
   - (U) TEMP - Approved 4 Oct 88
   - (U) Acquisition Program Baseline - Submitted to OSD 2 Aug 88

G. (U) RELATED ACTIVITIES: None. No unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604231F
PE Title: C-17 Program
Project Number: N/A
Budget Activity: # 4

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT:

	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate
Funds	1,099.3	1,979.3	2,595.7
Quantity	4	6	10

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
None	(Engineering Development Testing Only)	

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Initiate DT&E	Aug 90	None
Initiate Dedicated IOT&E	Aug 91	None
Complete DT&E/IOT&E	Apr 92	None

00420

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604233F
PE Title: Tanker-Transport Training System (TTTS)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

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

Project Title Popular Name	TTTS FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
TTTS		4,478	3,625	2,374	0	10,477

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 Tanker-Transport (TT) 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 accommodating 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 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments: Not Applicable.

2. (U) FY 1989 Planned Program:
   - (U) Issue Draft Request for Proposals 9 Feb 88
   - (U) Issue Request for Proposals 2 Jun 88

3. (U) FY 1990 Planned Program:
   - (U) Source Selection Decision 15 Oct 88
   - (U) Award Contract 30 Oct 88
   - (U) Begin simulator fidelity/compatibility design/integration
   - (U) Begin courseware and curriculum development and system integration planning

4. (U) FY 1991 Planned Program:
   - (U) Complete missionization of selected aircraft and simulators
   - (U) Complete curriculum and courseware development/integration

Program Element: #0604233F | Project Number: N/A
PE Title: Tanker-Transport Training System (TTTS) | Budget Activity: #4 - Tactical Programs

5. (U) Program to Completion: FY 1991 is final year for RDT&E funds.

D. (U) WORK PERFORMED BY: Air Force Systems Command's System Program Office at Aeronautical Systems Division, Wright-Patterson AFB OH. Prime Contractor has not been determined/no contract awarded.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	Yes	None	-6

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Program share of IR&D B&P costs.

F. (U) PROGRAM DOCUMENTATION: General Operational Requirement for Specialized Undergraduate Pilot Training, ATC GOR 01-78. Mission Element Need Statement for TTB Training System, MENS Dec 81. System Operational Requirement Document for TTTS, TTTS SORD, Dec 87.

G. (U) RELATED ACTIVITIES: Not Applicable. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement (PE 0804741F)						
Funds	0	9,525	147,425	178,272	1,149,396	1,484,618
Quantity	0	1	14	28	168	211

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

J. (U) MILESTONE SCHEDULE:

1. (U) Release RFP	2 Jun 89
2. (U) Award Contract	30 Oct 89
3. (U) Production Deliveries	1991-1997

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604236F
PE Title: Infrared Search and Track System (IRSTS)
Budget Activity: 4-Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3298 IRSTS	13,814	4,621	2,449	0	0	53,662
Total	13,814	4,621	2,449	0	0	53,662

B. (U) BRIEF DESCRIPTION OF ELEMENT: IRSTS is designed to provide a system to passively detect 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 IRST develop for the Advanced Tactical Fighter (ATF) program.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY1988 Accomplishments:
- (U) USAF conducted mid-wave flight test at Eglin AFB.
- (U) USN accepted delivery of first 2 mid-wave systems.

(U) FY1989 Planned Program:
- (U) USAF to complete flight testing and provide flight test data to support ATF SPO.
- (U) USN starts flight testing of both mid- and long-wave systems.
- (U) USAF to monitor and fund USN flight testing of long-wave IRSTS.
- (U) USN to do pre-approval for limited production testing.
- (U) USN to start FSD.

(U) FY1990 Planned Program:
- (U) Funds USAF share of USN flight testing to support USN production decision on mid- or long-wave IRST system. USAF monitors flight tests for applicability to ATF program.

(U) FY1991 Planned Program:
- (U) No USAF activities.

(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.

Program Element: #0604236F
PE Title: Infrared Search and Track System (IRSTS)

Budget Activity: 4-Tactical Programs

(U) Related Activities: The impact of the atmosphere upon IRSTS performance is being extensively studied. ASD/VL has contracted with Aeromet, Inc., to provide an airborne Light Detection and Ranging (LIDAR) system to qualitatively describe the test range atmosphere at the time of the test. Sandia National Laboratory is providing supersondes to relay weather parameters. MacAulay Brown, Inc., has been hired to collect data from all sources involved in this flight test and compile 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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604237F Project Number: 3308
Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA) Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Variable Stability In-Flight Simulator Test Aircraft (VISTA)	6,022	7,895	12,445	3,896	0	36,357

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 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 1988 Accomplishments:
   - (U) Production of the F-16D was completed to the subassembly stage, ready for VISTA-unique modifications.
   - (U) Contract to perform the VISTA-unique modifications and incorporate the variable stability system (VSS) was awarded.
   - (U) Detailed design work to substitute a digital flight control system in the F-16D was conducted.
   - (U) Flight control actuator modifications were designed and successfully tested.

2. (U) FY 1989 Planned Program:
   - (U) All modification design activity will be completed.

Program Element: #0604237F Project Number: 3308
Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA) Budget Activity: #4 - Tactical Programs

- (U) Extensive aircraft modification activity will be conducted.
- (U) Hydraulic and electrical systems will be fabricated.
- (U) The VSS hardware and software development will be initiated.
- (U) VSS components will be installed and integrated with the F-16D flight control system.
- (U) Proposed cockpit modifications will be evaluated in a ground simulator.

3. (U) FY 1990 Planned Program:
   - (U) Aircraft modification and VSS development activities will be completed.
   - (U) Aircraft fuselage mating and final assembly will be completed.
   - (U) Flight control and VSS software validation and verification testing will be initiated.
   - (U) Ground testing will be initiated to ensure design and safety requirements have been met.
   - (U) The flight readiness review will be conducted.

4. (U) FY 1991 Planned Program:
   - (U) Ground testing will be completed.
   - (U) Software validation and verification will be completed.
   - (U) Flight testing will be conducted to verify operational performance.
   - (U) Program will be completed and VISTA will be transitioned to flight research during the third quarter.

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

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 AMENDED FY 88/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	+3 month	None
Cost	Yes	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Due to lengthy contract negotiations and the SecDef moratorium on new starts, contract signature was delayed three months. This delay has no impact on cost but

Program Element: #0604237F Project Number: 3308
Title: Variable Stability In-Flight Simulator Test Aircraft (VISTA) Budget Activity: #4 - Tactical Programs

delays transition of VISTA to flight research by three months.

3. (U) COST CHANGES: Congress reduced funding during review of the FY 1989 budget. In order to avoid further delay in transitioning VISTA, the program is currently undergoing review to determine the system capabilities that may be eliminated while minimizing the impact on VISTA's capability to perform flight research.

F. (U) PROGRAM DOCUMENTATION: Approval of request for RDT&E Aerospace Vehicle, HQ USAF letter dated 15 July 1985.

G. (U) RELATED ACTIVITIES: This program receives technology inputs from Aerospace Flight Dynamics (PE 0602201F). The technology product of this program will be applied to Flight Vehicle Technology (PE 0603205F) and Advanced Flight Technology Integration (PE 0603245F). Coordination is maintained through the VISTA steering group comprised of members of the Air Force organizations, Navy, and NASA. 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:

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	3rd Quarter FY 1989
5. (U) Aircraft Modification Completed	3rd Quarter FY 1990
6. (U) Ground Check-out Completed	1st Quarter FY 1991
7. (U) First Flight	1st Quarter FY 1991
8. (U) Flight Test and Certification Completed	3rd Quarter FY 1991
9. (U) Transition to Flight Research Program	3rd Quarter FY 1991

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604239F Project Number: N/A
PE Title: Advanced Tactical Fighter (ATF) FSD Budget Activity: # 4 - Tactical Programs

Project Title: ATF FSD

POPULAR NAME: ATF

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

SCHEDULE	FY 1988	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 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract				1,373,565	7,958,300 (6,584,735)
Support Contract				2,000	20,000 (18,000)
In-House Support				7,000	50,000 (43,000)
GFE/ Other				29,000	1,000,000 (971,000)
Total				1,411,565	9,028,300 (7,616,735)

Program Element: # 0604239F
PE Title: Advanced Tactical Fighter FSD
Project Number: 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 mid-1990s to counter the emergence of large numbers of advanced Soviet fighters. The ATF is designed to penetrate enemy airspace and achieve a first-look, first-kill capability against multiple targets. The ongoing 50-month Demonstration/Validation phase is designed to reduce risk upon entering Full Scale Development (FSD) and features design trade-off analyses, flying prototype aircraft, ground-based avionics prototypes, and other contractor-tailored hardware demonstrations. The ATF FSD effort will capitalize on the data developed in the Dem/Val (Prototype) phase to develop and test fully-integrated ATF avionics systems and flight test vehicles providing the basis for proceeding into low-rate initial production of the ATF.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Program: Not Applicable.

2. (U) FY 1989 Planned Program: Not Applicable.

3. (U) FY 1990 Planned Program: Not Applicable.

4. (U) FY 1991 Planned Program:
   - (U) Award FSD contracts to airframe contractor.
   - (U) Initiate fabrication of FSD aircraft and conduct Preliminary Design Review.
   - (U) Award FSD engine contract.
   - (U) Initiate fabrication and assembly of FSD flight test engines.
   - (U) Upgrade avionics ground prototype of the contractor selected for the FSD phase to a system integration laboratory (SIL) to develop and test the full-up ATF integrated avionics architecture.
   - (U) Fully implement tri-Service Common Avionics specifications.
   - (U) Use winner's Prototype Air Vehicles to provide initial flight environment experience for emerging avionics components and other subsystems until FSD aircraft are available.

5. (U) Program to Completion:
   - (U) Critical Design Review (CDR) will be conducted in FY 1992.
   - (U) Nine Full Scale Development (FSD) aircraft will be delivered (FY 1993 to FY 1995).
   - (U) Testing will be conducted with these aircraft to include: weapon compatibility, performance, flying qualities, integrated avionics, climatics, SEEK EAGLE and completion of Initial Operational Test and Evaluation (FY 1993 to FY 1995).

Program Element: # 0604239F
PE Title: Advanced Tactical Fighter FSD
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

D. (U) WORK PERFORMED BY: Technology and advanced development efforts for ATF FSD are 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-83, 9 Nov 84.
- (U) TAF 304-83-3/IIA, SORD for ATF, 23 Oct 87.
- (U) ATF TEMP, 2 Feb 88.

G. (U) RELATED ACTIVITIES:
- (U) PE 0603230F, ATF (Dem/Val), will focus technologies to the ATF mission and perform risk reduction demonstrations prior to entering FSD.
- (U) Preliminary FSD for Integrated Electronic Warfare systems/ Integrated Communications, Navigation, Identification Avionics (INEWS/ICNIA) (PE 0604250F) will provide the common core set of integrated avionics modules for integration into the overall weapon system and continue test and validation of ATF applicable avionics modules.
- (U) ATF simulators/training systems will be developed under PE 0604227F, Flight Simulator Development.
- (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: Not Applicable.

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

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ATA	0				TBD	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
Mission requirement will be derived from the TAC SON. However, detailed information on the threat and resulting operational requirement, the Air Force capability to meet the requirement, and the system performance will be based on the Navy A-12 and is consequently classified at a higher level.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Completed Statement of Work (SOW) to begin Concept Definition Phase. RFP transmitted to contractor team.
   - (U) $1.5M of reprogrammed funds transferred to Program Element #0603109F to begin study efforts defined in the SOW.
   - (U) Contracted effort began on 29 Sep 88.

2. (U) FY 1989 Planned Program:

3. (U) FY 1990 Planned Program:

4. (U) FY 1991 Planned Program:
   - (U) Additional details are classified at a higher level.

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

Program Element: #0604242F Project Number: N/A
PE Title: Advanced Tactical Aircraft (ATA) Budget Activity: # 4 - Tactical Programs

D. (U) WORK PERFORMED BY:
(U) ATA prime contractors are:

General Dynamics	Ft. Worth TX	Concept Definition, Dem/Val, FSD phases
McDonnell Douglas Aircraft	St. Louis MO	Concept Definition, Dem/Val, FSD phases

The Program Office responsible for managing the Air Force ATA program is located at Aeronautical Systems Division, Wright-Patterson AFB OH.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY: Not Applicable.

F. (U) PROGRAM DOCUMENTATION:
- (U) SAF/AQ ATA Acquisition Strategy Information Memorandum (SECRET, Special Access Required), 9 June 88, based on AF/CC guidance of 13 May 88.
- (U) TAC SON, date TBD.
- (U) TAC SORD, date TBD.

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) The Air Force has staffed the Navy Program Office with an Air Force officer to provide Air Force insight into the Navy program. Expect to assign two to three more officers (to include one engineer) to have well-rounded Air Force representation in the Navy program office.
  -- (U) The Navy program is developing the A-12. The Air Force is developing a variant to fulfill its own unique requirements.

- (U) Program Element #0604250F (Integrated EW/CNI Development).
  -- (U) Programmatic relationship established with the ATF SPO for development of a Module Interface Unit (MIU). This unit will provide for the integration of JIAWG compliant avionics modules from different manufacturers into avionics systems based on the JIAWG advanced avionics architecture. It will facilitate the integration of subsystems such as INEWS and ICNIA into the A-12.

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

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

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

J. (U) MILESTONE SCHEDULE:

Program Element: #0604242F
PE Title: Advanced Tactical Aircraft (ATA)
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

- (U) Future plans include

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604245F Project: XXXI
PE Title: SRAM-T 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			MS II Oct		MS III FY94/2
Engineering Milestones			PDR Apr	CDR Feb	
T&E Milestones					1st Lnch FY92/3 16th Lnch FY94/1
Contract Milestones			FSD Feb		FRP LL FY93/3 FRP FY94/3
BUDGET	FY 1988	FY 1989	FY 1990	FY 1991	Program Total
Major Contract			37,670	58,590	TBD
Support Contract			8,500	17,300	TBD
In-House Support			5,790	17,490	TBD
GFE/ Other			6,642	21,138	TBD
Total	N/A	N/A	58,602	114,518	TBD

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

80434

Program Element: # 0604245F Project: XXX1
PE Title: SRAM-T Budget Activity: #4 - Tactical Programs

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 1988 Accomplishments: Not applicable.

2. (U) FY 1989 Planned Program: Not applicable.

3. (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

4. (U) FY 1991 Planned Program:
   - (U) Conduct critical design reviews on the tactical missile, support equipment and aircraft integration effort
   - (U) Conduct wind tunnel testing
   - (U) Begin fabrication and qualification of SRAM-T test units and F-15E adaptor hardware

5. (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. Sixteen total live launches planned
   - (U) Conduct flight test program on the F-111F/G. 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 (EPG F-16, ATA)

Program Element: # 0604245F Project: XXXI
PE Title: SRAM-T Budget Activity: #4 - Tactical Programs

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 1988 DESCRIPTIVE SUMMARY: Not applicable. This modification effort begins in FY 1990.

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

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 is funded within the F-15E program, PE #0207134F
- (U) NATO nuclear weapon storage facilities are funded in the Weapons Storage and Security System program, PE #0305155F

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

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 (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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604246F
PE Title: Close Air Support Alternatives
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

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

Project Title: Close Air Support Alternatives

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Not Applicable	--	--	66,000	55,000	TBD	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program reflects the continuing deliberations of the Close Air Support Mission Area Review Group (CASMARG) and Congress in conjunction with Air Force efforts to provide a Close Air Support/Battlefield Air Interdiction (CAS/BAI) aircraft to support the Army Air-Land Battle doctrine of the 1990s. This program will conduct an assessment of Army and Air Force analyses of CAS/BAI aircraft alternatives and subsequent development/acquisition of the selected alternative. The Director of OT&E will develop an operational test plan for a competitive fly-off of alternative aircraft for the CAS/BAI mission. Approval of the plan will initiate operational testing of representative CAS/BAI aircraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Not applicable.

2. (U) FY 1989 Planned Program:
   - (U) Test plan for competitive fly-off will be developed, due to Congress 31 March 1989.
   - (U) Alternative aircraft will be selected and definition, development and modification of configurations will begin.
   - (U) OSD-directed studies will be initiated.
   - (U) Detailed tasks will be determined/defined by CASMARG.

3. (U) FY 1990 Planned Program:
   - (U) Aircraft fly-off configurations will continue.
   - (U) OSD-directed studies will continue.
   - (U) OT&E of the selected aircraft will begin.

4. (U) FY 1991 Planned Program:
   - (U) Aircraft fly-off configurations will complete
   - (U) OSD-directed studies will continue.
   - (U) OT&E effort will continue.

5. (U) Program to Completion:
   - (U) OT&E efforts will complete.
   - (U) Development/acquisition efforts will be accomplished based on the OT&E results.
   - (U) Procurement funding begins in FY 1993 to initiate acquisition of a follow-on CAS aircraft.

Program Element: #0604246F
PE Title: Close Air Support Alternatives
Project Number: N/A
Budget Activity: # 4 - Tactical Program

D. (U) WORK PERFORMED BY: TBD.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY: Not Applicable.

F. (U) PROGRAM DOCUMENTATION:
- (U) Program Budget Decision (PBD) 235A3, 12 Dec 88.
- (U) Section 108 of Defense Authorization Amendments and Realignment Act, 24 Oct 88.

G. (U) RELATED ACTIVITIES:
- (U) YA-7F prototype program being conducted in PE #0502610F, Project #3606 (A-7 Upgrade).

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

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

J. (U) MILESTONE SCHEDULE: TBD as program progresses through its preliminary activities.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604247F Budget Activity: #4 - Tactical Programs
PE Title: Modular Automatic Test Equipment

A. (U) RESOURCES ($ in Thousands)

Project Title Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2503 Modular Automatic Test Equipment (MATE)	14,636.0	11,151.0	12,242.6	11,935.6	Cont.	Cont.
3080 Generic Integrated Maintenance Diagnostics (GIMADS)*	0*	0*	1,683.4	765.4	Cont.	Cont.
Total	14,636.0	11,151.0	13,926.0	12,701.0	Cont.	Cont.

*FY88 & FY89 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 3080, Generic Integrated Maintenance Diagnostics: Provides generic, expandable, integrated maintenance diagnostics methods and policies with early demonstration of GIMADS application on the Advanced Tactical Fighter (ATF).

(U) FY88 Accomplishments:
- (U) Developed diagnostic roadmap and integrated diagnostics master plan
- (U) Performed technical investigation tasks in nine areas: maintenance aids, human factors, emerging technologies, current problems, future needs, technical data base, fault detection/fault isolation, mechanical systems, and advanced testability

Program Element: #0604247F Budget Activity: #4 - Tactical Programs
PE Title: Modular Automatic Test Equipment

(U) FY 1989 Planned Program:
- (U) Redefine and integrate techniques and methodologies for non-electronics fault isolation with continuing application to weapon system acquisitions
- (U) Begin technology tasks of avionics prognostics (method to predict impending avionics failures) and software diagnostics (improve capability to diagnose software defects)

(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) Program to Completion:
- (U) GIMADS AFGS and Mil-Std 100% complete

(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 Activites: 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. 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 1990/1991 BIENNIAL 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	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MATE	14,636.0	11,151.0	12,242.6	11,935.6	Cont.	Cont.

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:

(U) FY 1988 Accomplishments:
- (U) Implemented and expanded improvements to MATE ATLAS compiler
- (U) Restructured MATE guides into more usable/readable format
- (U) Began new technology insertion into MATE architecture, i.e. pin electronics, fiber optics, man-portable testers, Very High Speed Integrated Circuit (VHSIC)
- (U) Completed MATE Unit Under Test (UUT) Simulator for use in developing software test programs
- (U) Established Full Operational Capability of MATE Operations Center

(U) FY 1989 Planned Program:
- (U) Pin electronics and fiber optic standards incorporated
- (U) Begin development of automated Test Program Set (TPS) generation MATE standards
- (U) Begin development of non-electrical MATE test standards, i.e. pneumatic, hydraulic
- (U) Begin development of artificial intelligence (expert systems) MATE test standards
- (U) Continue to develop MATE man-portable tester standards

(U) FY 1990 Planned Program:

- (U) Continue to develop and implement new technologies into MATE architecture and standards, i.e. artificial intelligence, non-electrical systems, automated TPS generation equipment, and man-

Program Element: #0604247F
PE Title: Modular Automatic Test Equipment
Project Number: 2503
Budget Activity: #4 - Tactical Programs

portable testers
- (U) Begin initial design requirements, code and start design testing of Ada language software conversion to support Advanced Tactical Fighter (ATF)
- (U) Release MATE Master Plan with appropriate annual revisions highlighting new candidate technologies and needed changes to the MATE concept
- (U) Release version 6.0 MATE Control and Support Software (MCSS)

(U) FY 1991 Planned Program:
- (U) Complete MATE JOVIAL software conversion to Ada to support ATF
- (U) Complete MATE man-portable tester standards, Radio Frequency (RF) interface standards, and electro-optical test standards
- (U) Establish VHSIC test standards
- (U) Issue revised MATE Master Plan

(U) Program to Completion:
- (U) Application of MATE Ada software to emerging weapon systems
- (U) Application of man-portable tester standards to emerging weapon systems

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, OH. The MATE Operations Center is manned and controlled by the Automated Test Systems Division at the San Antonio Air Logistics Center, San Antonio, TX. The MATE integrating contractor for new technology insertion is SOFTECH, Alexandria, VA. MATE is also supported with recommendations by the industry MATE Users Group (MUG) consisting of approximately 100 companies formed as a subgroup of the Automatic Testing Committee of the National Security Industrial Association.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	GIMADS project 3080 added	None	$1.683M Increase

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: The addition of GIMADS has increased MATE PE FY 1990 funds by $1.683 million. This increase gives the perception that funds for the MATE program itself have increased.

Program Element: #0604247F
PE Title: Modular Automatic Test Equipment
Project Number: 2503
Budget Activity: #4 - Tactical Programs

F. (U) PROGRAM DOCUMENTATION:
- (U) Mission Element Need Statement - USATRADOC 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: Not Applicable.

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

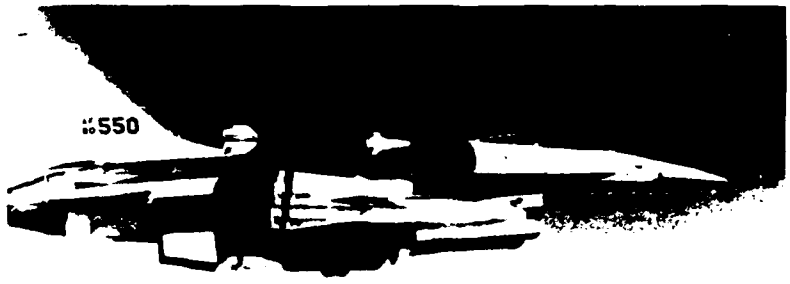
J. (U) MILESTONE SCHEDULE:

- (U) MATE Full Scale Development Phase I Completed	September 1985
- (U) MATE Operations Center Full Operational Capability	December 1987
- (U) Restructured MATE Guides Completed	July 1988
- (U) Unit Under Test (UUT) Simulator Completed	September 1988
- (U) MATE Pin Electronics Standard Completed	4Q FY 1988
- (U) MATE Fiber Optics Standard Completed	FY 1989
- (U) Release MATE Master Plan	FY 1990
- (U) Release Version 6.0 MATE Control & Support Software	FY 1990
- (U) MATE VHSIC Test Standard Completed	FY 1991
- (U) Ada Conversion Begins	FY 1991
- (U) Automated TPS Generation Standards Completed	FY 1992
- (U) Non-electrical Test Standards Completed	FY 1992
- (U) Artificial Intelligence Test Standards Completed	FY 1993

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	Tgt Pod IIIB Jan 89 Nav Pod IOC	Tgt Pod IOC	N/A	N/A
Enginerng Milestones	N/A	N/A	N/A	N/A	N/A
T&E Milestones	N/A	N/A	N/A	N/A	N/A
Contract Milestones	1st Tgt Pod Deliv Jun 88	N/A	N/A	N/A	N/A
BUDGET	**FY 1988**	**FY 1989**	**FY 1990**	**FY 1991**	**Program Total (To Complete)**
Major Contract	11,782	1,606	1,900	0	353,740 (0)
Support Contract	1,758	0	0	0	63,462 (0)
In-House Support	4,050	1,094	470	0	35,962 (0)
GFE/ Ocher	1,701	1,962	1,144	0	78,738 (0)
Total	19,291	4,662	3,514	0	531,902 (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 1988 Accomplishments:
   - (U) Continued integration and flight testing of LANTIRN/F-15E and F-16/Automatic Terrain Avoidance (ATA).
   - (U) Began integration of LANTIRN on the F-16 Block 40 production aircraft.
   - (U) Completed development of the intermediate level SE.

2. (U) FY 1989 Planned Program:
   - (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.

3. (U) FY 1990 Planned Program:
   - (U) Complete integration and development flight testing of LANTIRN/F-15E and the F-16 Block 40 production aircraft. FY 1990 will be the final year of the LANTIRN RDT&E program.
   - (U) Complete production of navigation pods and continue production of targeting pods.

4. (U) FY 1991 Planned Program: Not Applicable.

5. (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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
TECH	NONE	NONE	NONE
SCHED	NONE	+3 MONTHS	NONE
COST	NONE	NONE	NONE

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Targeting pod Milestone IIIB decision delayed three months to permit additional testing.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) SON 302-81, Dec 86
- (U) TEMP, Mar 88
- (U) SORD, Oct 88

G. (U) RELATED ACTIVITIES: 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.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, PE #0207249F						
Funds	817,900	727,277	362,198	277,887	0	3,506,762
Quantity						
Navigation Pods	169	240	67	0	0	628
Targeting Pods	81	231	157	150	0	628

00446

FY 1990/1991 BIENNIAL
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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
3389 Integrated Electronic Warfare System (INEWS) Pre-FSD	7,284	73,100	79,952	000	0	160,384
3393 Integrated Communications, Navigation, Identification Avionics (ICNIA) Pre-FSD	0	36,067	2,978	3,528	Cont	Cont
3786 Integrated Communications Security (COMSEC)	400	11,595	18,264	6,340	1,698	38,297
3858 SEEK SPARTAN	0	400	5,000	38,100	Cont	Cont
TOTAL	7,684	121,162	106,194	47,968	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program is an advanced avionics program with specific application to the Advanced Tactical Fighter (ATF), the Army Lightweight Helicopter Family (LHX) The INEWS/ICNIA program emphasizes a system architecture made up of advanced semi- conductor technology including insertion of Very High Speed Integrated Circuits (VHSIC) into communication, navigation, identification and electronic warfare subsystems. ICNIA, INEWS systems should provide a very high mission reliability, fault tolerant design, reduction in support costs and reduction in aircrew workload in a dense threat environment. The reliability and maintainability will be enhanced through the development of modular packaging techniques, portions of which will be developed for test flights on tactical aircraft. Tailored INEWS technologies will provide self-protection capability which not only translates into increased survivability, but also protects the integrity of its inherent further, by integrating INEWS/ICNIA with the offensive avionics package, the pilot's situation awareness and combat capability will be increased. The INEWS/ICNIA Pre-FSD tasks directly support the ATF program, while the SEEK SPARTAN task is designed to transition the INEWS technology to applications other than ATF.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10 MILLION IN BOTH FY 1990 AND FY 1991:

1. (U) PROJECT 3393 - ICNIA: ICNIA is a Tri-Service program to develop the next generation Integrated Communication, Navigation and Identification for Advanced Aircraft. ICNIA will provide highly reliable communications and navigation information within a smaller, lighter weight configuration through a modular, fault tolerant architecture. A total of 28 hardware module types with

00447

Program Element: 0604250F Budget Activity: 4 - Tactical Programs
Title: Integrated Electronic Warfare/Communications Navigation Identification (EW/CNI) Development

associated Ada software modules will be used to configure ICNIA terminals to meet the specific platform communications, navigation and identification requirements. Specific functions accommodated by ICNIA are: UHF AM/UHF HAVE QUICK/HF/VHF AM/VHF WITH SINCARS/GPS/ILS/ VOR/TACAN/MARK XII IFF/MARK XV IFF/and JTIDS. The ICNIA FFY 1988 program delivers advanced development models (ADM) funded in PE 0603109F.

(U) FY 1988 Accomplishments:
- (U) Continued fabrication of ICNIA ADM modules and software module codeing
- (U) Successfully passed brassboard demonstration milestones

(U) FY 1989 Planned Program:
- (U) Integrate ADM terminals for ATF ground prototype test
- (U) Re-code operating system and radio function software modules into Ada.
- (U) Begin fabrication of key modules into JIAWG specified (SEM-E) format
- (U) Begin Adm integration of an ICNIA UH-60 for LHX risk reduction fight demonstration.
- (U) Initiate a detailed requirements anallysis to baseline the definition of the functional needs.
- (U) Provide for an analysis of the basic avionics system for ingegrated avionics inclusion. The results of the analysis will include any recommended modifications which, if incorporated early in development, can reduce the overall procurement costs
- (U) Given the results of the above study, work will begin on a preliminary design of common core modules, the bulk of which falls within the integrated rocessors and CNI avionics

(U) FY 1990 Planned Program:
- (U) Complete ATF ground prototype demonstrations
- (U) Validate hardware/software modules in JIAWG format
- (U) Finish conversion of radio frequency (RF) modules into SEM-E configuration.

(U) Program to Completion:
- (U) Continue module validation and testing to support the ATF milestone II decision
- (U) Examine applications of ICNIA to platforms other than ATF

D. (U) Work Performed By: In-house work by the ATF SPO, Wright-Patterson AFB, OH. Major contractors are TRW Corp, San Diego, CA and Rockwell-Collins, Cedar Rapids, IA.

Program Element: #0604250F Budget Activity: #4 - Tactical Programs
Title: Integrated Electronic Warfare/Communications, Navigation, Identification (EW/CNI) Development

E. (U) Related Activities:
- (U) Program Element #0603109F, INEWS/ICNIA
- (U) Program Element #0603109N, Application of INEWS/ICNIA
- (U) Program Element #0603226F, DoD Common Language (Ada) Development
- (U) Program Element #0603226F, Advanced Computer Technology
- (U) Program Element #0603270F, Electronic Warfare Technology
- (U) Program Element #0603230F, ATF
- (U) DoD VHSIC/MMIC Program
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

F. (U) Other Appropriation Funds ($ in Thousands): none

G. (U) International Cooperative Agreements: none

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604250F Project Number: 3389
PE Title: Integrated EW/CNI Development Budget Activity: 4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title Integrated Electronic Warfare System Pre-FSD

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
INEWS Pre-FSD	7,284	73,100	79,952	0	0	160,384

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
Threat Warning and Countermeasures Suite for to be integrated into Avionics Suite of ATF/ /IHX.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Emphasis on hardware and software design for prime and support systems.
   - (U) Developed interface control documentation
   - (U) Conducted life cycle cost analysis
   - (U) Completed initial Integrated System Facility hardware and Ada Software demos.
   - (U) Flight test for advanced decoys complete

2. (U) FY 1989 Planned Program:
   - (U) Continue pre-FSD
   - (U) Tailor advanced development models to ATF LHX requirements
   - (U) Flight demo sensors
   - (U) Conduct Integrated Ground Prototye demos
   - (U) Complete software design

3. (U) FY 1990 Planned Program:
   - (U) Complete Pre-FSD
   - (U) Conduct weapon system integration demonstration at ATF prime contractor avionics labs
   - (U) Flight test IR Warning functions
   - (U) Ground test RF Warning functions at AFEWES
   - (U) Core critical design review

Program Element: 0604250F Project Number: 3389
PE Title: Integrated EW/CNI Development Budget Activity: 4 - Tactical Programs

4. (U) FY 1991 Planned Program: None, work transitions into ATF FSD.

5. (U) Program to Completion:
   - (U) Begin ATF FSD in FY 1991
   - (U) Spin-off developed technology to other tri-Service applications

D. (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.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

TYPE OF CHANGE	System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Eng	none	none	none
Sched	Yes	+6 months	+ 40,419
Cost	none	none	none

NARRATIVE DESCRIPTION OF CHANGES

1. (U) ENGINEERING CHANGES: N/A.
2. (U) SCHEDULE CHANGES: The INEWS program was accelerated approximately 6 months to match the ATF schedule through the infusion of budget year dollars.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-80, Tactical self-protection EW systems, 9 May 1980.
- (U) INEWS Tri-Service MOA, 22 Jun 88.
- (U) TAF SORD 304-83 I/IIA-ATF.
- (U) USN Statement of Operational Requirements for INEWS, Mar 1988.
- (U) GAO Report on RWR Commonality, Nov 1987.
- (U) DOD EC policy Guidance for FY 1988.
- (U) Joint Integrated Avionics Plan for New Aircraft, (with tri-Service MOA), Mar 1987.

G. (U) MILESTONE SCHEDULE:
1. (U) Begin INEWS pre-FSD June 1988
2. (U) INEWS Core Critical Design Review November 1990
3. (U) Begin ATF Full Scale Development January 1991

H. (U) RELATED ACTIVITIES:
- (U) Program Element #0603109F, INEWS/ICNIA
- (U) Program Element #0603109N, Navy Unique application of INEWS/ICNIA

Program Element: 0604250F Project Number: 3389
PE Title: Integrated EW/CNI Development Budget Activity: 4 - Tactical Programs

- (U) Program Element #0603226F, DoD Common Language (Ada) Development
- (U) Program Element #0603226F, Advanced Computer Technology
- (U) Program Element #060270F, Electronic Warfare Technology
- (U) Program Element #0603230F, ATF
- (U) Dod VHSIC/MMIC Program
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

I. (U) Other Appropriation Funds ($ in Thousands): none.

J. (U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604250F Title: Integrated EW/CNI Development
Project Number: 3786 Budget Activity: 4 - Tactical Programs

A. (U) RESOURCES ($ In Thousands)
Project Title: Integrated COMSEC

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1900 Estimate	FY 1991 Estimate	To Complete	Total Program
Advanced Airborne Comsec Unit (AACU)						
	.400	11,595	18,264	6,340	1,698	38,297

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This is a lead-service funded, NSA developed, software programmable, universal communicaitons security/transmission security (COMSEC/TRANSEC) device, in a VHSIC-based standard "Common Module" format, which will provide the encryption key streams required for secure transmission and reception of encrypted communications, navigation and identification signals. The hardware and software modules will be applicable to ensure information security between ATF, LHX internal subsystems (i.e., between INEWS and ICNIA) as well as between aircraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Contract awarded through NSA for COMSEC module at end of FY88.

2. (U) FY 1989 Planned Program:
   - (U) Develop COMSEC SEM-E modules based on JIAWG architecture specifications.
   - (U) Conduct security analysis risk assessment.
   - (U) Prototype custom micro-circuits.

3. (U) FY 1990 Planned Program:
   - (U) Deliver COMSEC SEM-E modules to support ATF prototype demonstrations.
   - (U) Demonstrates IFF and JTIDS COMSEC based on integrated architecture design.
   - (U) Conduct system interface test to ICNIA prototypes.

4. (U) FY 1991 Planned Program:
   - (U) Finish integrated COMSEC interface testing.
   - (U) Complete architecture interface specifications.
   - (U) Finalize security assessment.

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

D. (U) Work Performed By: NSA will conduct in-house selection for a sub-contractor. To date this selection is under competition.

Program Element: #0604250F Title: Integrated EW/CNI Development
Project Number: 3786 Budget Activity: 4 - Tactical Programs

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

CHANGE	System Capabilities	Schedule	FY1990 COST
Eng	YES	NONE	$ +14,795
Sched	NONE	NONE	NONE
Cost	NONE	NONE	NONE

NARRATIVE DESCRIPTION OF CHANGES

1. (U) ENGINEERING CHANGES: OSD directed the AF, as lead service, to accomplish the development-funding NSA for the work.
2. (U) SCHEDULE CHANGES: none
3. (U) COST CHANGES: none

F. (U) PROGRAM DOCUMENTATION: TAF SON 304-80, Advanced Tactical Fighter

G. (U) RELATED ACTIVITIES:
(U) Program Element #0603109F, INEWS/ICNIA

H. (U) OTHER APPROPRIATION FUNDS: none

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: none

J. (U) MILESTONE SCHEDULE:

1. (U) Contract Award Sep 88
2. (U) Preliminary Decision Review Feb 89
3. (U) Brassboard delivered to ATF Oct 89
4. (U) Critical Design Review Jun 90

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604250F Title: Integrated EW/CNI Development
Project Number: 3858 Budget Activity: 4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title SEEK SPARTAN (INEWS FOR OTHER THAN ATF)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SEEK SPARTAN	000	400	5,000	38,100	Cont	Cont

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: An integrated EW system is required to perform multi-spectral threat alert, threat response and system management/control functions. It must provide both functional and physical modularity so as to facilitate avionics commonality and reconfigurability for multiaircraft/mission applications. Advanced EW capabilities are required for future aircraft that provide (1) situation awareness, (2) and (3) a cost effective mix of on-board and countermeasures. These three capabilities shall be integrated into an EW system with architecture that meets Joint standards. The SEEK SPARTAN objective is to spin-off the Joint Integrated Avionics Working Group (JIAWG) specified functions for INEWS to platforms other than ATF, thereby achieving greater system capability, coupled with improvements in reliability and maintainability, and reducing the proliferation of EC devices. An off shoot of modular design and production should be greater economies of scale in production which complement a prime objective of affordability without compromising mission effectiveness.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments: none, FY 1989 start

2. (U) FY 1989 Planned Program:
   - (U) Monitor pre-FSD
   - (U) Initiate engineering studies
   - (U) Flight demo sensors

3. (U) FY 1990 Planned Program:
   - (U) Participate in Pre-FSD Demonstrations
   - (U) Initiate study for follow-on Weasel, F-16, and F-15E

4. (U) FY 1991 Planned Program:
   - (U) Begin Full Scale Development of a Sensor

Program Element: 0604250F Title: Integrated EW/CNI Development
Project Number: 3858 Budget Activity: 4 - Tactical Programs

- (U) Begin Full Scale Development of a modular ECM suitem for application to and Follow-on Wild Weasel

5. (U) Program to Completion:
   - (U) Initiate FSD program for a Sensor
   - (U) Spin-off developed technology to other tri-Service applications

D. (U) WORK PERFORMED BY: Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio, is responsible for the SEEK SPARTAN program. Contracts will be competively selected at the end of FY 1990.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	none	none	none
Sched	none	none	none
Cost	none	none	none

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: N/A.
2. (U) SCHEDULE CHANGES: N/A.
3. (U) COST CHANGES: N/A.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 304-80, Tactical self-protection EW systems, 9 May 1980.
- (U) INEWS Tri-Service MOA, 22 Jun 88.
- (U) TAF SON 305-86 Follow-on Wild Weasel.
- (U) USN Statement of Operational Requirements for INEWS, Mar 1988.
- (U) GAO Report on RWR Commonality, Nov 1987.
- (U) DOD EC Policy Guidance for FY 1988.
- (U) Joint Integrated Avionics Plan for New Aircraft, (with tri-Service MOA), Mar 1987

G. (U) MILESTONE SCHEDULE:

1. (U)	Begin INEWS pre-FSD	June 1988
2. (U)	Core Critical Design Review	November 1990
3. (U)	Begin Sensor and FSD	June 1991
4. (U)	Begin system FSD	Aug 1991
5. (U)	Begin sensor FSD	Feb 1992

Program Element: 0604250F Title: Integrated EW/CNI Development
Project Number: 3858 Budget Activiity: 4 - Tactical Programs

H. (U) RELATED ACTIVITIES:
- (U) Program Element #0603109F, INEWS/ICNIA
- (U) Program Element #0603109N, Application of INEWS/ICNIA
- (U) Program Element #060270F, Electronic Warfare Technology
- (U) Program Element #0603230F, ATF
- (U) DoD VHSIC/MMIC 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): none

I. (U) International Cooperative Agreements: none.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604268F
PE Title: Aircraft Engine Component Improvement Program (CIP)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Aircraft Engine CIP	91,009	92,993	112,494	137,325	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: CIP provides engineering support and testing to ensure that 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. 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 and the Air Force accepts the first production aircraft with the 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 also ensures continued improvements in engine R&M factors. This reduces the size of outyear support costs. Typically, CIP efforts reduce operations and maintenance costs by a factor greater than eighteen to one.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Provided continuing engineering support for all engines in the Air Force operational inventory
   - (U) Documented life cycle cost avoidance, a measure of reliability and maintainability improvement, exceeded $2.4 billion, with the majority of the savings from F100, F101, F110, TF30, T56, TF39, TF34 and TF41 engines
   - (U) Developed a number of repair techniques to avoid depot line stoppages and to provide needed parts to the field

Program Element: #0604268F
PE Title: Aircraft Engine Component Improvement Program (CIP)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

2. (U) FY 1989 Planned Program:
   - (U) CIP work is continuing on engines in the Air Force operational inventory to reduce air aborts, engine related safety incidents, not-mission-capable rates, scheduled and unscheduled engine removals, maintenance man-hours, and overall engine cost.

3. (U) FY 1990 Planned Program:
   - (U) Effort will be conducted 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 begin on the F100-PW-229 and the F110-GE-129 Increased Performance Engines (IPEs)

4. (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) Address IPE service revealed deficiencies as they are identified through operational use.

5. (U) Program to Completion:
   - (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 the San Antonio and the 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, J85-21, 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, J75, TF30, TF33); Solar Turbine Inc, CA (gas turbine engines); Teledyne CAE, Toledo OH (J69); and Williams International, Walled Lake MI (F107, F112).

Program Element: #0604268F
PE Title: Aircraft Engine Component Improvement Program (CIP)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	-44,365

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Program funding reduction was due to fiscal constraints and reallocation to PE #0604315 Alternate Fighter Engine (AFE) to fund work on the IPEs which is more properly budgeted in the AFE PE.

F. (U) PROGRAM DOCUMENTATION: Not Applicable.

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0603202F (Aircraft Propulsion Subsystem Integration) provides fan and low pressure turbine technology
- (U) Program Element #0603216F (Advanced Turbine Engine Gas Generator) provides compressor, combustor, and high pressure turbine technology
- (U) Program Element #0604218F (Engine Model Derivative Program) provides additional component and engine test data
- (U) Program Element #0708011F (Industrial Preparedness Program) provides materials processing and component fabrication demonstration
- (U) The Army and the Navy have Aircraft Engine CIPs, Program Element #0604268A and Program Element #0604268N, respectively
- (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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

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

Project Number & Title		FY 88 Act	FY 89 Est	FY 90 Est	FY 91 Est	To Comp	Total Pgm
1627	Sim., Analysis, and Eval.***	[15738]	30015	600	600	Cont.	N/A
2066	EF-111A Upgrade	13654	2000	7200	8600	Cont.	N/A
2114	Antenna Test Range***	[2114]	2100	[-	-]	Cont.	N/A
2272	F-16 Protective Systems	10400	9000	10850	12100	Cont.	N/A
2274	Special Ops Acft Prot Syst	1500	100	2000	1000	Cont.	N/A
2462	COMPASS CALL	12761	8900	5000	7600	Cont.	N/A
2712	ASPJ Common Development	5036	4800	2900	5200	Cont.	N/A
2719	F-16/ASPJ Devel/Integration	15001	5200	3900	3100	Cont.	N/A
2827	F/FB/EF-111 RWR***	[58007]	4300	[10600	11700]	Cont.	N/A
2879	Auto Reprog Capability	4000	3203	5700	2500	Cont.	N/A
2907	EC Intell Support***	1622	1500	[1750	1800]	Cont.	N/A
3106	A-10 Protective Systems	350	0	0	0	Cont.	N/A
3108	Airlift Defense Systems**	1100	2000	6200	6300	Cont.	N/A
3158	EC Digital Eval System***	3587	1000	[0	1000]	Cont.	N/A
3630	Joint Elect Warfare Center***	2000	2000	[2500	2700]	Cont.	N/A
3660	AFECO	1200	900	2000	1000	Cont.	N/A
3894	JSTARS (Self-Def Suite)	-	-	24500	47000	99000	170500
3895	B-1B RWR	0	0	46000	70000	169000	N/A
3896	Adv Expendables (B-1B)	0	0	13000	15000	82000	110000
5615	Strategic Protective Systems	0	0	0	0	Cont.	N/A
5616	B-52 Protective Systems	[6203]	0	0	0	Cont.	N/A
5618	F-15 Protective Systems	20950	20200	20606	15613	Cont.	N/A
N/A	Classified Programs	41349	0				N/A
	Various 63 Programs	45175	0				
TOTAL*		179685	97218	150456	195613	Cont.	N/A

* PE 0604270F did not exist prior to FY 1989. Totals are for the existing projects shown which became part of PE 0604241F in FY 1988 and PE 0604270F in FY 1989 when the host PEs for the project were dissolved to create the consolidated EW PE.

** Jointly funded between PE 0604738F project 3108 Airlift Defensive Systems and PE 0604241F project 3107 Have Charcoal in FY 1988. Consolidated into Project 3108 Airlift Defensive Systems in FY 1989 within PE 0604270F.

*** Funded in various PE's in FY 90.

[ ] Not included in PE 060241F (FY 88) or PE 0604270F (FY 90). Funds for reference only.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element consolidates engineering development efforts related to Air Force electronic

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

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 ultimate production programs. Technology base/advanced development efforts are funded in a separate program element, PE 0603270F, Electronic Warfare Technology. Multiple electronic warfare program elements (63 and 64) 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 addition program elements while 63 projects are excluded in the consolidation for FY 1989. In order to preserve continuity and clarity, the original project numbers under the former (FY 1987) Program Elements (PEs) have been retained.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project: 2066, EF-111A Upgrade: This project, which updates the ALQ-99E, is required to keep the tactical jamming 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 o counter these radars. The update program will incorporate a new multiple processing encoder, a MIL-STD 1750 computer, MIL-STD 1553-B data bus, two new narrow-band 7/8 antenna, and software changes to allow the system to defeat the threat by placing concentrated jamming through improved power management on specific radars of interest.

(U) FY 1988 Accomplishments (Funded in PE 0604241F):

- (U) A full scale development contract to update the ALQ-99E jammer with EATON/AIL was terminated for default in Jun 88. The requirement to update the ALQ-99E remains valid.
- (U) Initiated restructure of the development program to update the ALQ-99E.
- (U) Inititated operational assessments/studies to verify the system's requirements against an updated threat base.

(U) FY 1989 Planned Program (funded in PE 0604270F):

- (U) Complete operational assessments and definition of system requirements.
- (U) Complete restructure and definition of program.
- (U) Develop system specification.

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Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

(U) FY 1990 Planned Program:

- (U) Initiate full scale development program on the ALQ-99E.
- (U) Accomplish Preliminary Design Review

(U) FY 1991 Planned Program:

- (U) Continue Full-Scale development
- (U) Accomplish Critical Design Review

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

(U) Project: 2114, Antenna Test Range. This project provides for the acquisition, maintenance and continuing update of a precision Electronic Warfare (EW) antenna test range employing reconditioned shells of actual USAF combat aircraft. Current aircraft shells available include F-4, F-111, A-10, F-15, F-16, B-52 and KC-135 aircraft. The range is used during advanced and full-scale development programs to test and evaluate new EW antennas and antenna installations on board actual aircraft to determine radiation patterns.

(U) FY 1988 Accomplishments:

- (U) Electro-Optical/Millimeter wave (E-O/MMW) and Post Attack Airborne system (PAAS) programs continue.
- (U) B-1 shell mounting on pedestal.

(U) FY 1989 Planned Program:

- (U) E-O/MMW and PAAS programs complete.
- (U) B-1 shell mounting complete and shell available for antenna testing.

(U) Program to Completion: This is a continuing program moved to PE 0604735F in FY 1990.

(U) Project: 2274, Special Operations Aircraft Protection Systems. This project will evaluate the Technique 101 on tactical aircraft. was developed to counter the threat. This program, QRC 85-04, will test concept on an F-4 aircraft.

(U) FY 1988 Accomplishments:

- (U) Conceptual Flight Test/Demonstration at Eglin AFB completed Jul 88.
- (U) Full Scale Development (FSD) determination has been delayed pending TAF evaluation of competing alternatives.

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

(U) FY 1989 Planned Program: TBD

(U) FY 1990 Planned Program: TBD

(U) FY 1991 Planned Program: TBD

(U) Program to Completion: TBD

(U) Project: 2712, Airborne Self Protection Jammer Common Development. This project funds the Air Force share of the joint Navy/Air Force common development of the ASPJ (ALQ-165). This effort is required to increase Air Force and Navy tactical aircraft survivability and provide an enhanced probability of mission success.

(U) FY 1988 Accomplishments:

- (U) Completed developmental test flight testing
- (U) Successful AFOTEC/OPTEVFOR operational assessment
- (U) Awarded production verification option for 14 additional systems

(U) FY 1989 Planned Program:

- (U) AFOTEC/OPTEVFOR operational testing
- (U) Milestone IIIA limited production in March 1989

(U) FY 1990 Planned Program:

- (U) AFOTEC testing on F-16C aircraft
- (U) Milestone IIIA limited production
- (U) Delivery and lab testing of first PV systems

(U) FY 1991 Planned Program:

- (U) Delivery of remainder of PV systems and integration on F-16
- (U) Milestone IIIA limited production
- (U) Operational testing of PV systems on F-16C Block 40

(U) Program to Completion:

- (U) Complete development and testing of all improvements.
- (U) Integrate ASPJ on F-16 combat aircraft.

(U) Project: 2719, F-16 ASPJ Development/Integration. This project supports unique engineering required to integrate the ASPJ into the F-16 aircraft.

(U) FY 1988 Accomplishments:

- (U) Certified FSD system for operational testing
- (U) Successful AFOTEC operational assessment

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

(U) FY 1989 Planned Program:

- (U) Integration of FSD ASPJ system into F-16C
- (U) AFOTEC F-16C testing
- (U) Milestone IIIA

(U) FY 1990 Planned Program:

- (U) Integration of PV system with other F-16C avionics in General Dynamics Lab
- (U) Milestone 111A.

(U) FY 1991 Planned Program:

- (U) Installation and testing of PV system on Block 40 F-16C
- (U) AFEWES testing on PV system
- (U) Milestone IIIA decision

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

(U) Project: 2879 Automated Reprogramming Capability (ARC): Establish a system architecture for Command reprogramming. Develop a proof of concept system, then integrate with WRALC and TAWC. Release the system architecture to Commands for P3I of their systems.

(U) FY 1988 Accomplishments:

- (U) Develop an architecture for multi-command use
- (U) A proof of concept demonstration contract for the ALR-69/46

(U) FY 1989 Planned Program:

- (U) Complete source selection, sign contract
- (U) System delivery to Tactical Air Warfare Center 6-9 months After Receipt of Order
- (U) Continue system validation and update SAC's ALQ-172 system

(U) FY 1990/91 Planned Program: Continue P3I for SAC, MAC, TAC systems.

(U) Program to Completion: Complete concept development and upgrade Command systems. Transfer responsibility to Electronic Warfare Integrated Reprogramming Program Management Directive as a reprogramming tool.

(U) Project: 2907, Electronic Combat Intelligence Support. This project continues production of intelligence data files (EWIS) and intelligence data input packages (IDIPs) to support Air Force

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

electronic combat operations and continues support of aircrew training through the design, development, validation, and testing of threat emitter simulators.

(U) FY 1988 Accomplishments:

- (U) Electronic Warfare Intelligence Support Program will continue subfile development on Soviet ECM, Electro-Optical, and Infrared (IR) systems.
- (U) Continue work on IDIP production automation and intelligence data base interoperability.
- (U) Continue support to HAVE COPPER and begin support to the HAVE IRON simulator.
- (U) Continue to provide simulator validation (SIMVAL) reports.

(U) FY 1989 Planned Program:

- (U) Continue EWIS and threat SIMVAL efforts.
- (U) EWIS will continue to be used to validate digital simulations and produce threat models for future EW acquisition programs.
- (U) SIMVAL will continue to provide intelligence support to simulator threat development efforts (e.g., SA-13/15, ZSU-X, etc.).

(U) Program to Completion: This is a continuing program that moves to PE 35887F in FY 1990.

(U) Project: 3108, Airlift Defensive Systems: This project provides for development of a common defensive architecture on tactical and strategic airlift aircraft, specifically the C-17, C-130, C-141 and C-5.

(U) FY 1988 Accomplishments:

- (U) Previous limited-scope HAVE CHARCOAL activities were terminated in preparation for the current program

(U) FY 1989 Planned Program:

- (U) Initiate C-17 ECP

(U) FY 1990 Planned Program:

- (U) Conduct requirements and design studies
- (U) Continue C-17 ECP
- (U) Begin C-17 integration engineering

(U) FY 1991 Planned Program:

- (U) Continue integration engineering

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

(U) Program to Completion:

- (U) This is a continuing program

(U) Project: 3158, Electronic Combat Digital Evaluation System (ECDES). This project involves the development of the ECDES, which will transfer to PE 0604735F in FY 90.

(U) Project: 3630, Joint Electronic Warfare Center (JEWC). This project identifies various Joint Chiefs of Staff sponsored 6.2/6.3 projects for the Air Force/Navy/Army and provides management and funds to expedite the movement of applicable lab technology to a 6.4 effort. This project moves to PE 0208021F in FY 90 and is included in that Descriptive Summary.

(U) Project: 3660, Air Force Electronic Combat Office (AFECO): Purpose is to focus USAF electronic Combat acquisition and upgrade programs; integrative 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 1988 Accomplishments:

- (U) Will define program and funding estimate for Off-Board Decoy use for USAF fighters (Advanced Airborne Expendable Decoy - Navy led Joint program)
- (U) EW data base implementation
- (U) Accomplish RWR commonality study

(U) FY 1989 Planned Accomplishments:

- (U) Continue EW data base expansion
- (U) Initiate ECM Pod capabilities growth

(U) FY 1990 Planned Program: As tasked by HQ AFSC/AFLC

(U) FY 1991 Planned Program: As tasked by HQ AFSC/AFLC

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

D. (U) WORK PERFORMED BY:

(U) Project 2066: Air Force Systems Command will manage the development contract. Air Force Studies and Analysis and Air Force Electronic Warfare Center are performing operational assessments/studies. Class V modification of the EF-111 aircraft will be managed by Sacramento Air Logistics Center.

(U) Project 2114: The Air Force manager is Air Force Systems Command, Electronic Systems Division, Rome Air Development Center (RADC), Griffiss AFB, NY.

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

(U) Project 2274: The contractor is Raytheon Corporation, Goleta, CA, (QRC 85-04).

(U) Project 2462: 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 performing work for this effort include: Lockheed Aircraft Services, Ontario, CA; Sanders Associates, Nashua, NH; and Magnavox, Ft Wayne, IN.

(U) Project 2712: ASPJ development is 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, is managed by the Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH. The ASPJ Phase I design effort was accomplished by two competitive contractor teams. One ASPJ team was Northrop Corporation, Rolling Meadows, IL, and Sanders Associates, Nashua, NH. The second ASPJ 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.

(U) Project 2719: Integration of ASPJ into the F-16 is being accomplished by General Dynamics, Ft Worth, TX.

(U) Project 2879: The contractor is TBD. The Air Force project manager is TAC/TAWC with assistance from WRALC and Air Force Systems Command, HQ's SAC, TAC, and MAC.

(U) Project 2907: The Foreign Technology Division (FTD) at Wright-Patterson AFB, OH, performs Electronic Warfare Intelligence Support (EWIS) project tasks, using in-house and contract resources. Current EWIS data file development is being accomplished by the Planning Research Corporation (PRC) field office at Dayton, OH. The FTD also does threat SIMVAL program tasks for new threat simulators under development. This work is assisted by radar engineers from Sverdrup Technology, Inc., of Tullahoma,Tennessee.

(U) Project 3108: The Air Force manager of ADS is Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH.

(U) Project 3158: The Air Force project manager is Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH, with support from BDM, McLean VA, Booze Allen and SAIC.

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

(U) Project 3630: The Air Force project manager is Electronic Security Command, Kelly AFB, TX, with support from Northrop and numerous other contractors.

(U) Project 3660: This project is managed in-house by Air Force Systems Command, and Air Force Logistics Command with a joint office formed at Aeronautical Systems Division, Wright-Patterson AFB, OH.

(U) Project 3894: This project is managed by ESD, Hanscom AFB, MA to develop and test the Self-Defense Suite for the E-8 aircraft. Specific discussion is in Descriptive Summary for PE 0604770F.

E. (U) RELATED ACTIVITIES:

- (U) Project 2066: PE 0207252F, EF-111A Squadrons contains program production funds and FY 90/91 RDT&E funds.
- (U) PE 0207168F, F-111 Self Protection Systems.
- (U) PE 0207129F, F-111 Squadrons
- (U) Project 2114: PE 0604735F, Range Improvements Program (RIP), will absorb the RADC antenna test range project in FY 1990.
- (U) Project 2462: PE 0603743F, Electronic Combat Technology, provides technology development. COMPASS CALL, PE 0207253F, procures system hardware.
- (U) Projects 2712/2719: The ASPJ ECM efforts are directly related to PE 0207133F, F-16 Squadrons.
- (U) Project 2827: Radar Warning Receiver for F/FB/EF-111 aircraft.
- (U) Project 2907: This project supports and directly interfaces with the other EC projects within PE 0604270F. It also interfaces with the basic intelligence analysis efforts funded by PE 0301310F, Foreign Technology Division (FTD).
- (U) Project 3108:
  - (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.

00469

Program Element: #0604270F Budget Activity: 4 - Tactical Program
PE Title: EW Development (Consolidated PE)

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

	FY 88 Act	FY 89 Est	FY 90 Est	FY 91 Est
Aircraft Procurement (Proj 2462) BA (PE 0207253F)	15028	18411	N/A	
Aircraft Procurement (Proj 2827) BA (BP 1900)	50900	65700	72300	18000

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604270F Project Number: 1627
PE Title: EW Development Budget Activity: 4 - Tactical Programs

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

Project Title: AFEWES, REDCAP & AAMRL

Popular Name	FY 88 Act	FY 89 Est	FY 90 Est	FY 91 Est	To Comp	Total Program
	[15738]	25300	600	600	N/A	Cont.

[ ] Funded in PE 0604738F.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project develops, fabricates and validates laboratory simulations of Soviet threat systems for detailed development and evaluation of potential countermeasures systems and techniques. The two major 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). The AFEWES facility provides realistic laboratory simulations of
systems. The REDCAP facility provides a realistic laboratory simulation of the

as well as the
Both facilities include manned, high-fidelity simulations of cockpits and operator stations. These are one-of-a-kind facilities which permit effective definition, design and evaluation of new/improved counter-measures equipment in precisely controlled environments. They permit extensive testing for similar efforts. The third facility in this project is the Armstrong Aerospace Medical Research Lab (AAMRL)/Human Engineering Development (HED). AAMRL/HED 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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:

- (U) AFEWES generic clutter completes
- (U) Fabrication of AFEWES simulations continues
- (U) Design of AFEWES simulation, laboratory improvements, and test director system begins
- (U) Design of REDCAP and upgrades begins
- (U) AAMRL B-1B crew station simulator operational

00471

Program Element: #0604270F Project Number: 1627
Project Title: AFEWES, REDCAP & AAMRL Budget Activity: 4 - Tactical Programs

(U) FY 1989 Planned Program:

- (U) Fabrication of AFEWES simulations continues
- (U) Design of AFEWES simulation, laboratory improvements, and test director system complete, fabrication begins
- (U) Design of AFEWES simulation begins
- (U) Design of REDCAP upgrades continue, fabrication begins
- (U) Continued operation of AAMRL simulations

(U) FY 1990 Planned Program:

- (U) Continued maintenance and operation of AAMRL/HED facility
- (U) AFEWES and REDCAP funded under PE 0604735F

(U) FY 1991 Planned Program:

- (U) Continued maintenance and operation of AAMRL/HED facility
- (U) AFEWES and REDCAP funded under PE 0604735F

(U) Program to Completion: This is a continuing program. The AFEWES and REDCAP responsibilities will transfer to PE 0604735F in FY 1990. These efforts were in PE 0604738F in FY 1988.

D. (U) WORK PERFORMED BY: The Air Force manager of AFEWES and REDCAP is Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH. AAMRL/HED is its own manager. Major contractors are General Dynamics, Ft Worth, TX (AFEWES); and Calspan Corp., Buffalo, NY (REDCAP).

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	N/A
Schd	None	+0 - +30 months	N/A
Cost	None	None	N/A

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.

2. (U) SCHEDULE CHANGES: Delay caused in determining simulation architecture investment strategy/plan

Program Element: #0604270F Project Number: 1627
Project Title: AFEWES, REDCAP & AAMRL Budget Activity: 4 - Tactical Programs

3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION: Numerous SONs for multiple programs which require AFEWES, REDCAP, and AAMRL

G. (U) RELATED ACTIVITIES:

- (U) PE 0604735F, Range Improvements Program (RIP), will absorb the AFEWES and REDCAP portions of this project in FY 1990
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

H. (U) OTHER APPROPRIATION FUNDS ($ in Thousands): None.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

-
-
-

FY 1988/1989 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604270F Project Number: 2272
Title: EW Development Budget Activity: 4-Tactical Programs

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

Project Title: F-16 Protective Systems

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	10400	9000	10850	12100	N/A	Cont

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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS: 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.

(U) FY 1988 Accomplishments:

- (U) ALE-47 FSD/Prod (FFP) contract award Jul 88
- (U) OBEWS - System acceptance test at contractor's facility Nov 87 - Mar 88
- (U) F-16 acft modification at Eglin AFB, FL

(U) FY 1989 Planned Program:

- (U) OBEWS DT&E Flight test begins Jan (6 months)
- (U) Continue ALE-47 FSD design and fabrication
- (U) OBEWS - IOT&E Flight test at Nellis AFB, NV begins Jul 89 (4 months) production decision after IOT&E completion

(U) FY 1990 Planned Program:

- (U) ALE-47 DT&E/IOT&E Jan 90 - Sep 91

(U) FY 1991 Planned Program:

- (U) ALE-47 Production Decision Sep 91

(U) Program to Completion:

- (U) ALE-47 Production lots 1-4 begin mid 1992

Program Element: #0604270F Project Number: 2272
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 4 production lots. The program is managed by ASD/RW at WPAFB OH. OBEWS prime contractor is A.A.I., Baltimore, MD. The program is managed by AD/YI at Eglin AFB, FL.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	Reduced

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.

2. (U) SCHEDULE CHANGES: None.

3. (U) COST CHANGES: Reduced due to contract negotiations.

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

*All Dates presented in FY 1988/FY 1989 Descriptive Summary are bettered due to the negotiated contract with TRACOR Aerospace.

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):

Acft Procurement PE 0207133F,	FY 88 Act	FY 89 Est	FY 90 Est	FY 91 Est	To Comp	Total Program
BA Funds	2,632,000	3,157,700	2,385,100	2,215,700	13,047,900	47,403,751
Quantity	180	180	108	108	648	2723

I. (U) INTERNATIONAL COOPERATIVE AGREEMENT: None.

J. (U) MILESTONE SCHEDULE:

Program Element: #0604270F Project Number: 2272
Title: EW Development Budget Activity: 4 - Tactical Programs

(U)	ALE-47 Preliminary FSD Contract Award	Sep 1983
(U)	ALE-47 FSD and Prod Contract Award	Jul 1988
(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 1990/1991 BIENNIAL 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 RWR

Popular Name	FY 1988 Actual	FY 1989 Est	FY 1990 Est	FY 1991 Est	To Complete	Total Program
	0	0	46000	70000	169000	N/A

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
The B-1B is a strategic, long-range, multirole weapon system which is able to perform the missions of conventional bomber, cruise missile launch platform, and nuclear weapons delivery system in both the tactical and strategic roles. Production of the B-1B addresses the national requirements to increase our targeting flexibility, to redress the relative decline of our strategic capabilities, and to revitalize our strategic deterrent forces. The B-1B significantly enchances 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 1988 Accomplishments:

- (U) Flight test of the ALQ-161A confirmed that the most operationally significant electronic countermeasures techniques worked, but the tests also identified a design deficiency that will preclude achieving the systems full specification performance without further modifications.
- (U) Continued initial and follow-on operational test and evaluation of the B-1B weapons system.

2. (U) FY 1989 Planned Program:

- (U) Continue development as well as lab and flight evaluations of the ALQ-161A core configuration (Mature the Central Integrated Test System, Improve performance system relability, verify installed system performance).
- (U) Conduct risk reduction efforts in preparation for full scale development for integration on the B-1B of the Air Force common radar warning receiver (RWR).

3. (U) FY 1990 Planned Program:

- (U) Begin full scale development to integrate the Air Force Common RWR into the B-1B.
- (U) Complete residual core ALQ-161A evaluations and the improved 1122 antenna evaluations

Program Element: # 0604270F Project Number: 3895
PE Title: EW Development Budget Activity: 4 - Tactical Programs

4. (U) FY 1991 Planned Program:

- (U) Conduct Anechoic, Integrated Facility For Avionics Test (IFAST), and FLight evaluations on the Air Force commom RWR installed on a B-1B.
- (U) Begin initial operational test and evaluation of the Air Force common RWR installed on the B-1B.

5. (U) Program to Completion:

- (U) Complete developmental evaluations of the Air Force common RWR installed on the B-1B.
- (U) Continue operational evaluations of the Air Force common RWR installed on the B-1B

D. (U) WORK PERFORMED BY: The B-1B program is in concurrent full scale development/production. It is managed by the B-1B System Program Office, Aeronautical Systems Division, Wright-Patterson AFB, OH. The B-1B System Program Office 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 AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	YES	YES	* 46,200
Sched	NONE	NONE	0
Cost	NONE	NONE	0

Program Element: # 0604270F Project Number: 3895
PE Title: EW Development Budget Activity: 4 - Tactical Programs

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: Recent Flight test confirmed that the most operationally significant ECM techniques worked, but the tests also identified a design deficiency which precludes achieving the fullperformance specification without further modifications. The Air Force believes that the parallel development effort for integrating the common Air Force radar warning receiver into the B-1B with the the EATON core ALQ-161A program is the most prudent, best risk approach to providing the B-1B with needed operational requirements.

2. (U) SCHEDULE IMPACT: None.

3. (U) COST CHANGES: None

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 under Program Element 0604227F, Flight Simulator Development. The program will be 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 Program Element 0604427F.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.
- (U) PE 0604244F (SRAM II Engineering Development) The SRAM II is being developed to replace the aging SRAM missiles.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not Applicable.

2. (U) MILITARY CONSTRUCTION: Not Applicable.

Program Element: # 0604270F Project Number: 3895
PE Title: EW Development Budget Activity: 4 - Tactical Programs

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 Reciever	Mar 92	

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604270F
PE Title: EW Development
Project Number: 3896
Budget Activity: 4 - Tactical Programs

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

Project Title: Advanced Expendables

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	0	0	13000	15000	82000	110000

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This FY 1990 new start will develop

This program will provide a An evaluation of all current IR expendable programs within the DOD will be used to identify those promising technologies that complement the goals of the program. The program will then select some of those technologies and demonstrate them in an advanced development program. A vigorous schedule is required to complete FSD of a The program will also develop a he current. If this test is successful, then this technology will be used to develop the

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments: Not applicable.

(U) FY 1989 Planned Program: Not applicable.

(U) FY 1990 Planned Program:
- (U) Start an advanced development program for a
- (U) Start a RF expendable program using applicable technologies from the MSD program.

(U) FY 1991 Planned Program:
- (U) Continue the IR expendable advanced development program.
- (U) Continue the RF expendable program.

(U) Program to Completion:
- (U) This is a continuing program.
- (U) Complete the IR expendable advanced development program by FY 1992.
- (U) Start IR Expendable FSD program in FY 1992.
- (U) Start a RF expendable FSD in FY 1991.

D. (U) WORK PERFORMED BY: The Air Force Avionics Laboratory and the B-1B System

Program Element: #0604270F
PE Title: EW Development
Project Title: Advanced Expendables

Project Number: 3896
Budget Activity: 4 - Tactical Programs

Program Office, Wright-Patterson AFB, OH, will jointly manage this program.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech:	None	None	None
Schd:	None	None	None
Cost:	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None

2. (U) SCHEDULE CHANGES: None

3. (U) COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:
(U) SAC SON 86-020

G. (U) RELATED ACTIVITIES:
(U) Program Element 0602204F, Aerospace Avionics
(U) Program Element 0604220F, EW Counter Response
(U) Program Element 0604701F, Reconnaissance Equipment
(U) Program Element 0604724F, Tactical Command, Control, and Communications (C3) Countermeasures
(U) Program Element 0604738F, Protective Systems
(U) Program Element 0604270F, Project 2712, Airborne Self-Protection Jammer
(U) Program Element 0604270F, Project 5618, Tactical Protective Systems
(U) Program Element 0603270A, Electronic Combat Technology
(U) Program Element 0603270N, Electronic Combat Technology
(U) Program Element 060203F, Offensive Avionics, ECCM Technology
(U) The work in this project will be closely coordinated wth related Army and Navy efforts through Joint reviews conducted by the Joint Director of Laboratories/Technical Panel for Electronic Warfare and 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.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #0604270F
PE Title: EW Development
Project Title: Advanced Expendables

Project Number: 3896
Budget Activity: 4 - Tactical Programs

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

(U) Complete IR expendable advanced development	FY 1992
(U) Start RF expendable program	FY 1992
(U) Complete IR expendable FSD	FY 1995

FY 1990/1991 BIENNIAL 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 88 Act	FY 89 Est	FY 90 Est	FY 91 Est	To Comp	Total Program
TEWS	20950	20200	20606	16500	Cont.	N/A

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, 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 threat and sophisticated threats.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:

- (U) Installation of ALQ-135 QRC systems at 33 TFW began in May 88
  - — (U) Delivery of 65 units complete
  - -- (U) Flight testing to continue
- (U) Phase IV F-15 TEWS integration flight testing commenced (Includes: ALE-45, ALQ-135, ALR-56C, and ALQ-128)

(U) FY 1989 Planned Program:

- (U) IOT&E flight testing of ALR-56C began in Nov 89
- (S) ALQ-135 Band 3 P^{3}I systems begin delivery in Feb to support
- (S) FSD of countermeasures in the ALQ-135 will continue
- (U) ALR-56C testing at DEES Mar/May

(U) FY 1990 Planned Program:

- (U) ALQ-135 Band 1.5 software development continues
- (U) TEWS integration testing continues

(U) FY 1991 Planned Program:

- (U) Integration testing continues
- (U) ALQ-135 Band 1.5 system deliveries begin

00484

Program Element: #0604270F
PE Title: EW Development
Project Number: 5618
Budget Activity: 4 - Tactical Programs

(U) Program to Completion: Improve integration of TEWS with aircraft avionics and fire control radar. Annual upgrades to defeat the evolving threat. This is a continuing program.

D. (U) WORK PERFORMED BY:

- (U) ASD/VF at 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

IMPACT OF CHANGES

Type of Change	Impact on Systems Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	Improved R&M	TBD	None
Cost	Improved R&M	TBD	TBD

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Schedule impact to assure R&M testing is adequate
3. (U) COST CHANGES: Increased emphasis and testing focusing on R&M, reduced FY90/91 funding by OSD allows minimum Integration/Flight testing of baseline TEWS - No upgrades.

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).

G. (U) RELATED ACTIVITIES: VHSIC technology developed in PE 0603452F. F-15E aircraft is developed and produced in PE 0207134F.

H. (U) OTHER APPROPRIATION FUNDS ($ In thousand):

ACFT Procurement PE 0207134F,	FY 88 Act	FY 89 Est	FY 90 Est	FY 91 Est	To Comp	Total Program
BA 01 Funds	150,700	1,484,731	1,571,523	1,530,413	3,857,600	30,211,800
Quantity	42	36	36	36	78	1152

Program Element: #0604270F Project Number: 5618
PE Title: EW Development Budget Activity: 4 - Tactical Programs

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- (U)	ALE-45 CMD Development Contract Award	Jun 1978
- (U)	ALR-56C RWR Development Contract Award	Aug 1981
- (U)	ALE-45 CMD DT&E Flight Test	Dec 1981
- (U)	ALE-45 CMD IOT&E Flight Test	Dec 1982
- (U)	ALQ-135 Internal Countermeasures System (ICS) Quick Reaction Capabilities (QRC) Band 3 Development Contract Award	Feb 1983
- (U)	ALQ-135 ICS QRC Band 3 Ground Test	Nov 1983
- (U)	ALR-56C RWR Ground Test	Apr 1984
- (U)	ALQ-135 ICS P3I Development Contractor 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

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604315 Project Number: N/A
PE Title: Advanced Short Range Air-to-Air Missile (ASRAAM) Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	ASRAAM FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ASRAAM	996	996	4,987	6,472	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Advanced Short Range Air-to-Air Missile is planned to be the next generation short range missile to meet the validated Trilateral Operational Requirement for Advanced Short Range Air-to-Air Missile for the 1990s (USAF Statement of Operational Need 16-82). Under the terms of the Family of Advanced Air-to-Air Missile Systems Memorandum of Understanding, the United States is developing the Advanced Medium Range Air-to-Air Missile (AMRAAM) and the European governments (Germany, Norway, and the United Kingdom) are developing ASRAAM. A US ASRAAM procurement decision will be made after a complete review of missile cost, schedule, performance, reliability and maintainability. F-15/16 test integration, a limited Development Test and Evaluation, and Initial Operation Test and Evaluation will be required in support of a production decision. Production deliveries are expected in the late 1990s. Definitive European contractor estimates are not yet available for missile system costs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Funded US program office.
   - (U) Funded aircraft integration studies.

2. (U) FY 1989 Planned Program:
   - (U) Funds US representation at European ASRAAM Joint Program Office.
   - (U) Development of 6 degrees of freedom simulation to aid in evaluation of ASRAAM.

3. (U) FY 1990 Planned Program:
   - (U) Perform Class II Mods to test aircraft.
   - (U) Purchase initial test hardware.

4. (U) FY 1991 Planned Program:
   - (U) Purchase additional test hardware.
   - (U) Hardware in the loop testing of the missile.
   - (U) Must pay European contractors for test support.

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

Program Element: #0604315 Project Number: N/A
PE Title: Advanced Short Range Air-to-Air Missile (ASRAAM) Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY: ASRAAM prime contractor is British Aerospace with subcontractors in Germany, Norway, and Canada. The Program Office responsible for managing ASRAAM is located at Armament Division, Eglin AFB FL.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	Yes	Yes	-4,692
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: The difference in 1990 is due to a restructuring of the Air Force ASRAAM program to relfect program delays in the European program.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENATION: Trilateral Operational Requirement for Advanced Short Range Air-to-Air Missile, SON 16-82.

G. (U) RELATED ACTIVITIES: ASRAAM is related to the AIM 9L/M Sidewinder (PE 0207161F) and to the AMRAAM (PE 0604314F). 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: Memorandum of Understanding for a Family of Weapons of Advanced Air-to-Air Missile Systems, AMRAAM/ASRAAM, dated August 1980.

J. (U) MILESTONE SCHEDULE:

1. (U) Complete Project Definition Phase — April 1989
2. (U) Engineering Development Phase — June 1989
3. (U) Production Deliveries — Mid-1990s

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604321F Project Number: N/A
PE Title: Joint Tactical Fusion Program (JTFP) Budget Activity: 4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title JTFP Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Not Applicable	14,049	7,960	10,196	10,206		—

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 main program consists of the Air Force Enemy Situation Correlation Element (ENSCE) and the Army All Source Analysis System (ASAS). Other JTFP efforts supporting the Air Force include the Intelligence Correlation Element (ICE) software capability, which will provide a fusion/display capability for IBM-based intelligence host computers at United States Air Forces, Europe (USAFE) and Pacific Air Forces (PACAF); and interim fusion capabilities which include the Limited Operational Capability Europe (LOCE) and Limited ENSCE (LENSCE) for USAFE and Tactical Air Command (TAC), respectively.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Initial ENSCE fielded to 12th Tactical Intelligence Squadron (TIS).
   - (U) IBM/IWS Application Protocol System Phase II critical design review (CDR).
   - (U) LOCE participation in Exercise Crested Eagle 88.
   - (U) 12th TIS ENSCE participation in Exercise Blue Flag 88-4.
   - (U) PACAF/USAFE All Source system verification test and software integration readiness review.
   - (U) LOCE Baseline 2.0 software installed.
   - (U) LENSCE 9th and 12th TIS Baseline 2.0 software installed.

2. (U) FY 1989 Planned Program:
   - (U) ASAS/ENSCE continuing limited operational capability development.
   - (U) ICE software delivery to USAFE (March 1989).
   - (U) ICE software delivery to PACAF (June 1989).
   - (U) LOCE/LENSCE version software.

Program Element: #0604321F Project Number: N/A
PE Title: Joint Tactical Fusion Program (JTFP) Budget Activity: 4 - Tactical Programs

3. (U) FY 1990 Planned Program:
   - (U) ASAS/ENSCE initial operational test & evaluation (IOT&E) and continuing development.
   - (U) LOCE/LENSCE software development, version 2.
   - (U) ICE follow-on development.

4. (U) FY 1991 Planned Program:
   - (U) ASAS/ENSCE continuing development
   - (U) ASAS/ENSCE IOT&E
   - (U) LOCE/LENSCE version 4 software delivery.
   - (U) ICE delivery.

5. (U) Program to Completion:
   - (U) Air Force decision to field ENSCE.
   - (U) Begin block upgrades.

D. (U) WORK PERFORMED BY: The Jet Propulsion Laboratory (JPL), California Institute of Technology, Pasadena, CA is the prime integration contractor for the JTFP. Subcontractors include: TRW, McLean, VA; McDonnell Douglas, Huntington Beach, CA; HRB Singer, State College, PA; Ford Aerospace Corp, San Jose, CA; Martin Marietta, Denver, CO; MITRE Corp, Bedford, MA; Digital Fantasies Limited, Huntington Beach, CA; Eagle Technology, Fairfax, VA; and Sterling Federal Systems Inc., Bellview, NE. AFSC/Electronic Systems Division is the Air Force in-house developing organization responsible for the Air Force segment of JTFP.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	No	No	None
Schd	No	No	None
Cost	Yes	Yes	+10,000

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: Deletion of FY 1989 funds caused AF to cancel Intelligence Data Processor & Communication Processor Interface hardware modules. Loss of these hardware modules puts IOT&E schedule in jeopardy. Congress restored 7.0M in FY 1989 and the Defense Resources Board restored $10.0M in FY 1990.

Program Element: #0604321F Project Number: N/A
PE Title: Joint Tactical Fusion Program (JTFP) Budget Activity: 4 - Tactical Programs

F. (U) PROGRAM DOCUMENTATION:

TAF SON 319-82, May 84
TAC SOC, Mar 87

G. (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 for Chairman Joint Chiefs of Staff, Subject: Airland Battle Programs, 30 June 1983; and Air Force Program Management Directive 9087(7)/64321F/27431F, 21 July 1987. 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.

H. (U) OTHER APPROPRIATIONS FUNDS: None.

I. (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 Battlefield Information Collection and Exploitation System (BICES). The JTFP is currently supporting BICES Concept and Design Studies (CADS) with the LOCE system. The JTFP supports BICES through the Defense Intellignce Agency. The LOCE system is a limited capability ENSCE fielded in 1982. 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.

J. MILESTONE SCHEDULE:

1. (U) ENSCE IOT&E	FY 1990/1991
2. (U) Air Force decision on ENSCE procurement	FY 1992

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3273 I-2000 P^3I	1,474	6,248	3,408	- 0 -	- 0 -	11,130
Total	1,474	6,248	3,408	- 0 -	- 0 -	11,130

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program develops munitions with standoff launch capability for attacking hardened targets that cannot be successfully attacked with current 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 present MK-84 bomb suffers from case failure, low order detonation and ricochet when used against hard targets.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3273 - I-2000 Pre-Planned Product Improvement (P^3I): Integrates the I-2000 (BLU-109/B) hard target warhead with the existing BU-15 guidance system to produce a standoff munition for attacking hard targets.

(U) FY 1988 Accomplishments:
- (U) Conducted wind tunnel testing to evaluate the Short Chord wing configuration of the GBU-15/I-2000.
- (U) Prepared to award full scale development (FSD) contract.

(U) FY 1989 Planned Program:
- (U) Award FSD contract for GBU-15/I-2000 integration kits.
- (U) Conduct Critical Design Review.
- (U) Modify AN/GTM-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) FY 1991 Planned Program:
- (U) Begin production of integration kits.

(U) Program to Completion: Not Applicable; FY 90 is the last year for RDT&E funding.

Program Element: #0604327F Budget Activity: #4 - Tactical Programs
PE Title: Hardened Target Munitions

(U) Work Performed by: Air Force Arnold Engineering Development Center, TN; Rockwell International, Duluth GA; FSD contractors to be selected in FY 1989. Armament Division at Eglin AFB FL manages the development effort.

(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: Procurement funding for the GBU-15/I-2000 integration kits will be under Program Element 0208037F.

Other Procurement, PE 0208037F

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	- 0 -	- 0 -	- 0 -	404	- 0 -	404
Quantity	- 0 -	- 0 -	- 0 -	17	- 0 -	17

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3321 Chemical and Biological Agent Detection and Warning	111	2,300	1,145	0	Continuing	TBD
3337 Individual Protection	10,490	13,138	8,000	9,449	Continuing	TBD
3762 Collective Protection	3,189	1,900	0	0	Continuing	TBD
3764 Decontamination	500	1,300	0	0	Continuing	TBD
Total	14,290	18,638	9,145	9,449	Continuing	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 chemical/biological environment and provide a critical deterrent to Soviet use of chemical/biological weapons. Without these protective systems, sortie generation on a sustained basis will be degraded significantly.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3321, Chemical/Biological Agent Detection and Warning: Develops detectors to warn personnel of chemical attacks.

(U) FY 1988 Accomplishments:
- (U) Continued to monitor Army efforts to develop their Advanced Chemical Agent Detector/Alarm and the Remote Sensing Chemical Agent Alarm.
- (U) Started procurement of the Automatic Liquid Agent Detector.

(U) FY 1989 Planned Program:
- (U) Start full-scale development of a Fixed Site Chemical Detection and Warning System (FSDWS).

(U) FY 1990 Planned Program:
- (U) Continue development of FSDWS.

(U) FY 1991 Planned Program:
- (U) Continue development of FSDWS.

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

00494

Program Element: #0604601F Budget Activity: #4 - Tactical Programs
PE Title: Chemical/Biological Defense Equipment

(U) Work Performed By: Work has been performed by the JAY Corporation, Dayton OH and Bendix, Baltimore MD. FY 89 efforts will be under a new competitive contract.

(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 #0604617F, Air Base Survivability.
- (U) Program Element #0604703F Aeromedical Chemical Defense System Development.
- (U) Program Element #0603806A, Chemical/Biological Defense Equipment Advanced Development.
- (U) Program Element #0604806A, Chemical/Biological Defense Equipment Development.
- (U) Program Element #0603514N, Ship Survivability.
- (U) Program Element #0604506N, Biological Radiological/Chemical Warfare Countermeasures.
- (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):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	7,367	-	4,093	5,700	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 3337, Individual Protection: Develops clothing and equipment to protect personnel from chemical agent effects.

(U) FY 1988 Accomplishments:
- (U) Initiated evaluation and development of Aircrew Eye/ Respiratory Protection (AERP) systems for the F-16, C-130, and the KC-135.
- (U) Initiated development of the aircraft integration hardware for above aircraft.
- (U) Continued development of the new aircrew chemical defense ensemble.

(U) FY 1989 Planned Program:
- (U) Initiate Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) of AERP systems for the above aircraft and expand aircraft modifications to include the B-52, MH-53, B-1B, C-9, AV-8, and P-3C.

Program Element: #0604601F Budget Activity: #4 - Tactical Programs
PE Title: Chemical/Biological Defense Equipment

- (U) Make a production decision on the aircrew chemical defense ensemble.

(U) FY 1990 Planned Program:
- (U) Continue Initial Operational Test and Evaluation (IOT&E) of Aircrew Eye/Respiratory Protection (AERP) systems for AC-130, OV-10,MH-53, B-1B, C-9, and AV-8 aircraft.
- (U) Make a limited production decision on AERP for the top three categories of aircraft. (F-16, C-130, KC-135)

(U) FY 1991 Planned Program:
- (U) Continue IOT&E of AERP for additional aircraft types. (B-1B, C-9, AV-8)
- (U) Make a limited production decision on AERP for the B-1B, C-9, and AV-8 categories of aircraft.

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

(U) Work Performed By: Work is performed by Boeing Advanced Systems Company, Seattle WA.

(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 #0604617F, Air Base Survivability.
- (U) Program Element #0604703F Aeromedical Chemical Defense System Development.
- (U) Program Element #0603806A, Chemical/Biological Defense Equipment Advanced Development.
- (U) Program Element #0604806A, Chemical/Biological Defense Equipment Development.
- (U) Program Element #0603514N, Ship Survivability.
- (U) Program Element #0604506N, Biological Radiological/Chemical Warfare Countermeasures.
- (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):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	3,500	13,102	8,920	9,581	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2586 DAACM	8,086	13,460	17,000	19,100	33,396	90,295
2784 Armament Standardization/Control	1,192	985	600	700	Cont	TBD
3113 HAVE VOID/I-2000	1,262	0	0	0	0	27,835
3133 Bombs and Fuzes	1,294	2,230	1,500	800	Cont	TBD
3627 Cast Bomb Development	0	983	0	0	0	5,017
3760 Inertial Guidance Technology Demonstration	1,308	0	0	0	0	1,171
5613 Munitions Material Handling Equipment/Containers	702	1,334	4,136	4,429	Cont	TBD
Total	13,844	18,992	23,236	25,029	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. Due to the completion of Project 3627, Cast Bomb Development, in FY 1989, this project will not be mentioned in subsequent descriptive summaries.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 1988 Accomplishments:
- (U) Continued Military Standard 1760 development.
- (U) Continued aircraft/munition interface data identification and collection for the data base.
- (U) Began investigation of fuze and armament test set standardization.
- (U) Continued missile modular software program development (*Common Ada Missile Package* [CAMP 3]).

00497

Program Element: #0604602F Budget Activity: #4 - Tactical Programs
PE Title: Armament/Ordnance Development

(U) FY 1989 Planned Program:
- (U) Continue missile modular software program development (CAMP 3).
- (U) Continue Military Standard 1760 development.
- (U) Continue standardization activities.
- (U) Begin AMRAAM retrofit with blind mate connectors.

(U) FY 1990 Planned Program:
- (U) Continue missile modular software development (CAMP 3).
- (U) Continue Military Standard 1760 development.
- (U) Continue standardization activities.

(U) FY 1991 Planned Program:
- (U) Continue missile modular software development (CAMP 3).
- (U) Continue Military Standard 1760 development.
- (U) Continue standardization activities.

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

(U) Work Performed by: This project is managed by the Armament 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 Appropriations Funds: Not Applicable.

- (U) Internationl Cooperative Agreements: Not Applicable.

2. (U) Project 3133, Bombs and Fuzes: This project develops and improves conventional bombs and fuzes. Current efforts include the Timer, Actuator, Fin and Fuze (TAFF), a device to delay the fin/retarder actuator on high drag bombs until they clear the bomb bay, the DSU-30 joint service proximity sensor and the M117/BSU-85 integration effort to allow high drag delivery of the M117 bomb from strategic aircraft.

(U) FY 1988 Accomolishments:
- (U) Began M117/BSU-85 integration.
- (U) Initiated Air Force participation in the Navy DSU-30 program.

Program Element: #0604602F Budget Activity: #4 - Tactical Programs
PE Title: Armament/Ordnance Development

(U) FY 1989 Planned Program:
- (U) Complete Air Force Development Test and Evaluation of the DSU-30.
- (U) Begin Air Force Initial Operational Test and Evaluation (IOT&E) of the DSU-30.
- (U) Fabricate and test M117/BSU-85 flight test articles.

(U) FY 1990 Planned Program:
- (U) Complete DSU-30 IOT&E.
- (U) Joint Air Force/Navy low rate production decision on the DSU-30.

(U) FY 1991 Planned Prozram:
- (U) Begin DSU-30 Low Rate Initial Production.

(U) Program to Completion:
- (U) Begin DSU-30 Phase II IOT&E.
- (U) Begin DSU-30 Full Rate Production.

(U) Work Performed by: This project is managed by the Armament Division at Eglin AFB FL. The major contractor is ISC Defense Systems, Lancaster PA.

(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:
Other Procurement, PE 0208030F Project 3133, FMU-139 Fuze

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	28,800	30,127	25,300	44,200	Cont	TBD
Quantity	38,700	41,300	35,900	45,000	Cont	TBD

*FY 1991 Cost and Quantity includes $11.8M and 5000 units for the initial procurement of the DSU-30 Proximity Sensor.

(U) International Cooperative Agreements: Not Applicable.

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

Program Element: #0604602F Budget Activity: #4 - Tactical Programs
PE Title: Armament/Ordnance Development

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 Adverse Terrain Ammunition Assembly Trailer/Adverse Terrain Tow Vehicle (ATAAT/ATTV) will be capable of dispersing munitions at bases where minimal roads exist or have been damaged. The CDRS and MMHE Focal Point tasks were moved from Project 2784 in FY 1988.

(U) FY 1988 Accomolishments.
- (U) Continued operation of the CDRS.
- (U) Continued MMHE focal point efforts to identify new requirements and resolve common MMHE user problems.

(U) FY 1989 Planned Program:
- (U) Continue CDRS activities.
- (U) Continue MMHE focal point activities.
- (U) Conduct preparatory efforts for ATAAT/ATTV full scale development (FSD) to begin in FY 1990.

(U) FY 1990 Planned Program:
- (U) Continue CDRS activities.
- (U) Continue MMHE focal point activities.
- (U) Begin ATAAT/ATTV full scale development (FSD).

(U) FY 1991 Planned Program:
- (U) Continue CDRS activities.
- (U) Continue MMHE focal point activities.
- (U) Continue ATAAT/ATTV full scale development (FSD).

(U) Program to Completion:
- (U) Continue CDRS activities.
- (U) Continue MMHE focal point activities.
- (U) Continue ATAAT/ATTV full scale development (FSD).

(U) Work Performed by: This project is managed by the Armament Division at Eglin AFB FL. Pending selection of the ATAAT/ATTV FSD contractor, there is no major contractor involved in this project. It is a combination of multiple contractors managed by the Armament 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: None.

(U) International Cooperative Agreements. Not Applicable.

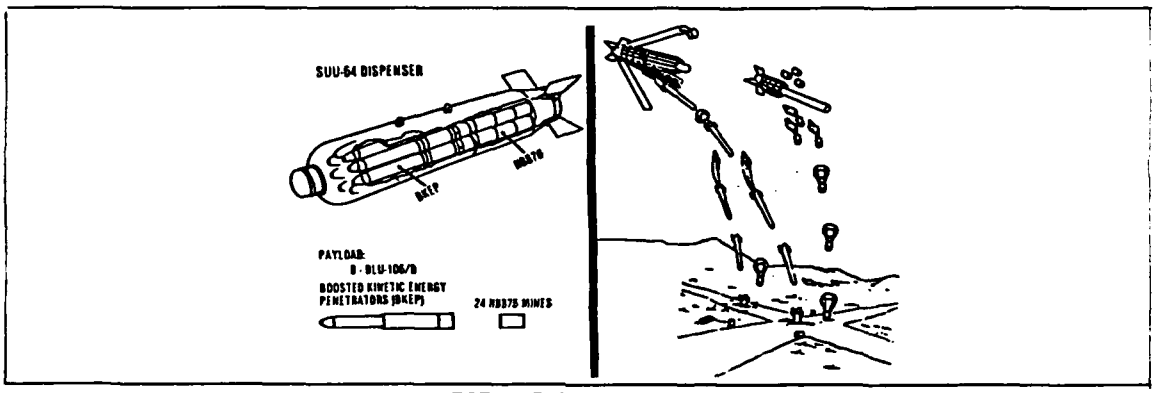
00500

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604602F
PE Title: Armament/Ordnance Development

Project Number: 2586
Budget Activity: #4 - Tactical Programs

Poject Title: Direct Airfield Attack Combined Munition



POPULAR NAME: DAACM

A. (U) *SCHEDULE/BUDGET INFORMATION ($ in thousands)*

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	FSD Start 3 Qtr/89	N/A	Downselect to 1 Contractor	FSD Complete LRIP Decision FY 92
Engineering Milestones	N/A	PDR 2 Qtr/89	CDR 1 Qtr/90	N/A	N/A
T&E Milestones	N/A	N/A	DT&E Start	DT&E Complete	IOT&E Complete FY 92
Contract Milestones	N/A	FSD Contract Award 3 Qtr/89	N/A	N/A	N/A
Budget ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	2,767	5,686	8,194	15,954	49,436 (16,835)
Support Contract	2,463	2,000	700	0	4,231 (8,050)
In-House Support	1,578	5,355	7,426	2,596	24,796 (7,841)
GFE/ Other	260	419	680	550	2,580 (670)
Total	8,086	13,460	17,000	19,100	90,295 (33,396)

00501

Program Element: #0604602F
PE Title: Armament/Ordnance Development
Project Number: 2586
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, F-4E, and B-52.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Source Selection Activity.
   - (U) BKEP Risk Reduction/Qualification Testing Completed.
   - (U) HB876LE Reliability Testing Completed.

2. (U) FY 1989 Planned Program:
   - (U) Begin Full Scale Development - Two Contractors.
   - (U) Complete Preliminary Design Review.

3. (U) FY 1990 Planned Program:
   - (U) Complete Critical Design Review.
   - (U) Continue FSD.
   - (U) Start Development Test and Evaluation.

4. (U) FY 1991 Planned Program:
   - (U) Development, Test & Evaluation Complete.
   - (U) Downselect to one contractor.
   - (U) Begin Initial Operational Test and Evaluation.

5. (U) Prozram to Comoletion:
   - (U) Initial Operational Test and Evaluation Complete - FY 92.
   - (U) FSD Complete - FY 92.
   - (U) Low Rate Initial Production Decision - FY 92.

D. (U) WORK PERFORMED BY: This project is managed by the Armament Division at Eglin AFB FL. DAACM prime contractors are in source selection. 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.

Program Element: #0604602F
PE Title: Armament/Ordnance Development
Project Number: 2586
Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	FY 1990 Cost
Tech	None	None	None
Sched	None	+10 Months	None
Cost	None	None	+7,706

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Direction to add alternate acquisition strategies and change contract type during source selection, delayed award from Jun 88 to Apr 89.
3. (U) COST CHANGES: FY 1990 cost increased due to the requirement to implement a competitive strategy for full scale development. Two contractors will be carried through the end of DT&E where the downselect to a single contractor will occur for the start of IOT&E.

F. (U) PROGRAM DOCUMENTATION:
- (U) TAF SON 306-79, March 1979.
- (U) TEMP, July 1987 (Draft).
- (U) Tactical Air Command Concept for DAACM (U), 29 January 1987.
- (U) SORD for DAACM, Nov 88 (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. PROCUREMENT: Not Applicable.

2. MILCON: Not Applicable.

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

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.

Program Element: #0604602F
PE Title: Armament/Ordnance Development

Project Number: 2586
Budget Activity: #4 - Tactical Programs

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Pre-CDR Contractor Demo	Jun 1989 - May 1990	Each contractor to demonstrate integration and ejection of six DAACMs.
DAACM DT&E	Jun 1990- Sep 1991	Evaluation of 14 DAACMs from each contractor for pattern and dispensing through 600 KCAS.
DAACM IOT&E	Oct 1991- Jul 1992	Initial operational testing of 30 DAACMs by the winning DAACM development contractor.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604604F Budget Activity: # 4 - Tactical Programs
PE Title: Submunitions

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3166 Terminally Guided Sub-missile (TGSM)/Sense and Destroy Armor (SADARM)/Skeet Evaluation and Submunition Development	4,583	7,289	7,349	7,406	Continuing	TBD
Total	4,583	7,289	7,349	7,406	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Project 3089 commonly known as "Chicken Little" has been merged with Project 3166, Terminally Guided Submissile (TGSM)/Sense and Destroy Armor (SADARM)/Skeet Evaluation and Submunition Development, to continue Chicken Little activities. Project 3166 evaluates TGSM, SADARM, Skeet submunitions and variations of these and any other seeker/sensor or warhead with a high potential for use against armor and other tactical mobile targets. The project has been expanded to determine antiarmor/counter-battery submunition performance against actual foreign targets. This project provides the basis for institutionalizing the Chicken Little approach for evaluating antiarmor/counter-battery submunitions. Armor and other mobile tactical targets required to conduct developmental tests, to evaluate operational munitions, and to provide the independent target set for the Chicken Little approach will be acquired within Project 3166. Project 3166 is a joint project with the US Army and US Navy.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3166 - Terminally Guided Submissile (TGSM)/Sense and Destroy Armor (SADARM)/Skeet Evaluation and Submunition Development: Evaluate antiarmor submunition performance against armor and other mobile targets.

(U) FY 1988 Accomplishments:
- (U) Evaluated submunition warhead and conducted seeker/sensor flight tests
- (U) Conducted tests of improved submunitions against newer targets in snow, subtropical forest, and desert environments
- (U) Conducted warhead and warhead simulant firings against sections of armor to determine penetration and behind the armor effects
- (U) Supported Joint Tactical Coordinating Group (JTCG) in developing interdiction-kill (I-Kill) methodology and standard damage assessment lists (SDAL) for lightly armored fighting vehicles
- (U) Procured armored and other tactical mobile targets

Program Element: # 0604604F Budget Activity: # 4 - Tactical Programs
PE Title: Submunitions

(U) FY 1989 Planned Program:
- (U) Continue Chicken Little testing against newer targets with potential countermeasures
- (U) Continue warhead/simulated firings against advanced and add-on armor targets to determine penetration and behind armor effects for improved vulnerability analysis techniques
- (U) Continue to support JTCG in I-Kill and SDAL efforts
- (U) Conduct Live Fire Test and Evaluation for Sensor Fuzed Weapon (SFW)
- (U) Procure armored targets and develop high fidelity simulators
- (U) Obtain newer target characteristics for submunition effectiveness modelling
- (U) Evaluate advanced sensors/seekers for possible future application

(U) FY 1990 Planned Program:
- (U) Continuation of efforts described in FY 1989 planned program

(U) FY 1991 Planned Program:
- (U) Continuation of efforts described in FY 1989 planned program

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

(U) Work Performed By: Program management is provided by the Armament Division, Eglin Air Force Base FL. Contractor suppot for the Skeet submunition is provided by Textron Defense, Wilmington MA. Contractors for the warheads and sensors to be evaluated will be identified after the source selections.

(U) Related Activities:
- (U) Sense and Destroy Armor Munition (SADARM) development effort is conducted under Army PE 0603628A, Field Artillery Ammunition Development, and PE 0604631A, Field Artillery Ammunition
- (U) Development of the Sensor Fuzed Weapon (SFW) using the Skeet warhead is conducted in PE 0604607F
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense

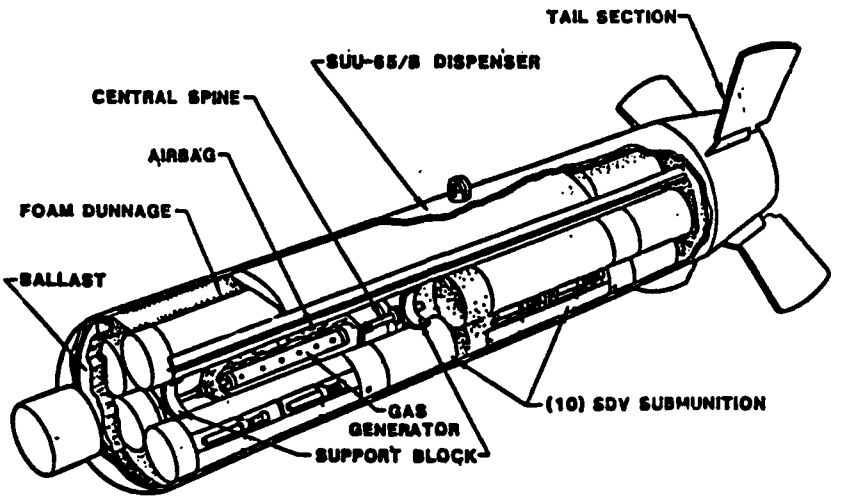
(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			IIIA-Mar		IIIB-Aug 92
Engineering Milestones	CDR-Apr	FCA-Jul			
T&E Milestones		DT&E-Dec IOT&E-Apr	Complete IOT&E-Feb		FOT&E-4Qtr92
Contract Milestones	CDR-Apr	FCA-Jul		LRIP1-Dec90	Annual Prod Award
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	14,695	17,513	22,494	0	144,632 (0)
Support Contract	1,753	2,126	2,085	0	10,130 (0)
In-House Support	587	658	505	0	3,557 (0)
GFE/ Other	4,959	6,222	2,541	0	22,032 (0)
Total	21,994	26,519	27,625	0	180,351 (0)

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Program Element: # 0604607F Project Number: 2961
PE Title: Wide Area Antiarmor Munitions 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 Warsaw Pact 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 1988 Accomplishments:
   - (U) Conducted the Critical Design Review (CDR) in April 1988
   - (U) Conducted subsystem and system qualification tests
   - (U) Began fabrication of test hardware for Development Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E)
   - (U) Procured 42 SFW test stores to conduct ballistic verification tests to quantify SFW's ballistic characteristics

2. (U) FY 1989 Planned Program:
   - (U) Begin DT&E with 28 full SFW tests in 26 launches/drops
   - (U) Complete qualification & fabrication of test hardware for DT&E and IOT&E
   - (U) Begin IOT&E. IOT&E will include 36 live SFW tests from the candidate aircraft in operational mission scenarios against realistic target sets
   - (U) Continue FSD throughout the year and correct problems found during DT&E and IOT&E
   - (U) Continue SEEK EAGLE ballistics testing of SFW on tactical aircraft
   - (U) Procure 36 SFW test stores for SEEK EAGLE accuracy verification testing of F-16
   - (U) Begin tasks to develop an alternate source
   - (U) Complete FSD
   - (U) Begin necessary efforts to perform Live Fire Testing

3. (U) FY 1990 Planned Program:
   - (U) Begin preproduction process verification program
   - (U) Complete alternate source technology transfer and demonstration
   - (U) Complete Live Fire Testing

4. (U) FY 1991 Planned Program:
   - (U) Not applicable. FY 90 is the last planned year for RDT&E

5. (U) Program to Completion:
   - (U) Not Applicable. FY 90 is the last planned year for RDT&E.

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 Armament Division, Eglin Air Force Base FL. Contractor support for the Sensor Fuzed Weapon (SFW) is provided by Textron Defense Systems, Wilmington MA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	+1 year	None
Cost	None	None	+27,625

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Production contract authorization changed from 1 Qt FY 90 to 1 Qt FY 91, and first delivery to inventory changed from Apr 91 to 3 Qt FY 92 due to funding redirection. DT&E and IOT&E start dates slipped 2 and 3 months respectively, to incorporate design changes identified during CDR. DAB IIIA slipped from Aug 89 to Mar 90 to align with the slip in the production funding.
3. (U) COST CHANGES: An additional $27,625 is required in FY 90 to perform preproduction process verification, finish alternate source development tasks, and complete Live Fire Testing. This was due to funding requirements of higher priority programs which slipped the start of LRIP one year.

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) (draft) 302-78-III-A for SFW (S)

Program Element: # 0604607F | Project Number: 2961
PE Title: Wide Area Antiarmor Munitions | Budget Activity: # 4 - Tactical Programs

G. (U) RELATED ACTIVITIES:
- (U) SFW technology support is ongoing in Program Element (PE) 0602602F, Conventional Munitions; PE 0603601F, Conventional Weapons Technology; and PE 0604604F, Submunitions. SFW demonstration/validation was accomplished in PE 0603609F
- (U) The Live Fire Tests will be done by the Chicken Little Project of PE 0604604F. Funding will be from this PE (PE 0604607F)
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. OTHER PROCUREMENT						
PE 0208030F (SFW)						
Cost	0	0	0	94,393	2,936,042	3,030,435
Quantity	0	0	0	65	19,738	19,803
PE 0207590F (SEEK EAGLE)						
Cost	0	0	0	24,281	TBD	TBD
Quantity*	0	0	0	188	TBD	TBD

* These units are ballistic test rounds and not full-up rounds

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 - Dec 88	Demonstrated 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 - Feb 90	DT&E includes 26 launches/drops. IOT&E includes 36 live SFW tests
Live Fire Testing	Aug 89	To be Completed before IIIB (Aug 92)

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2621 Rapid Runway Repair	3,389	2,118	2,226	2,574	Continuing	TBD
2895 Air Base Operability	4,299	6,519	7,536	7,420	Continuing	TBD
3141 Camouflage, Concealment, and Deception	4,070	5,135	7,392	7,020	Continuing	TBD
Total	11,758	13,772	17,154	17,014	Continuing	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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2621, Rapid Runway Repair: 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 1988 Accomplishments:
- (U) Initiated test of a profilometer to quickly identify the limits of upheaved pavement and to control repair quality.
- (U) Completed tests of the polymer concrete repair technique; began review of new materials as polymer found unsuitable.
- (U) Completed feasibility test of an asphalt planer.
- (U) Continued review of alternative materials and equipment.
- (U) Started development to correct problems with asphalt planer.
- (U) Continued fiberglass mat development.
- (U) Completed study of sweeping requirements for foreign object damage prevention when operating over repaired surfaces.
- (U) Tested Minimum Operating Strip (MOS) Marking System.

(U) FY 1989 Planned Program:
- (U) Test new materials for runway repair suitability.
- (U) Decide on production of asphalt planer after tests.
- (U) Finalize procurement specifications for a fiberglass mat crater-capping material for an air-transportable repair capability.
- (U) Production decision for MOS Marking System.

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

(U) FY 1990 Planned Program:
- (U) Complete surface roughness documentation for existing aircraft to enable operation over minimum quality repairs.

(U) FY 1991 Planned Program:
- (U) Complete development and test of a repair capability that can be used for small craters caused by either 30 mm cannon strafing or by anti-material submunitions.

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

(U) Work Performed By: Program contractor is BDM Corporation, McLean VA. The in-house development organizations responsible for elements of the program are Armament Division, Eglin AFB FL; the Air Force Engineering and Services Center, Tyndall AFB FL; and the Air Force Weapons Laboratory, Kirtland AFB NM.

(U) Related Activities: This project transitions the advanced development efforts in PE 0603307F, Air Base Operability Advanced Development, to Full-Scale Development. Procurement is executed through:
- (U) PE 0102896F, Base Operations, Defensive;
- (U) PE 0207595F, Base Communications, Tactical Air Forces;
- (U) PE 0207596F, Base Operations, Tactical Forces;
- (U) PE 0208028F, Camouflage, Concealment, and Deception;
- (U) PE 0401896F, Base Operations;
- (U) PE 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: Included at Project 2895.

(U) International Cooperative Agreements: None

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 1988 Accomplishments:
- (U) Completed studies of generic Aircraft Ground Mobility Systems (AGMS) for all aircraft.
- (U) Obtained Government Furnished Equipment to support the Mobile Armored Reconnaissance/Operations Vehicle (MARV) (now called the Base Recovery Vehicle) development.
- (U) Completed OT&E of the Ordnance Rapid Clearance A (Oracle A) system (now called Munitions Clearance Vehicle), finding deficiencies requiring redesign.

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

- (U) Completed tradeoff studies of AGMS vs taxiway repair.
- (U) Contracted for MARV development (competitive). The basic armored vehicle will be modified slightly to accommodate current Explosive Ordnance Disposal (EOD) equipment and personnel and to carry a Standoff Munitions Disrupter (SMUD), to be developed with MARV. SMUD will provide a rapid capability to safely neutralize large unexploded ordnance.
- (U) Transitioned to full scale development, a survivable base recovery communications system. The system will satisfy the critical need for quick and orderly transfer of damage information, air base status, and tasking information between recovery personnel and command units. Software needed to support base damage assessment, determine proper placement of a minimum operating strip to resume aircraft operations, provide chemical contamination warning, and emergency action message handling will be integrated to provide a complete decision-aid tool.
- (U) Initiated development of an airfield contingency lighting system to outline the MOS and provide visual course and glide path guidance, to be completed in FY 1990.
- (U) Started redesign of Oracle A.

(U) FY 1989 Planned Program:
- (U) Complete MARV/SMUD development and test.
- (U) Continue development of the survivable base recovery communications system through FY 1993, in a phased approach, allowing production of Phase I in FY 1991.
- (U) Continue development of airfield contingency lighting.
- (U) Complete the redesign and retest of Oracle A.

(U) FY 1990 Planned Program:
- (U) Complete development of a portable airfield lighting system and initiate production.
- (U) Begin FSD for a follow-on mine clearing system and for a survivable base communication system.

(U) FY 1991 Planned Program:
- (U) Complete FSD for a follow-on mine clearing system.
- (U) Complete FSD for a survivable base communication system.

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

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

(U) Work Performed By: Program contractor is Technology Applications Incorporated, Falls Church VA. The in-house development organizations responsible for elements of the program are Armament Division, Eglin AFB FL; Aeronautical Systems Division, Wright-Patterson AFB OH; the Air Force Engineering and Services Center, Tyndall AFB FL; and the Air Force Weapons Laboratory, Kirtland AFB NM.

(U) Related Activities: This project transitions the advanced development efforts in PE 0603307F, Air Base Operability Advanced Development, to Full-Scale Development. Procurement is executed through:

- (U) PE 0102896F, Base Operations, Defensive;
- (U) PE 0207595F, Base Communications, Tactical Air Forces;
- (U) PE 0207596F, Base Operations, Tactical Forces;
- (U) PE 0208028F, Camouflage, Concealment, and Deception;
- (U) PE 0401896F, Base Operations; and PE 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):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(U) Other Procurement:						
PE 0102896F	20	14	454	1,609	Continuing	TBD
PE 0207596F	7,728	25,864	25,978	46,550	Continuing	TBD
PE 0208007F	3,685	0	0	0	0	-
PE 0208028F	0	15,201	29,100	21,900	Continuing	TBD
PE 0401896F	1,157	1,234	3,307	3,185	Continuing	TBD
PE 0702896F	1,763	1,858	2,793	2,421	Continuing	TBD
Totals	14,353	44,121	61,632	75,665		
(U) Military Construction:						
PE 0207596F	1,730	9,880	5,200	7,950	Continuing	TBD
PE 0208007F	7	0	0	0	0	-
PE 0208028F	0	2,400	3,400	4,800	Continuing	TBD
PE 0401896F	1,050	0	0	0	Continuing	TBD
Totals	2,787	12,280	8,600	12,750		

(U) International Cooperative Agreements: None

3. (U) Project 3141, Camouflage, Concealment, And Deception: This project embraces the full spectrum of camouflage, concealment, and deception methods to mitigate the effectiveness of enemy attacks against air bases.

Program Element: #0604617F Budget Activity: #4 - Tactical Programs
PE Title: Air Base Operability

(U) FY 1988 Accomplishments:
- (U) Contract award for F-15 and F-16 aircraft decoys.
- (U) Completed testing of the decoys and began production.
- (U) Started development of radar reflective deception devices.
- (U) Started development of camouflage nets, large area canopy shelters, large area smoke screens, and SAM simulators.

(U) FY 1989 Planned Program:
- (U) Complete tests of radar reflectors and start production.
- (U) Start the development of false operating surfaces.

(U) FY 1990 Planned Program:
- (U) Complete development and test of nets, shelters, smoke, SAM simulators, and false operating surfaces.

(U) FY 1991 Planned Program:
- (U) Begin development of equipment with capabilities for electronic, infrared, and ultraviolet sensor deception.

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

(U) Work Performed By: Durodyne Incorporated, Tucson AZ. The in-house development organizations are Armament Division, Eglin AFB FL; Aeronautical Systems Division, Wright-Patterson AFB OH; the Air Force Engineering and Services Center, Tyndall AFB FL; and the Air Force Weapons Laboratory, Kirtland AFB NM.

(U) Related Activities: Program transitions the advanced development efforts in PE 0603307F, Air Base Operability Advanced Development, to Full Scale Development. Procurement is executed through:
- (U) PE 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: Included at Project 2895.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2866 Aeromedical/Chemical Defense Systems	6,005	6,067	6,038	7,667	Continuing	TBD
Total	6,005	6,067	6,038	7,667	Continuing	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 the treatment and evacuation of wartime casualties in a chemical or conventional warfare environment (first, second and third echelon medical units) to fulfill Air Force unique needs. The Army is developing medical equipment common to both services. This program will also provide tactical and strategic aeromedical evacuation systems for which the Air Force is the lead DoD agency.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 2866, Aeromedical/Chemical Defense Systems: The introduction of chemical warfare into a conventional conflict will significantly increase casualty rates and limit the effectiveness of the Air Force medical mission. Urgent requirements have been identified by the major commands to sustain effective operations. 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 will significantly increase our chances 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 1988 Accomplishments:

- (U) Initial acquisition of 950 Portable Liquid Oxygen Systems for use in the treatment of casualties evacuated on C-130 aircraft, and transition to San Antonio Air Logistics Center.
- (U) Successful operational test and evaluation at Ramstein AB GE, of the on base second echelon Survivable Collective Protection System-Medical (SCPS-M) for treatment of chemical or conventional wartime casualties. This test resulted in a production decision to field 105 units in USAFE and PACAF starting in FY 89.

Program Element: #0604703F Budget Activity: #4-Tactical Programs
PE Title: Aeromedical/Chemical Defense Systems

(U) FY 1989 Planned Program:
- (U) Development, test and evaluation of the Civil Reserve Air Fleet (CRAF) aeromedical evacuation kits to increase strategic aeromedical evacuation capability (50%-100%) and relieve military aircraft for transport of warfighting materiel. These kits temporarily convert civilian aircraft for medical care during flight.
- (U) Initiate installation in Europe and Korea of the SCPS-M for expedient on-base emergency medical care immediately after air base attack.

(U) FY 1990 Planned Program:
- (U) Initiate installation in Japan of the SCPS-M for expedient on-base emergency medical care immediately after air base attack.
- (U) Initiate acquisition of 85 Boeing 767 CRAF aeromedical evacuation kits for Military Airlift Command.
- (U) Initiate development of a Transportable Blood Transshipment Center to provide both liquid and frozen blood products to combat zones.

(U) FY 1991 Planned Program:
- (U) Initiate acquisition of 30 McDonnell-Douglas MD-80 CRAF aeromedical evacuation kits for Military Airlift Command.

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

(U) Work Performed By: This program is conducted by the Aeromedical/Casualty System Program Office, Human Systems Division, Brooks AFB, Texas. The contract portion of the program is conducted by Essex Cryogenics, St Louis, MO; Systems Research Laboratories, Beavercreek, OH; E-Systems, Greenville, TX; ILC Dover, Frederica, DE and Krug International, Dayton, 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 Department of Defense lead for Chemical Warfare Defense; this project works Air Force unique requirements.
- (U) There is no unnecessary duplication of effort in the Air Force or DoD programs.

(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604704F Budget Activity: #4 - Tactical Programs
PE Title: Common Support Equipment

A. (U) RDT&E RESOURCES: ($ in thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2479 - Common Support Equipment Development	1,117	1,120	765	976	Cont.	Cont.
3759 - Air Force Office of Support Equipment Management (AFOSEM)	500	500	323	409	Cont.	Cont.
3852 - 60,000 Pound Capacity Aircraft Transporter Loader	0*	0*	5,879	7,100	4,100	17,100
Total	1,617	1,620	6,967	8,485	Cont.	Cont.

* 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. 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 a 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 1988 Accomplishments:
- (U) Completed FSD, testing, and initiated production of the Large Aircraft Start System for the Military Airlift and Strategic Air Commands.
- (U) Completed FSD and extensive tests of two competing prototype Ground Power Generator (GPG) Systems for the Tactical Air Forces and awarded a production contract.
- (U) Concluded FSD efforts on the Standard Hydraulic Test Stand and transferred all data and specifications to AFLC for replacement

Program Element: #0604704F Budget Activity: #4 - Tactical Programs
PE Title: Common Support Equipment

procurement.

(U) FY 1989 Planned Program:
- (U) Complete the Cost Benefits Analysis of the SGNSC.
- (U) Complete all pre-contract award notifications and review of proposals, conduct source selection, and award an AXES FSD prototype contract.
- (U) Draft the performance characteristics, specifications, SOW, and Instructions To Offerer to enable release of the draft RFP for development of the SGNSC.

(U) FY 1990 Planned Program:
- (U) Complete AXES design reviews and environmental testing.
- (U) Complete all pre-contract award notifications and review of proposals, conduct source selection, and award the SGNSC FSD prototype contract.
- (U) Conduct AXES Initial Operational Test and Evaluation (IOT&E).
- (U) Conduct preliminary and critical design reviews of the SGNSC.

(U) FY 1991 Planned Program:
- (U) Complete configuration audits and initiate AXES production.
- (U) Complete Development, Environmental, and IOT&E of the SGNSC.
- (U) Initiate Benefits Analysis Study of proposed down-sized, modular multi-function, powered SE.

(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 by 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: Procurement Funding Source: 3010 Appropriations, BP 1200, Common Ground Equipment.

(U) International Cooperative Agreements: Not Applicable.

2. (U) Project 3759, Air Force Office of Support Equipment Management: This project develops automation software and system enhancements for the SEAMS, MIL-HDBK-300 and common hand tool lists. This will include 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

Program Element: #0604704F Budget Activity: #4 - Tactical Programs
PE Title: Common Support Equipment

maintainability records.

(U) FY 1988 Accomplishments:
- (U) Developed software for the automation of MIL-HDBK-300.
- (U) Added over 6,300 multi-service SE items and data to the SEAMS.
- (U) Completed beta test, transition to a mainframe host computer, and initiated operation of the MIL-HDBK-300 automated SE query system.

(U) FY 1989 Planned Program:
- (U) Increase the SE item data base to include over 11,700 items.
- (U) Expand the automated SEAMS data base to capture Standard and Preferred Items, Common Hand Tools, and Modular Automatic Test Equipment data.
- (U) Develop an automated SEAMS problem reporting and tracking system.

(U) FY 1990 Planned Program:
- (U) Initiate SE standardization candidate cost/benefits analyses.
- (U) Develop automated SE pricing and budget development tools.
- (U) Develop automated SE acquisition documentation aids/tools.

(U) FY 1991 Planned program:
- (U) Develop artificial intelligence related programs to improve the SE acquisition process.
- (U) Develop expedited SE requirements documentation processing.
- (U) Develop automated SE acquisition contract development aids.

(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 by 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: BP 3400, Contract Funds related to engineering assistance for the project.

(U) International Cooperative Agreements: Not Applicable.

3. (U) Project 3852, 60,000 Pound Capacity Aircraft Transporter Loader: 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

Program Element: #0604704F Budget Activity: #4 - Tactical Programs
PE Title: Common Support Equipment

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.

(U) FY 1988 Accomplishments: Not Applicable.

(U) FY 1989 Planned Program:
- (U) Complete statement of need, system operation requirements document, program management directive, test and evaluation master plan, and approved program baseline.

(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.

(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.
- (U) Continue first and/or second article development and production.

(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.

(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.

(U) Other Appropriation Funds: 3080 Appropriations, BP 8200, Vehicular Equipment Program.

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
412A Life Support Systems	7,036	4,091	4,930	9,997	Continuing	TBD
2952 F-111 Cluster Parachute	2,415	6,146	50	0	N/A	15,071
3111 Aircraft Mishap Prevention Program	50	483	3,240	2,800	4,600	11,173
3812 Combat Edge	3,000	6,047	4,800	518	0	14,365
Total	12,501	16,767	13,020	13,315	Continuing	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 data base and 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 crewmembers to help reduce the number of G-loss of consciousness incidents with these aircraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 1988 Accomplishments:
- (U) Aircrew anti-drown system FSD and production.
- (U) Positive pressure breathing system demonstrated on F-16.
- (U) Cold weather sleeping bag Initial Operational Test & Evaluation (IOT&E).
- (U) Vacuum-packed one-man life raft IOT&E and contract award.

Program Element: #0604706F Budget Activity: #4 - TACTICAL PROGRAMS
PE Title: Life Support Systems

- (U) Multi-place life raft FSD began.
- (U) Laser eye protection FSD and production
- (U) Follow-on anti-G valve FSD.
- (U) Cold weather flying boot IOT&E.
- (U) B-1B ACES II seat FSD and production.
- (U) B-1B thermal flash blindness protection window FSD and production.
- (U) PRC 112 survival radio FSD and IOT&E.

(U) FY 1989 Planned Program:
- (U) Universal Seawater Activated Release System (SEAWARS) will enter FSD.
- (U) ACES II restraint emergency release system testing and contract.
- (U) HGU-53P helmet FSD and Development Test & Evaluation (DT&E).
- (U) Aircrew Integrated System (AIS) RFP release.
- (U) Laser eye protection Phase II.
- (U) Award FSD contract for Active Noise Reduction/Thermal Flash Blindness Protection.
- (U) Advanced Recovery Sequencer (ACES II seat) system qualification test.
- (U) Multi-place raft FSD contract award.

(U) FY 1990 Planned Program:
- (U) Aircrew anti-drown system IOC.
- (U) Aircrew integrated system (AIS) FSD contract award.
- (U) Universal SEAWARS IOT&E.

(U) FY 1991 Planned Program:
- (U) AIS continuation.

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

(U) Work Performed By: Air Force Systems Command's Human Systems Division (HSD), Brooks AFB, TX, manages the Life Support Systems, Project 412A, having taken over management responsibility from the Aeronautical Systems Division (ASD), Wright-Patterson AFB, OH, effective 1 December 1988. 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; and Gentex, Carbondale, PA.

(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.

Program Element: #0604706F Budget Activity: #4 - TACTICAL PROGRAMS
PE Title: Life Support Systems

- (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. 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
Appropriation 3010	5,200	0	900	2,000	TBD	N/A

(U) International Cooperative Agreements: Not Applicable.

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 1988 Accomplishments:
- (U) Cluster parachute design.
- (U) CEM-parachute integration and testing.
- (U) Captive and air-drop tests.

(U) FY 1989 Planned Program:
- (U) Continue parachute design.
- (U) Continue air-drop and begin 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) Program to Completion: This is a continuing program.

(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.

Program Element: #0604706F Budget Activity: #4 - TACTICAL PROGRAMS
PE Title: Life Support Systems

(U) Other Appropriation Funds: Not applicable

(U) International Cooperative Agreements: Not applicable

3. (U) Project 3111, Aircraft Mishap Prevention Program: This project develops and demonstrates a data base and information management system to reduce loss of aircraft and aircrew lives due to human factors. It establishes an Air Force wide mishap and near-mishap reporting system tailored to provide detailed data on human factors problems for direct command-level access to aircraft system project offices for design change recommendations, to the R&D and engineering community for identifying R&D needs to the laboratories, and to the safety community for compiling mishap statistics.

(U) FY 1988 Accomplishments:
- (U) Acquisition plan approved.

(U) FY 1989 Planned Program:
- (U) Begin development.
- (U) FSD contract award.
- (U) Refine and update prototype software.
- (U) Develop user application scenarios.

(U) FY 1990 Planned Program:
- (U) Continue current efforts.

(U) FY 1991 Planned Program:
- (U) Continue current efforts.
- (U) Operations Impact Model development.
- (U) In-house training programs development.
- (U) Conduct development test and evaluation

(U) Program to Completion:
- (U) Conduct IOT&E.

(U) Work Performed By: HSD, Brooks AFB, TX manages project 3111.

(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

Program Element: #0604706F Budget Activity: #4 - TACTICAL PROGRAMS
PE Title: Life Support Systems

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 crewmembers. It will use the G-protection aspects that have been under development in the Tactical Life Support System (TLSS). These include the lower 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 and G-valve.

(U) FY 1988 Accomplishments:
- (U) Continued advanced development of TLSS within PE #0603231F.

(U) FY 1989 Planned Program:
- (U) Approval of acquisition plan.
- (U) FSD contract award.
- (U) Conduct preliminary design review.
- (U) Conduct critical design review.
- (U) Begin qualification testing.

(U) FY 1990 Planned Program:
- (U) Conduct DT&E and IOT&E.

(U) FY 1991 Planned Program:
- (U) Transition to full scale production.

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

(U) Work Performed By: HSD, Brooks AFB, TX manages project 3812.

(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.

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

Appropriation	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3010						
F-16	0	600	5,900	6,300	0	12,800
F-15	0	100	0	5,000	2,400	7,500
4921	0	700	6,600	5,000	3,500	15,800

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2054 Aerospace Facilities Engineering Development	2,084*	445*	272	265	Cont.	TBD
2505 Aircraft Fire Fighting, Suppression and Rescue	1,219	988	761	877	Cont.	TBD
2674 Tactical Shelters	1,800	966	925	729	Cont.	TBD
3080 Generic Integrated Maintenance Diagnostics	2,375	3,200	0**	0**	N/A	N/A
3788 Environmental Quality	0*	1,659	272	264	Cont.	TBD
Total	7,478	7,258	2,230	2,135	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 seeks to improve the operational effectiveness, survivability, durability, and longevity of air base pavements, buildings and utilities; the overall objective being to provide an infrastructure that effectively supports the Air Force 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 USAF 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 theaters of operation, 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 1988 Accomplishments:
- (U) Completed development and publishing of a pavement evaluation manual.
- (U) Concluded development of a system for non-destructive testing of pavements.
- (U) Initiated development of design methods for splinter protection of fire fighting resources.

(U) FY 1989 Planned Program:
- (U) Initiate 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) Funding will not permit any new initiatives.

(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

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

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 1988 Accomplishments:
- (U) Completed development of a lightweight fire fighting ensemble, an automatic fire suppression system for base housing, and a fire fighting vehicle simulator.
- (U) Continued evaluation of an improved crash/rescue vehicle.
- (U) Completed development of a two-hour fire fighter rebreather, a helmet for use in chemical warfare environments, and procedures for decontaminating fire fighters' ensembles.
- (U) Proceeded with preparations for a contract to develop an automatic fire suppression system for hardened aircraft shelters (HAS).

(U) FY 1989 Planned Program:
- (U) Continue contract preparations for the HAS fire suppression system, which must be available for the programmed USAFE FY 91 through FY 95 buys.
- (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 1990 Planned Program:
- (U) Complete development of the remotely controlled fire fighting vehicle.
- (U) Initiate development of a post-attack assessment system.

(U) FY 1991 Planned Program:
- (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; the Department of Energy Oakridge Laboratories, Oakridge, TN; the Fire Research Corporation, Nesconset, NY; and AMETEK, Inc., Goleta, CA. 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.

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

(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 1988 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 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) Completed work on the add-on armor program.
- (U) Continued contract development of shelters for specific uses, such as for standard tactical military vehicles.
- (U) Completed a tactical shelter market survey and report.

(U) FY 1989 Planned Program:
- (U) Begin 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 1990 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.

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

(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.

(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 1988 Accomplishments:
- (U) Concluded review of existing volatile organic compound (VOC) control technologies.
- (U) Concluded development of an infrared hydrogen chloride detector to monitor effects of space vehicle launches.
- (U) Concluded study to characterize emissions from aircraft engines in current USAF inventory.
- (U) Initiated development of biodegradable solvents and cleaners for industrial processes.

(U) FY 1989 Planned Program:
- (U) Continue work on treatment of contaminated groundwater and monitoring devices for JP-4 releases.
- (U) Continue development of biodegradable chemicals.
- (U) Initiate development of systems for VOC control.
- (U) Initiate development of monitoring techniques to reduce costs of permitting hazardous waste incinerators.

Program Element: #0604708F Budget Activity: #4 - Tactical Programs
PE Title: Other Operational Equipment

(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) Funding will not permit new starts.

(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) Funding will not permit new starts.

(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.
- (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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2598 Mark XV USAF Unique Development	1,200	3,000	10	4,922	Continuing	TBD
2751 Indirect ID Subsystems	7,495	8,500	3,000	3,000	Continuing	TBD
3592 Mark XV Tri-Service Core Development	20,800	63,196	108,379	96,484	Continuing	TBD
3756 TACS NCTR	1,466	3,000				
TOTAL	30,961	83,359	111,389	104,406	Continuing	TBD

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.

C. (U) Program Accomplishments and Plans: See specific descriptive summaries.

(U) Work Performed By: The Mark XV IFF program (Projects 2598 & 3592) is managed by the Tri-Service, Combat Identification System Program Office (CISPO) at the Aeronautical Systems Division, Air Force Systems Command, Wright- Patterson AFB, OH. The Indirect Subsystem (Project 2751) and TACS NCTR (Projects 3756) programs are managed by the Combat Identification System - Indirect Subsystem 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 and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. Additionally, the following contractors are supporting this program: Allied-Bendix Communications Division, Baltimore, MD (project 2598 & 3592); Westinghouse, Baltimore, MD (project 2751); Litton, Los Angeles, CA (project 3756) and Scope, Reston, VA (project 3756).

(U) Related Activities:
- (U) This program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide
- (U) Program Element (PE) 0603742F, Combat Identification Technology.
- (U) PE 0603790F, NATO Cooperative RDT&E.
- (U) PE 0603790A, NATO Cooperative RDT&E.
- (U) PE 0603790N, NATO Cooperative RDT&E.
- (U) PE 0603267N, NATO Future Identification System.
- (U) PE 0603515N, Advanced Identification Techniques.

Program Element: 0604725F Budget Activity: 4 - Tactical Programs
PE Title: Combat Identification Systems

- (U) PE 0603706A, Identification Friend or Foe (IFF) Developments.
- (U) PE 0604211M, Air Traffic Control Radar Beacon System/Mark XII.
- (U) PE 0604709A, IFF Equipment.
- (U) Coordination and integration of the various activities under these program elements are accomplished through the Air Force led Tri-Service, Combat Identification System Program.
- (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: Project 3592, Mark XV Tri-Service Core Development, will include a Memorandum of Understanding with Italy to participate in FSD. This MOU is expected to be signed 2 Qtr FY 1989.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604725F Project Number: 2598
PE Title: Combat Identification Systems Budget Activity: #4 - Tactical Program

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

Project Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Mark XV USAF Unique Development	1,200	3000	0010	4922	Cont	Cont
Total	1,200	3000	0010	4922	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This project funds engineering design, testing, development and integration of Air Force Unique efforts for Mark XV including integration of the standard transponder into the F-16 and development of a unique interrogator for the E-3 AWACS.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 2598, Mark XV USAF Unique Development:

(U) FY 1988 Accomplishments:
(U) Supported initial preparations for the common FSD program, testing of the Demonstration/Validation (Dem/Val) Advanced Development Models, and the analytical efforts supporting NATO waveform negotiations.

(U) FY 1989 Planned Program:
(U) Conduct initial study for E-3 interrogator design and development.

(U) FY 1990 Planned Program:
(U) Complete E-3 interrogator study.

(U) FY 1991 Planned Program:
(U) Initiate design of E-3 interrogator and begin integration efforts.

(U) Begin F-16 transponder integration.

Program Element: #0604725F Project Number: 2598
PE Title: Combat Identification Systems Budget Activity: #4 - Tactical Program

(U) Work Performed By: The Mark XV IFF program (Projects 2598 & 3592) is managed by the Tri-Service, Combat Identification System Program Office (CISPO) 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. Additionally, the following contractors are currently engaged in work under this program: Allied-Bendix Communications Division, Baltimore, MD (project 2598); and Texas Instruments, Dallas, TX (project 2598). The FSD lead contractor will be Allied-Bendix and the FSD follower will be Raytheon of Marlborough, Mass.

(U) Related Activities:

- (U) This program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide

- (U) Related activities include: Program Element 0603742F, Combat Identification Technology; Program Element (PE) 0603790F, NATO Cooperative RDT&E; PE 0603790A, NATO Cooperative RDT&E; PE 0603790N, NATO Cooperative RDT&E; PE 0603267N, NATO Future Identification System; PE 0603515N, Advanced Identification Techniques; PE 0603706A, Identification Friend or Foe (IFF) Developments; PE 0604211N, Air Traffic Control Radar Beacon System/Mark XII; and PE 0604709A, IFF Equipment.

- (U) Coordination and integration of the various activities under these program elements are accomplished through the Air Force led Tri-Service, Combat Identification System Program.

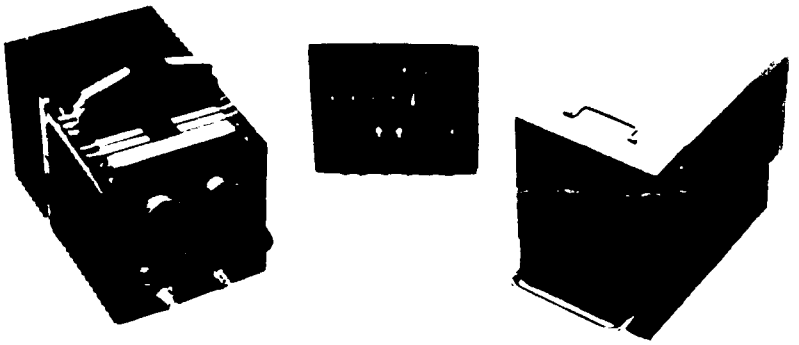
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not applicable.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604725F Project: #3592
PE Title: Combat Identification Systems Budget Activity:4-Tactical Programs
Project Title: Mark XV Tri-Service Core Development



POPULAR NAME: Mark XV IFF

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Completed
Program Milestones		MSII 2 Qtr			TBD
Engineering Milestones	Finalize Dev Specifications	Begin FSD Design	PDR 4 Qtr	CDR 4 Qtr	N/A
T&E Milestones	Dem/Val Flight test complete	Contractor Testing	Contractor Testing	Core Platform Preparation	TBD
Contract Milestones	FSD RFP release April	FSD Contract Award 2 Qtr			N/A
BUDGET ($000)					Continuing
Major Contract	12,200	50,596	82,079	70,584	Continuing
Support Contract	5,200	5,300	5,300	5,400	Continuing
In-House Support	1,400	3,000	3,000	3,000	Continuing
GFE/ Other	2,000	4,300	18,000	17,500	Continuing
Total	20,800	63,196	108,379	96,484	Continuing

00537

Program Element: #0604725F Project: #3592
PE Title: Combat Identification Systems Budget Activity: 4-Tac Prgms

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 reach agreement on the basic operating characteristics (e.g., signals-in-space) of future identification equipment. Ongoing work in this project completes the advanced development of Mark XV and begins full scale development. The Mark XV will replace the aging Mark XII system. The thrust of this project is the design, integration, and testing of the Mark XV system of 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 1988 Accomplishments:

- (U) Demonstration/Validation laboratory and flight testing phase (Advanced Development) completed
- (U) RFP for FSD released and source selection started
- (U) Started preparation for the DAB milestone II
- (U) Additional risk reduction efforts completed

(U) FY 1989 Planned Program:

- (U) Additional flight testing will be conducted to baseline the performance of both the current Mark XII IFF and the Mark XV IFF Advanced Development Models
- (U) Continued risk reductions efforts to reduce total program costs will conclude
- (U) The Milestone II review was held on 21 Dec 88. FSD contract award will be in Feb 89.
- (U) Final technical agreement on the system's waveforms and frequencies with NATO Allies should be in late FY 1989.

(U) FY 1990 Planned Program:

- (U) Preliminary Design Review (PDR) scheduled for 4 Qtr FY 1990.

(U) FY 1991 Planned Program:

- (U) Completion of design for Mark XV transponders (3 configurations) and interrogrators (3 configurations)
- (U) Critical Design Review (CDR) scheduled for 4 Qtr FY 1991
- (U) Initiate fabrication of end items
- (U) Modification efforts and integration planning to install interrogrators and transponders to appropriate core platforms

(U) Program to Completion:

- (U) Preliminary FSD design and integration engineering of Mark XV engineering development models into the Tri-Service Core platforms completes in 2 Qtr FY 1992.
- (U) A limited Tri-Service Combined Development Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E) is planned for two phases from 2 Qtr FY 1992 to 4 Qtr FY 1994.

Program Element: #0604725F Project: #3592
PE Title: Combat Identification Systems Budget Activity: 4-Tac Prgms

D. (U) WORK PERFORMED BY: The Mark XV IFF program (Projects 2598 & 3592) is managed by the Tri-Service, Combat Identification System Program Office (CISPO) at 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. Additionally, the following contractors are currently engaged in the Dem/Val phase: Allied-Bendix Communications Division, Baltimore, MD; and Texas Instruments, Dallas, TX. For Full Scale Development (FSD), Allied-Bendix will be the lead contractor and Raytheon, Marlborough, Mass, the follower.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech:	None	None	None
Schd:	None	None	None
Cost:	None	None	+3,000

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: None
3. (U) COST CHANGES: Increase in FY89 of $3M reflects increased contract cost as defined by the successful offeror's (Bendix) bid price.

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, Jan 89
- (U) TAF 304-79-I/II-A, System Operational Requirement Document, Jan 89

G. (U) RELATED ACTIVITIES:

- (U) This program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide
- (U) Related activities include: Program Element 0603742, Combat Identification Technology; Program Element (PE) 0603790F, NATO Cooperative RDT&E; PE 0603790A, NATO Cooperative RDT&E PE 0603790M, NATO Cooperative RDT&E; PE 0603267N, NATO Future Identification System; PE 0603515N, Advanced Identification Techniques; PE 0603706A, Identification Friend or Foe (IFF) Developments; PE 0604211N, Identification Friend or Foe Systems; and PE 0604709A, IFF Equipment.
- (U) Coordination and integration of the various activities under these program elements are accomplished through the Air Force led Tri-Service, Combat Identification System Program.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

Program Element: #0604725F Project: #3592
PE Title: Combat Identification Systems Budget Activity: 4-Tac Prgrms

H. (U) OTHER APPROPRIATION FUNDS Not Applicable

1. PROCUREMENT: Not Applicable
2. MILITARY CONSTRUCTION: Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Project 3529, Mark XV Tri-Service Core Development, will include a Memorandum of Understanding with Italy to participate in FSD. This MOU is expected to be signed in 2 Qtr FY 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
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
Core Program DT&E	40 mo after FSD contract award	Completes 10 months later (50 mo after contract award) Core test platforms: F-15, F-18, Hawk, EH-60, AEGIS and Spruance ships
Core Program IOT&E	52 mo after FSD contract award	Completes 12 months later (64 mo after contract award) Core test platforms: F-15, F-18, Hawk, EH-60, AEGIS and Spruance ships

00540

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2751 Indirect Identification Subsystem	7,495	8,500	3,000	3,000	Continuing	TBD
3756 TACS NCTR	1,466	8,663	0	0		
Total	8,961	17,163	3,000	3,000	Continuing	TBD

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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2751, Indirect Identification Subsystem: Current ground-based identification (ID) systems

This project investigates techniques to use

in the Ground Tactical Control System (TACS).

will also be developed.

(U) FY 1988 Accomplishments:
- (U) Completed evaluation of passive identification sensor technologies/programs within all Services, for applicability to ground TACS combat ID requirements.
- (U) Completed specification definition for
- (U) Began the FSD to incorporate the fusion and processing algorithm into the MCE.

(U) FY 1989 Planned Program:
- (U) FSD for the ends.
- (U) Begin FSD of the

(U) FY 1990 Planned Program:
- (U) Testing of will be conducted.
- (U) Continue FSD for the

00541

Program Element: 0604725F Budget Activity: #4 - Tactical Programs
PE Title: Combat Identification Systems

(U) FY 1991 Planned Program:
-
-

(U) Program to Completion:
- (U) Conduct testing of the
- (U) Production of the

(U) WORK PERFORMED BY: The Indirect Subsystems program is managed by the Combat Identification System - Indirect Subsystem 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 Westinghouse, Baltimore, MD.

(U) RELATED ACTIVITIES:
- (U) Program Element 0603742F, Combat Identification Technology.
- (U) PE 0603515N, Advanced Identification Techniques.
- (U) PE 0603706A, Identification Friend or Foe (IFF) Developments.
- (U) PE 0604709A, IFF 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: Not Applicable

2. (U) Project 3756, TACS NCTI: This project investigates techniques to provide the Ground Tactical Control System (TACS) a reliable means of

The technique This project will be ended in FY89 due to funding limitations.

(U) FY 1988 Accomplishments:
- (U) Conducted initial integration studies and analyses baselining

- (U) Project concludes.

(U) FY 1989 Planned Program:
- (U) Conclude feasibility and integration investigations for integrating a

(U) FY 1990 Planned Program: No planned USAF activities.

(U) FY 1991 Planned Program: No planned USAF activities.

(U) Program to Completion: N/A

00542

Program Element: 0604725F Budget Activity: #4 - Tactical Programs
PE Title: Combat Identification Systems

(U) WORK PERFORMED BY: The Indirect Subsystems program is managed by the Combat Identification System - Indirect Subsystem 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. Contractors will be Litton, Los Angeles, CA and Scope, Reston, VA.

(U) RELATED ACTIVITIES:
- (U) Program Element 0603742F, Combat Identification Technology.
- (U) PE 0603515N, Advanced Identification Techniques.
- (U) PE 0603706A, Identification Friend or Foe (IFF) Developments.
- (U) PE 0604709A, IFF 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: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604727F
PE Title: Joint Standoff Weapons Program (JSOW)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Modular Standoff Weapon MSOW	3,300*	1,600*	24,711	34,611	Continuing	TBD

* - Program and funding previously reported under OSD PE 0604702D

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program funds USAF participation in the development of standoff weapons and subsystems for joint and Allied use. The primary project, the Modular Standoff Weapons (MSOW) program is a cooperative Research and Development initiative proposed under the Nunn amendment. Five countries have signed an Umbrella Memorandum of Understanding to pursue the development of a modular approach to standoff weapons for use against fixed and mobile targets. These five countries are the United States, Germany, Italy, Spain, and United Kingdom. These weapons will be employed from a wide variety of US and NATO aircraft and will be able to attack a variety of targets such as: airfields; air defense units; hardened command, control and communication nodes; and armor. A product of this effort will be improved interoperability and standardization within NATO. This PE funds the Project Definition (PD) Phase of MSOW and the Full Scale Development (FSD) of MSOW/JSOW variants. The JSOW program may also provide funding as necessary to develop or demonstrate subsystems to support evolving JSOW requirments.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Received industrial consortia proposals and started Source Selection process
   - (U) Due to withdrawal of France and Canada from program, the RFP was amended and redistributed to industries of the five remaining participating countries

2. (U) FY 1989 Planned Program:
   - (U) Project Definition (PD) phase will begin, consisting of design definition, ground testing, and integration of near term technologies (modules)
   - (U) Work on longer-term technology modules will be initiated for application to subsequent variants

Program Element: #0604727F
PE Title: Joint Standoff Weapons Program (JSOW)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

3. (U) FY 1990 Planned Program:
   - (U) PD Phase continues and captive carry and free-flight testing begins

4. (U) FY 1991 Planned Program:
   - (U) PD Phase completed and formulation of FSD design(s) for JSOW variants accomplished

5. (U) Program to Completion:
   - (U) Consortium selected in the 3rd quarter of FY 1992 to begin FSD of initial fixed target attack variant of JSOW
   - (U) Other follow-on variants will be developed in shorter-term FSD phases due to modularity of the design philosophy
   - (U) Other subsystems will be evaluated for integration into JSOW variants

D. (U) WORK PERFORMED BY: The five participating countries will select one consortium to conduct demonstrations of the modularity concept. Contracts will be awarded in April 1989. The MSOW program will be managed by an International Program Office located at Eglin AFB FL. Air Force Systems Command, Andrews AFB MD, will manage all efforts under this project to ensure integration of MSOW/JSOW into the USAF structure.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	+ 6 months	None
Cost	None	None	+24,915

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: Amended FY 1988/1989 Descriptive Summary milestones were based on estimated dates for completion of a seven nation source selection process. The withdrawal of France and Canada from the program required cost shares and industrial work sharing to be readdressed resulting in Contract Award for the PD phase slipping until 3Q FY 1989.

Program Element: #0604727F
Project Number: N/A
PE Title: Joint Standoff Weapons Program (JSOW) Budget Activity: #4 - Tactical Programs

3. (U) COST CHANGES: FY 1988 and 1989 funding was readjusted as a result of Congressional action combining MSOW and the Navy's Advanced Interdiction Weapon System (AIWS) in a single program element. The reduced level of funding through FY 1989 increased the funding required in FY 1990.

F. (U) PROGRAM DOCUMENTATION:
- (U) AF SON 4-86, NATO Staff Requirement (NSR) AC/224-D/760, 23 Jun 87
- (U) OSD Standoff Weapons Master Plan, 2 Jun 88

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0602602F, Conventional Munitions, is providing ordnance-related technology
- (U) Program Element #06063601F, Conventional Weapons Technology, is providing subsystem definition technology
- (U) Program Element #0603790F, NATO Cooperative Research and Development, is providing multinational requirements coordination
- (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: Seven nations signed a Memorandum of Understanding in July 1987. Canada and France have withdrawn from the agreement leaving five nations remaining.

J. (U) MILESTONE SCHEDULE:

1.	(U) MSOW Project Definition Phase Contract Award	May 1989
2.	(U) Complete MSOW Project Definition Phase	Oct 1991
3.	(U) JSOW FSD Decision	Apr 1992

FY 1990/1991 BIENNIAL 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 / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
GBU-15 P^3I						
None	9,745	39,213	15,422	7,149	-0-	156,395
Total	9,745	39,213	15,422	7,149	-0-	156,395

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: This program develops and tests the improved data link which is an upgrade to the current GBU-15 data link. It 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 and tests advanced support equipment to replace the current GBU-15 support equipment. The advanced support equipment will provide increased efficiency, reliability, and mobility. Reliability will be increased by sixfold (500 hours mean time between failures versus 80 hours for the old support equipment). Mobility is greatly increased with the advanced support equipment which is composed of two-man portable modules versus the older 875 pound single unit support equipment. This program also develops and tests the AGM-130A air-to-ground weapon system. The AGM-130A is a Preplanned Product Improvement (P^3I) of the GBU-15 previously developed under this Program Element. While the lower cost GBU-15 is effective against targets protected by terminal defenses, the AGM-130A is designed to attack high value targets which have extended terminal area defenses. The AGM-130A is the only Air Force general purpose short range standoff attack weapon. It has a 2,000 pound warhead and the television (TV) or imaging infrared (IIR) seeker of the GBU-15 coupled with a rocket motor for extended range. It will use the improved data link and advanced support equipment being developed for the GBU-15. The AGM-130A will have the capability to attack from standoff range, well outside terminal area defenses, in day and night and in an electronic countermeasures environment. The AGM-130A will be certified for carriage and delivery from the F-4E and F-111F aircraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued improved data link full scale development and AGM-130A DT&E.

2. (U) FY 1989 Planned Program:
   - (U) Continue improved data link full scale development for the GBU-15.
   - (U) Initiate development of advanced support equipment for the GBU-15.

Program Element: #0604733F
PE Title: Surface Defense Suppression
Project Number: 3006
Budget Activity: #4 - Tactical Programs

- (U) Complete AGM-130A DT&E with the TV seeker.
- (U) Start AGM-130A IOT&E with the TV seeker.
- (U) Analyze GBU-15 IIR seeker ability to support the AGM-130A mission.

3. (U) FY 1990 Planned Program:
   - (U) Complete development and initiate production of improved data link.
   - (U) Continue development of advanced support equipment.

4. (U) FY 1991 Planned Program:
   - (U) Continue production of improved data link.
   - (U) Complete development of advanced support equipment.

5. (U) Program to Completion:
   - (U) Initiate production of advanced support equipment.
   - (U) Continue production of improved data link.

D. (U) WORK PERFORMED BY: Program management is provided by the Deputy for Air-to-Surface Guided Weapons at the Armament Division (AD), 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 has not yet been identified.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

Program Element: #0604733F
PE Title: Surface Defense Suppression
Project Number: 3006
Budget Activity: #4 - Tactical Programs

F. (U) PROGRAM DOCUMENTATION:

(U) SON TAF 301-86, Nov 87
(U) TEMP, Mar 88

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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement PE 0207165F (BA 4)						
Cost	-0-	-0-	4,511	17,219	48,831	70,561
IDL Pod Quantity	-0-	-0-	10	48	132	190
Other Procurement PE 0207165F (BA 4)						
Cost	-0-	-0-	-0-	-0-	47,426	47,426
ASE Quantity	-0-	-0-	-0-	-0-	24	24
Other Procurement PE 0208030F (BA 4)						
Cost	-0-	-0-	-0-	14,644	71,250	85,894
IDL Quantity	-0-	-0-	-0-	126	1386	1512

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

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	3rd Quarter FY 1989
6. (U) Improved Data Link Low Rate Production Award	3rd Quarter FY 1990
7. (U) Advanced Support Equipment Procurement	1st Quarter FY 1992

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2239 Computer Security Technology	1,270	1,410	1,160	1,724	Cont	N/A
2522 Requirements Analysis	1,052	1,250	1,215	1,270	Cont	N/A
2523 Management Control Technology	172	595	1,443	1,503	Cont	N/A
2524 Policy and Procedure Guidance	484	833	890	235	Cont	N/A
2526 Software Engineering Tools & Methods	620	715	776	692	Cont	N/A
2983 Logistics Info Mgt Spt Sys (LIMSS)	4,625	4,704	4,505	4,921	Cont	N/A
3315 Automation of Technical Information (ATI) Computer Aided Logistics Support (CALS)	2,192	3,513	1,747	1,950	Cont	N/A
Total	10,415	13,020	11,736	12,295		

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, and (4) Enhancing AF personnel ability to acquire and support systems by providing guidance on policy, procedures, and training.(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. This is the only full scale development program to address computer security issues. Excludes civilian and military manpower and their related costs and military construction costs which are included in appropriate management and support elements in this program.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2239, Computer Security Technology.
Develop and apply computer security (COMPUSEC) products to support Air Force/DOD operations, and propagate information on COMPUSEC

Program Element: 0604740F Budget Activity: 4-Tactical Programs
PE Title: Computer Resources Management Technology

Issues and solutions. This project achieves its objectives by focusing on the demonstation 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,

(U) FY 1988 Accomplishments:
- (U) Software Requirement Specification (SRS) and Preliminary Design document.
- (U) Development of initial Security Products (Security Pro) Program specifications and the release of a draft RFP to industry.
- (U) Initiated development of a Major Command MLS SON and a COMPUSEC Awareness Briefing.

(U) FY 1989 Planned Program:
- (U) Continue Multilevel Secure (MLS) Database Management System (DBMS) task-coding, testing, certification, and accreditation support.
- (U) Continue Security Pro Program task, award contract for general purpose MLS products.

(U) FY 1990 Planned Program:
- (U) Complete the MLS DBMS task.
- (U) Initiate an Advanced MLS DBMS task.
- (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) Continue Advanced MLS DBMS task.

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

(U) Worked Performed By: Work is performed by the MITRE Corp., Bedford, MA; and BSED, Albuquerque, NM.

(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

Program Element: 0604740F Budget Activity: 4-Tactical Programs
PE Title: Computer Resources Management Technology

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 1988 Accomplishments:
- (U) Completion of detailed design for Display Rapid Prototyping & Simulation (DRPS) system.
- (U) Distribution of the enhanced Automated Interactive Simulation Modeling System (AISIM).
- (U) Publishing the Software Requirement Specification (SRS) Evaluation Criteria guidebook.

(U) FY 1989 Planned Program:
- (U) Continue development of DRPS.

(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) Complete the DRPS and URS tasks.

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

(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

Program Element: 0604740F Budget Activity: 4-Tactical Programs
PE Title: Computer Resources Management Technology

unnecessary duplication and proliferation of software acquisition standards and practices among the three Services.

(U) FY 1988 Accomplishments:
- (U) Completed the prototype of a cost estimation tool.
- (U) Published, through the JLC, DOD-STD-2167A, Defense System Software Development Standard, and DOD-STD-2168, Defense System Software Quality Standard.
- (U) Transitioned the maintenance responsibilities for the Ada/Jovial tool catalog to Hill AFB.

(U) FY 1989 Planned Program:
- (U) Initiate a Quality Measurement Tool (QMT) task-a tool for evaluating software quality.
- (U) Continue funding JLC Support Activities.

(U) FY 1990 Planned Program:
- (U) Complete the QMT task.
- (U) Initiate a Corporate MCCR Technical Management System (TMS) task-a tool to improve MCCR contract management.
- (U) Continue funding JLC Support Activities.

(U) FY 1991 Planned Program:
- (U) Continue TMS task.
- (U) Initiate an Avionics Reliability Design Tool Task.
- (U) Initiate a Joint Stars IV&V testing/tracking Tool task.
- (U) Continue funding JLC Support Activities.

(U) Program To Completion:
- (U) This is a continuing task.

(U) Work Performed By: Work is performed by the Advanced Technology Corp., Reston, VA.

(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.

4. (U) Project 2524, Policy and Procedure Guidance Develop comprehensive support on policies and procedures which lead to improvements in the planning, acquisition, and maintenance of MCCR. This is accomplished through the use of guidebooks, multimedia training methods, and automated management aids.

(U) FY 1988 Accomplishments:

Program Element: 0604740F Budget Activity: 4-Tactical Programs
PE Title: Computer Resources Management Technology

- (U) Delivery of version 1.0 of the prototype ACQUIRE CD-ROM library system to test sites for test and evaluation.
- (U) Delivery of the Instructional Support System (ISS).
- (U) Delivery of Computer Resources Acquisition Course Computer Aided Instruction (CRAC CAI) courseware for evaluation.

(U) FY 1989 Planned Program:
-(U) Continue the MCCR Acquisition Library System (MALS) task.
-(U) Initiate a Courseware Transportability Initiative (CTI) task.
-(U) Complete the ISS task.
-(U) Continue the CRAC CAI task.

(U) FY 1990 Planned Program:
-(U) Complete the MALS task.
-(U) Continue the CTI task.
-(U) Complete the CRAC CAI task.
-(U) Initiate a Software Guidebook Update (SAGU) task.

(U) FY 1991 Planned Program:
-(U) Complete CTI task.
-(U) Continue SAGU task.

(U) Program To Completion:
-(U) *This is a continuing* 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 #06037565F, 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.

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 1988 Accomplishments:
- (U) Development of a prototype Expert Missile Maintenance Aid

Program Element: 0604740F Budget Activity: 4-Tactical Programs
PE Title: Computer Resources Management Technology

(EMMA)-a system for field and depot level missile maintenance.
- (U) Installation of prototype IV of the Interactive Ada Workstation (IAW) at an ESD facility.
- (U) Continued Ada compiler run-time efficiency studies.
- (U) Continued Portable Natural Language Database Interface (PNLDBI) task-development of a user-friendly database tool for easier database queries.

(U) FY 1989 Planned Program:
- (U) Complete the EMMA task.
- (U) Continue the PNLDBI task- develop a test suite and apply the product to the MAC-Plan program.
- (U) Initiate 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) FY 1991 Planned Program:
- (U) Complete the PNLDBI task.
- (U) Continue EMMA-II task.
- (U) Initiate a Flexible Customization Methodology task.

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

(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.

6. (U) Project 2983, Logistics Information Management Support System (LIMSS). This is a long term development effort to provide a standard architecture and a Communications, Command and Control

Program Element: 0604740F Budget Activity: 4-Tactical Programs
PE Title: Computer Resources Management Technology

(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 1988 Accomplishments:
- (U) Delivered the Logistics Communication-Computer System (C-CS) Plan for base level logistics information systems.
- (U) Provided a logistics ADP assessment document to AF/LE.
- (U) Released the Logistics Transportation Architecture.
- (U) Procured and installed software at the model base (Mather AFB), creating a paperless maintenance environment.

(U) FY 1989 Planned Program:
- (U) Continue work at the model base and expand to a second base.
- (U) Final copy of the Maintenance Architecture will be delivered.
- (U) Initiate work on the Logistics Supply Architecture.
- (U) Begin 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:
- This is a continuing program.

(U) Work Performed By: Work is performed by the Transportation Systems Center, Cambridge, MA and the Analytical Systems Engineering Corp., Burlington, MA.

(U) Related Activities:
- (U) Program Element #0603106, Logistics System Technology.
- (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

Program Element: 0604740F Budget Activity: 4-Tactical Programs
PE Title: Computer Resources Management Technology

7. (U) Project 3315, Automation of Technical Information (AT.I) Computer AIDED 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 technical information used in the design, manufacture, maintenance and operation of DOD weapon systems.

(U) FY 1988 Accomplishments:
- (U) The Technical Order (TO) Modular Plan was completed and approved by the Secretary of the Air Force, resulting in the establishment of the AF TO Modernization System (AFTOMS) Program Office at AFLC.
- (U) A successful demonstration of the CALS on the Advanced Tactical Fighter was completed and demonstrated the current CALS capabilities across major life cycle phases of a weapon system and the potential CALS costs/benefits.

(U) FY 1989 Planned Program:
- (U) A CALS demonstration will be accomplished on the Advanced Tactical Fighter (2nd contractor team).
- (U) The Logistic Support Analysis (LSA) and Product Definition Data (PDD) Modular Plans will be completed.
- (U) The integrated automation of processes across the TO, LSA, and PDD modules will begin.

(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 define a strategy to implement a data base containing weapon system product and supportability data.

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

(U) Work Performed By: Work is performed by the Transportation Systems Center, Cambridge, MA; Dynatrend, Cambridge, MA; and Unisys, Cambridge, MA.

(U) Related Activities:
- (U) Program Element #0603106, Logistics System Technology.
- (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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1174 Intelligence Security Equipment	844	916	925	955	Continuing	N/A
1955 Air Force Indications and Warning (AFI&W)	2,887	1,510	0	0		20,750*
2053 Foreign Technology Division Intelligence Processes	2,115	2,426	2,597	2,853	Continuing	N/A
TOTAL	5,846	4,852	3,522	3,808	Continuing	N/A

*Funds for the AFI&W project were deleted starting in FY 1990; this value represents the project total for FY 1986 through FY 1989.

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: The state-of-the-art in electronics and

This project develops equipment to
The Air Force Office of Special Investigations (AFOSI) needs this research and development program to maintain it's counterespionage mission capability and to protect the Air Force investment in advanced technology. This is the only program developing equipment to support the Technical Surveillance Countermeasures (TSCM) mission.

(U) FY 1988 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.
- (W) Completed a feasibility study and demonstration of

(U) FY 1989 Planned Program:
- (W) Finish
- (W) Start development of a
- (W) Develop a prototype of the

(U) FY 1990 Planned Program:
- (W) Develop software to support
- (W) Develop.

(U) FY 1991 Planned Program:
- (W) Develop
- (W) Develop enhanced algorithms for

(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.
- (W) Coordination with the. prevents duplication of effort.

(U) Other Appropriation Funds: Not applicable.

(U) International Cooperative Agreements: Not applicable.

2. (U) Project 1955, Air Force Indications and Warning (I&W): This project is due for completion in FY 1989.

3. (W) Project 2053, Foreign Technology Division (FTD) Intelligence Processes: FTD's mission is to acquire evaluate, analyze and report on 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 acquire, 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 operational commanders, research and development planners, and national level agencies.

(U) FY 1988 Accomplishments:
- (U) Initiated design of
- (U) Initiated studies of

(U) FY 1989 Planned Program:
- (U) Initiate development of a computer program to
- (U) Continue development of an expert system tc
- (U) Begin development of
- (U) Start development or a
- (U) Develop a computer program to

(U) FY 1990 Planned Program:
- (U) Initiate development of
- (U) Start development of code to
- (U) Begin research and development activities to develop an

(U) FY 1991 Planned Program:
- (U) Complete development of the
- (U) Complete Phase III of the
- (U) Complete development of

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

(U) Work Performed By: International Computing Company, McLean, VA; Rockwell International, Canoga Park, CA.

(U) Related Activities: PE 0301310F (FTD).

(U) Other Appropriation Funds: Not applicable.

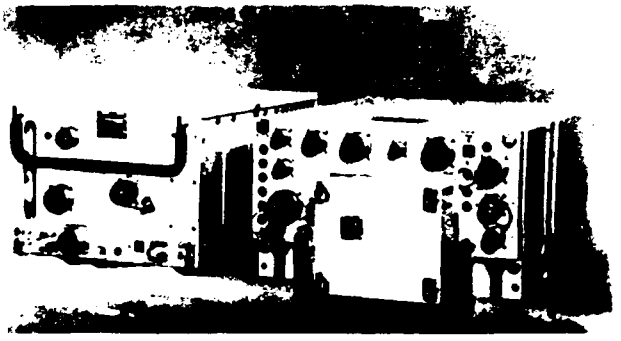
(U) International Cooperative Agreements: Not applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0604754F Budget Activity: #4 - Tactical Programs

PE Title: Joint Tactical Information Distribution System (JTIDS)

Project Title: JTIDS



POPULAR NAME: JTIDS

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	Class 2 LRIP Prod Dec	N/A	N/A	Class 2 IOC
Enginering Milestones	N/A	MIDS Phase I Complete	N/A	N/A	N/A
T&E Milestones	N/A	Pre DAB test Complete	Follow on DT/OT	F-15 flight test	N/A
Contract Milestones	N/A	MIDS FSD Contract	N/A	N/A	N/A
BUDGET	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	18,104	28,015	21,851	20,883	
Support Contract	JSE Upgrade 1,500	14,300	7,000	7,200	
In-House Support	Testing 180	Testing 6,000	5,500	5,000	
GFE/ Other	AFOTEC 2,030	AFOTEC 1,000	1,000	1,600	
MIDS			9,000	9,000	
Total	21,814	49,315	44,351	43,683	(Continuing)

Program Element: # 0604754F Budget Activity: #4 - Tactical Programs

PE Title: Joint Tactical Information Distribution System (JTIDS)

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The objective of this program is to provide pilots 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 status information among all terminals in the tactical theater. The program also provides for the development of a follow-on JTIDS Class 2 compatible terminal called the Multifunction Information Distribution System (MIDS). This new program is an OSD directed, NATO cooperative development effort to design, fabricate, test and evaluate an advanced terminal for space constrained US and NATO fighter aircraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continue system integration and software development for the MCE.
   - (U) Continue reliability growth plan.
   - (U) Develop Class 2/2H integration into US Navy F-14, E-2C, and ships.

2. (U) FY 1989 Planned Program:
   - (U) Continue system integration and software development for the MCE.
   - (U) Begin production of JTIDS Class 2 terminals for the F-15.
   - (U) Continue reliability growth plan.
   - (U) Complete follow-on DT/OT Pre-DAB testing.
   - (U) Begin Avionic Intermediate Support development for F-15.

3. (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 & RC-135.
   - (U) Begin Pecular Support Equipment development for E-3.

4. (U) FY 1991 Planned Program:
   - (U) Continue Pecular Support Equipment development for E-3
   - (U) Continue development of Avionic Intermediate Support for F-15.
   - (U) Start production for E-3, Navy F-14, E-2C, and Ships.

5. (U) Program Plan to Completion:
   - (U) Begin production for the Army's JTIDS Class 2M terminals.
   - (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.

Program Element: # 0604754F Budget Activity: #4 Tactical Programs

PE Title: Joint Tactical Information Distribution System (JTIDS)

D. (U) WORK PERFORMED BY: The Joint Program Office is located at the Electronic Systems Division, Hanscom AFB, MA. Work is also being done at the Aeronautical Systems Division, Wright-Patterson AFB, OH; and the Electromagnetic Compatibility Analysis Center (ECAC), Annapolis, MD. The major contractors are Plessey (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 1988 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	Reliability growth	None	-0-
Sched	IOT&E Completion Delayed	Delayed from Dec 1988 to Feb 1989	-0-
	Production Decision for Class 2 for the F-15	Delayed from May 1989 to Jul 1989	-0-
Cost	F-15 procurement funding reduced	None	-41.2M

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: MTBF has increases substantially. Test, Analyze, and Fix. RVT #2 completed Aug 88.

2. (U) SCHEDULE CHANGES: Dependent on 2nd F-15 for test and DAB IIIA date.

3. (U) COST CHANGES: No significant change in average procurement cost. F-15 Class 2 terminals have decreased from a quantity of 204 to 25 (including spares). Includes costs of production line start-up supporting additional USAF, Army, and Navy buys beginning in FY 91.

F. (U) PROGRAM DOCUMENTATION:
- (U) Tactical Air Forces Statement of Operational Need (TAF SON) 703-73, November 1973
- (U) TAF/PACAF/USAFE Required Operational Capability (ROC) 306-74, February 1974
- (U) JTIDS System Operations Concept (SOC), 1 December 1986
- (U) Test and Evaluation Master Plan (TEMP), 1 September 1988, (draft)
- (U) JTIDS Program Baseline, 11 March 1988 (draft)
- (U) Decision Coordinating Paper (DCP), 6 May 1987
- (U) Joint Integrated Logistics Support Plan, 24 October 1986

Program Element: # 0604754F Budget Activity: #4 - Tactical Programs

PE Title: Joint Tactical Information Distribution System (JTIDS)

G. (U) RELATED ACTIVITIES:

1. (U) The JTIDS development is managed by a jointly manned program office.

2. (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); as well as the US portion of the NATO MIDS.

3. (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.

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

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

1. (U) PROCUREMENT:

	FY 1988 ACTUAL	FY 1989 ESTIMATE	FY 1990 ESTIMATE	Total PROGRAM
Aircraft Procurement, BA				
F-15 JTIDS Mod (PE 27130F)	14.2	48.0	40.0	102.2

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: The Office of the Secretary of Defense is sponsoring, under the Nunn Amendment legislation, the MIDS NATO cooperative development project. This project is expected to enter FSD during the second quarter of FY 89. Participants will include UK, Germany, Italy, France, Canada and Spain. This codevelopment program calls for the development of a smaller, low cost, Class 2 compatible terminal that can be produced to the maximum extent practical by the participating nations. The MIDS terminal cooperative development program will be structured in two phases. Phase I was a project definition phase that will finish in FY 89. Phase II will be full scale development and will last approximately six years. Plessey's Electronic Systems Division is the lead contractor for Phase I. Phase II contractors have not been selected yet. Financial commitments of the participating nations are set at a minimum of $500,000 each for the Phase I and equitable cost sharing for Phase II. Additionally, 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 under-

Program Element: # 0604754F Budget Activity: #4 - Tactical Programs

PE Title: Joint Tactical Information Distribution System (JTIDS)

standings 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.
Multi-service	Feb 87 - Apr 87	Demonstrated potential for service interoperable use.

T&E ACTIVITY (TO COMPLETION)

Event	Date	Remarks
Follow on	Apr 87 - Apr 91	AFOTEC monitor ongoing in plant DT/OT reliability verification testing and flight testing.
Follow on	Apr 89 - Aug 90	Eglin AFB DT/OT flight testing of DT/OT Class 2 terminal improvements and untested functions.
TEMP Aproval	Dec 88	
F-15 Integration	May 89	DT/OT of production representative F-15 flight test interface.
DT/OT MIDS	FY 94-95	

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2037 SLAR Sensors	1,800	3,632	8,155	4,026	Continuing	TBD
Total	1,800	3,632	8,155	4,026	Continuing	TBD

B. (U) 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2037, SLAR Sensors: Develops advanced airborne and ground SLAR components.

(U) FY 1988 Accomplishments:
- (U) SLAR was inadvertently zeroed by Congress. The Air Force was unable to restore the PE to the authorized amount.
- (U) Software development for the ASARS Processing Segment (APS) continued at a much slower rate than planned.
- (U) Unable to develop remote console for immediate spot mode.

(U) FY 1989 Planned Program:
- (U) The APS software development will continue.
- (U) An effort to achieve imagery yield at extended ranges will also start. These improvements will allow complete mission availability for ASARS-2 radar.

(U) FY 1990 Planned Program:
- (U) Develop immediate spot capability for APS.
- (U) Complete all APS development and support equipment efforts.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604756F Budget Activity: #4 - Tactical Programs
PE Title: Side Looking Airborne Radar (SLAR)

(U) FY 1991 Planned Program:
- (U) Begin a design study to implement [redacted] for better wartime performance.
- (U) Initiate a study to assess the design of a podded SLAR to be employed on a tactical reconnaissance aircraft for flight demonstration in the mid-1990's.

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

(U) Work Performed By: The major contractor for SLAR is Hughes Radar Systems Group, Culver City, CA.

(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: N/A

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604770F
PE Title: Joint STARS
Project Number: N/A
Budget Activity: # 4 - Tactical Programs
Project Title: N/A

POPULAR NAME: JOINT STARS

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	TO COMPLETE
Program Milestones	DAB IIB Apr 1988	N/A	FSD Block II Begins 1st Qtr. FY 1990	N/A	DAB III-1st Qtr FY 1992 IOC-FY 1995
Eng. Milestones	System Prelim Design Review Apr 1988	System Crit Design Review Nov 1988 1st Radar Flt Dec 1988	FSD Flight Testing Continues	System Level Performance Verification 1st Qtr FY 1991	N/A
T&E Milestones	N/A	N/A	N/A	Comb Gov't DT/IOT&E Begins Nov 1990	DT/IOT&E Completed
Contract Milestones	N/A	N/A	FSD Block II Contract 1st Qtr FY 1990	Long Lead Contract 2nd Qtr FY 1991	Production Contract FY 1992

BUDGET (000)	FY 1988	FY 1989	FY 1990	FY 1991	PROGRAM TOTAL (TO COMPLETE)
Major Contract	297.000	149.900	82.100	4.800	(TBD)
Support Contract	23.400	26.900	26.300	24.300	(TBD)
In-House Support	6.400	8.800	6.900	3.000	(TBD)
GFE/ Other	10.511	50.388	38.183	26.764	(TBD)
TOTAL	337.311	235.988	153.483	58.864	1,595.193 (199.747)

Program Element: #0604770F Project Number: N/A
PE Title: Joint STARS Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEMS 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 Systems (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 missiles.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Program:
   - (U) First flight of the E-8A test aircraft on 1 April 1988.
   - (U) Prime Mission Equipment hardware was fabricated and was integrated on the aircraft and the Army Ground Station Module.
   - (U) The Defense Acquisition Board for Milestone IIB was completed in April 1988 (Approved: force structure increase from 10 to 22 E-8s; new versus old refurbished Boeing 707s; third new test aircraft; added FSD Block II content with self-defense suite, mission/flight simulators, and readiness improvements).
   - (U) System Preliminary Design Review was conducted in April 1988.
   - (U) The Antenna Flight Tests were completed in July 1988.

2. (U) FY 1989 Planned Program:
   - (U) The System Critical Design Review will be completed.
   - (U) The first radar flight will occur in December 1988.
   - (U) The Self-Defense Suite will be defined in a study effort.
   - (U) Operational beddown plans will be formalized.
   - (U) Peculiar Support Equipment, tech manuals, and spares will be delivered to support contractor developmental flight testing.
   - (U) Contractor flight tests will prove out the radar capabilities for the Wide-Area Surveillance Moving Target Indication mode.

3. (U) FY 1990 Planned Program:
   - (U) Full Scale Development Block II program begins.
   - (U) The third test aircraft is delivered to the prime contractor.
   - (U) Contract flight tests will prove out the full system in preparation for a System Level Performance Verification (SLPV).
   - (U) A short Operational Flight Demonstration (OFD) in Europe will be accomplished to check system performance in that environment.

4. (U) FY 1991 Planned Program:
   - (U) SLPV will be completed and the system will be certified to begin the government DT/IOT&E.
   - (U) The long lead production contract will be initiated.
   - (U) The second phase of OFD will begin to support joint exercises in

Program Element: #0604770F
PE Title: Joint STARS
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

the European environment.
- (U) The Operational Utility Evaluation (Phase II) will be completed to support a long lead decision.

5. (U) Program to Completion:
   - (U) Full Scale Development will be completed.
   - (U) Government DT/IOT&E will be completed.
   - (U) Milestone III Full Production decision will be made.
   - (U) Production of the E-8 aircraft will be completed.
   - (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; Motorola Corp, Tempe AZ; Joint Program Office, Electronics Systems Division, Hanscom AFB MA; and the Army Communications and Electronics Command.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on Systems Capabilities	Impact on Schedule	Impact on FY 1990 Cost
TECH	NONE	NONE	NONE
SCHED	NONE	NONE	NONE
COST	NONE	NONE	NONE

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:

- (U) ROC 313-75 (S)	Apr 75
- (U) TAF SON 309-82 (S)	Jun 82
- (U) USAF/USA MOU	Apr 85
- (U) JSOC (S)	Jun 86
- (U) JSOR (S)	Apr 87
- (U) JSOR REV. 1 (S)	Aug 87
- (U) OUE 1 (S)	Feb 88
- (U) DCP (S)	Apr 88
- (U) ADM (DAB IIB)	Jul 88

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 in the Army

Program Element: #0604770F
PE Title: Joint STARS
Project Number: N/A
Budget Activity: # 4 - Tactical Programs

Other Procurement program.

- (U) PE 0604270F, Electronic Warfare, contains $170.5 million of RDT&E funds to develop and 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) The Joint STARS Program Office (JPO) is a joint Army/Air Force program office to manage the full scale development of Joint STARS. A component of the SPO operates from Fort Monmouth NJ.

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

	FY 1988 Estimate	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	To Complete
Aircraft Procurement/PE 0207581F/(BA4)						
Cost	0	0	0	65,621 (Long Lead)	4,582,300	4,647,921

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. There are two on-going cooperative efforts. First is a US/UK joint Stand-Off Radar Program Studies (SORPROS) that includes: (1) alternate Joint STARS 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 funds. The NATO cooperative R&D funds will fund a program to study and design a common data link for three different SOR systems currently under development in three NATO nations: the US (Joint STARS), France (Orchidee) and Italy (Creso). Second 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
None		

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Government DT/IOT&E	1st Qtr 1991 - 1st Qtr 1992	NONE

FY 1990/1991 BIENNIAL 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)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
JINTACCS TOTAL PROGRAM ELEMENT	5,563	5,850	6,271	6,456	Continuing	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) FY1988 Accomplishments
- (U) Developed the Simulation,Monitoring, Analysis, Reduction, Test System (SMARTS).
- (U) Developed the service support functional segment for interoperability testing of new versions and interim changes to Tactical Digital Information Link "J" (TADIL-J).

(U) FY 1989 Planned Program:
- (U) Continue development of the TADIL-J capability into the Air Force Testing Facility.
- (U) Support research and development of a generic Message

Program Element: #0604779F Budget Activity: #4 - Tactical Programs
PE Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)

Text Format (MTF) parser.
- (U) Continued development of the United States Message Text Formats (USMTFs).

(U) FY 1990 Planned Program:
- (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) Continue the development of the TADIL-J capability, to integrate the E-3 OPFAC 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 C3I systems.

(U) Program Plan to Completion:
- (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, is 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 PTU 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.

(U) Related Activities: The Service and Agency related JINTACCS program elements/projects are: PE 0604780M, Joint Interoperability for Tactical Command Control Systems; PE 0604779N, JINTACCS Program; PE 0604779A, JINTACCS; PE 0208045D, C^3 Interoperability (Joint Tactical C^3 Agency); and PE 0208298D, Management Headquarters. 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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2952 F-111 Avionics Intermediate Shop (AIS)	1,400	0	0	0	0	93,750
2962 F-111 Avionics Modernization Program (AMP)	1,926	3,960	5,890	3,328	868	126,198
3079 F-111 Digital Flight Control System (DFCS)	13,556	17,340	16,479	5,700	1,201	63,441
Total	16,822	21,300	22,369	9,028	54,375*	335,695*

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides funds for development activities associated with the F-111 aircraft. Project 2952 was an engineering effort to replace the existing F-111 AIS Automatic Test Stations which have become technologically obsolete, unreliable, and logistically unsupportable. 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 FY 88 RDT&E funding completes residual engineering tasks. 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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(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 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

*Total figures include $52.306M (FY 92-94) for integration of the Short Range Attack Missile - Tactical (SRAM-T) into F-111F/G aircraft. Full Scale Development (FSD) will begin in FY 92, with flight testing scheduled for FY 93-94.

00574

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

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. Attainment of this critical repair capability is also expected to negate the requirement for an estimated $100M in Interim Contractor Support (ICS) costs over the period FY 91-94.

(U) FY 1988 Accomplishments:
- (U) Began development of TPSs for Shop Replaceable Units (SRUs) for an organic depot level maintenance capability.

(U) FY 1989 Planned Program:
- (U) Continue SRU TPS development.
- (U) Begin 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 LRU TPS Independent Validation and Verification (IV&V).

(U) Program to Completion:
- (U) Complete LRU TPS development and 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: Not Applicable.

(U) OTHER APPROPRIATION FUNDS

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	190,000	87,426	36,576	49,597	8,000	857,399

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

00575

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207129F
PE Title: F-111 Squadrons
Project Number: #3079
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title: F-111 Digital Flight Control System (DFCS)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
F-111 Digital Flight Control System (DFCS)	13,556	17,340	16,479	5,700	1,201	63,441

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: 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 system reliability of the flight control system will be improved from the current 60 hours to 1750 hours.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Complete Critical Design Review.
   - (U) Modify first F-111 test aircraft and perform functional flight check.
   - (U) Begin Development Test and Evaluation (DT&E) for the F/FB-111 aircraft.

2. (U) FY 1989 Planned Program:
   - (U) Begin durability testing, reliability growth testing and combined DT&E/IOT&E on the FB-111A.
   - (U) Begin Test Program Set (TPS) development.

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

4. (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 (MTS).
   - (U) Begin delivery of Test Program Sets.

5. (U) Program to Completion:
   - (U) Program Management Responsibility Transfer (PMRT) to Air Force Logistics Command will occur.
   - (U) Full rate production and modification of all F-111 models will be completed by FY 1995.

Program Element: #0207129F
PE Title: F-111 Squadrons
Project Number: #3079
Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY: The DFCS contractor is General Dynamics, Ft Worth, TX. 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.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	+3,817

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Cost increase is the result of a revised cost estimate.

F. (U) PROGRAM DOCUMENTATION:
- (U) TEMP, April 1988.
- (U) Acquisition Plan, January 1986.

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:

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	0	2,600	26,700	35,300	64,600

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1. (U) DFCS Contract Award	February 1987
2. (U) DFCS Critical Design Review	February 1988
3. (U) DFCS Flight Test	3Q FY 1989 - 2Q FY 1991
4. (U) Start DFCS Kit Deliveries	4Q FY 1992

00577

FY 1990/1991 BIENNIAL 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 1988	FY1989	FY1990	FY1991	To Complete
Program Milestones	N / A	N / A	N / A	Milestone II F-16 Derivative	N / A
Engineering Milestones	Ongoing Integ	Ongoing Integ	F-16 Derivati Configuration Definition	Block 50 F-16 Derivati Integration	Ongoing Integ
T&E Milestones	Block 40 Sys Integration Testing	EW suite Integration Testing	IPE Flight Test	Block 50 Integration Testing	Block 50 Integration Testing
Contract Milestones	Initiate Block 50 Integration	Authorize MSIP Follow-on contract	Continuing Effort	Initiate F-16 Derivati FSD Effort	Continuing Effort
BUDGET ($000)	FY1988	FY1989	FY1990	FY1991	Program Total (To Complete)
Major Contract	10,800	9,800	21,000	165,800	1,944,000 (800,700)
Support Contract	2,600	500	200	0	229,300 0
In-House Support	7,321	8,000	8,100	8,200	185,121 (51,300)
GFE/ Other	4,346	7,929	4,158	2,961	101,929 (22,305)
Total	25,067	26,229	33,458	176,961	2,460,350 (874,305)

00579

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. 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. The F-16 is a single-engine, single-seat, multirole tactical fighter with full air-to-air and air-to-surface combat capabilities. 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. 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. To continue to meet the increased threat of the 1990's as a complement to the Advanced Tactical Fighter (ATF), configuration studies will be conducted in a multinational predevelopment phase of an F-16 Derivative effort. These studies will seek to enhance maneuverability by increasing the size of the wing and by increasing thrust with a variant of the IPE or ATF engine.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued development and testing of the improvements initiated in FY 1987 and prior.
   - (U) Continued Seek Eagle certification to include the Shrike and HARM missiles.
   - (U) Continued development of the ECCM capabilities for the APG-68 radar, and development of the All Environment Identification system.
   - (U) Development was completed on several subsystems including the Low Altitude Navigation and Targeting Infrared for Night System, Global Positioning System, digital flight controls, and the Advanced Medium Range Air-to-Air Missile .
   - (U) Continued development of an advanced radar warning receiver and chaff and flare dispenser for full incorporation in future F-16 aircraft.

2. (U) FY 1989 Planned Program:
   - (U) Continue flight test and RDT&E tasks associated with Seek Eagle and improved avionics development to meet the evolving threat of the 1990s.
   - (U) Government test support for the F-16 Air Defense Fighter.
   - (U) Development of the All Environment Identification system to improve beyond visual range identification capability and preplanned product improvement for MK XV will be completed.
   - (U) Continue the Predevelopment Phase for F-16 Derivative configuration definition

3. (U) FY 1990 Planned Program:
   - (U) Continue the Predevelopment Phase for F-16 Derivative configuration definition
   - (U) Continuation of tasks underway including radar improvements, ECCM improvements, and additional flight testing for safety and operational deficiencies.

4. (U) FY 1991 Planned Program:
   - (U) Initiation of F-16 Derivative FSD
   - (U) Continuation of tasks underway including radar improvements, ECCM improvements, and additional flight testing for safety and operational deficiencies.

5. (U) Program to Completion:
   - (U) Completion of tasks underway including radar improvements, ECCM improvements, and additional flight testing for safety and operational deficiencies.
   - (U) Complete full scale development of the F-16 Derivative aircraft configuration, and flight testing for development and operational evaluations
   - (U) This is a continuing program.

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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	Yes	None	+20,000
Sched	None	None	None
Cost	None	None	+1,133

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: Conclude F-16 Derivative Predevelopment phase
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Includes funds for government test and support of the Block 50 Aircraft and reduction to transfer out test support for Seek Eagle support office.

F. (U) PROGRAM DOCUMENTATION:

- (U) DCP #120, LWF Prototype, 1 November 1972.
- (U) TAC ROC 303-76, F-16 Air Combat Fighter, 28 December 1976.
- (U) DCP #143, Multipurpose Fighter (F-16), 8 May 1978.
- (U) F-16C/D TEMP, March 1988.

G. (U) RELATED ACTIVITIES:

- (U) The Airborne Self Protection Jammer system for F-16 application is being developed in PE 0604737F, Airborne Self Protection Jammer.
- (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; and PE 0604233F, Alternate Fighter Engine Program. Engine sustaining engineering is performed under PE 0604268F, Aircraft Engine Component Improvement Program. A higher thrust variant engine considered for the F-16 Derivative Program would be developed under PE 0604218F, Engine Model Derivative 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, (BA 01)						
Funds	2,740.0	3,245.0	3,262.7	3,033.7	17,413.2	51,310.0
Quantity	180	180	150	150	840	2999

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. Since then we have established the framework for the F-16 Derivative program as a three-phase cooperative program with the EPG consisting of: predevelopment, development, and production. In May 1988, an agreement for the predevelopment phase was signed by the U.S. and all the EPG except Belgium, who had to coordinate it with the recently formed new government. Belgium has still not signed and is under heavy pressure from the French to commit to the Rafale. The purpose of the predevelopment phase is to explore the feasibility of upgrades to F-16 aircraft (production and retrofit) which will consider avionics, propulsion, and aerodynamic improvements. The EPG 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 predevelopment program. DOD funding for the first two years of the predevelopment phase will come from the NATO R&D appropriation (Nunn Amendment) as follows: FY88 $5.0M, FY89 $7.5M.

FY 1990/1991 BIENNIAL 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 1988	FY1989	FY1990	FY1991	To Complete
Program Milestones	N / A	N / A	N / A	N / A	N / A
Engineering Milestones	Ongoing Integ	Ongoing Integ	Ongoing Integ	Ongoing Integ	Ongoing Upgrades
T&E Milestones	ALQ135 QRC DT&E/OT&E Flt Test	MSIP /AMRAAM Flt Test	IPE Flight Test	Nuclear Cert Flight test	Follow on Weapons Integ Flt Test
Contract Milestones	VHSIC Computer Start	Complete F-15E Contract	SRAM T Integration Start	F-15E IPE Integr Complete	N / A
BUDGET * ($000)	FY 1988	FY1989	FY1990	FY1991	Program Total (To Complete)
Major Contract	73,644	53,089	85,688	88,989	2,779,322 (97,428)
Support Contract	0	0	0	0	0
In-House Support	21,710	32,921	36,455	14,903	368,329 (35,900)
GFE/ Other	3,845	1,600	2,500	2,100	351,849 (4,972)
Total	99,199	87,610	124,643	101,792	3,499,500 (138,300)

* FY 1988/1989 reported under PE 0207130F (including Proj 0132).
FY 1990 and out funds from PE 0207130F included in this Summary.

00583

Program Element: # 0207134F
PE Title: F-15 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 an all weather, deep penetration and night/ under the weather air-to-surface attack. However, the Soviet/Warsaw Pact threat continues to grow quantitatively and qualitatively with their new generation of aircraft possessing all-weather detection and kill capabilities. To maintain the F-15's superiority against the threat in the late-1980s and 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 air combat identification (ID) capability and an updated 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) to solve memory and throughput limitations.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued development and testing of the improvements initiated in FY 1987 and prior.
   - (U) Final design, test and checkout of all MSIP changes and peculiar support equipment to ensure system compatibility, continued IPE integration, VHSIC CC, RF compatibility efforts, and continued Electronic Counter-counter Measure (ECCM) enhancements. The upgraded systems serve as a baseline for the F-15E aircraft.

2. (U) FY 1989 Planned Program:
   - (U) Complete F-15E contract previously reported in PE 0207130F/ Project 0132.
   - (U) Continue development and testing of the improvements initiated in FY 1988 and prior.
   - (U) Continue flight test and RDT&E tasks associated with Seek Eagle, Phase IV Tactical Electronic Warfare System (TEWS) integration, ALQ-135 Band 1.5/3 jammer integration, TEWS Intermediate Support System (TISS) development, IPE integration, Global Positioning System (GPS), VHSIC CC, RF compatibility, advanced algorithm dual mode recognizer (DMR), Memory Module Test System (MMTS) and radar module test station.

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

3. (U) FY 1990 Planned Program:
   - (U) Continue flight test and RDT&E tasks associated with Phase IV Tactical Electronic Warfare System (TEWS) integration, ALQ-135 Band 1.5/3 jammer integration, Increased Performance Engine (IPE) integration, VHSIC CC development, RF compatibility efforts with emphasis on hardware definition and modification, advanced algorithm ECCM and combat identification improvements, integration with the common tactical mission support system and radar module test station development.
   - (U) Begin integration of SRAM T, the standard crash survivable flight data recorder, a ground collision avoidance system, and development of an improved vertical stabilizer.

4. (U) FY 1991 Planned Program:
   - (U) Continue flight test and RDT&E tasks associated with Phase IV Tactical Electronic Warfare System (TEWS) integration, ALQ-135 Band 1.5/3 jammer integration, TASM integration, VHSIC CC development, RF compatibility efforts with emphasis on Full Scale Development and flight test, advanced algorithm ECCM and combat identification improvements, and the common tactical mission support system
   - (U) Complete efforts on the integration of the Increased Performance Engine (IPE), the standard crash survivable flight data recorder and the ground collision avoidance system.
   - (U) Complete radar module test station development, and the improved vertical stabilizer.
   - (U) Begin air-to-ground software improvements.

5. (U) Program to Completion:
   - (U) Completion of tasks including radar improvements, ECCM improvements, 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	Yes	None	+46,495
Sched	None	None	0
Cost	None	None	+19,800

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

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: FY 1990 RDT&E changes are due to the addition of the VHSIC Central Computer for increased throughput and memory capability; SRAM T integration into the F-15E; incorporation of the Standard Flight Data Recorder and a Ground Collision Avoidance System for flight safety; a High Accuracy Algorithm for improving combat ID capability; and an Improved Vertical Stabilizer for reliability and maintainability.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Revised cost estimates for flight test, radio frequency compatibility efforts, and annual software updates to meet the evolving threat.

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, November 1984
- (U) F-15E TEMP, November 1987

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) 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, (BA 01)						
Funds	1,510,700	1,484,731	1,571,523	1,528,524	3,857,600	30,033,800
Quantity	42	36	36	36	78	1152

2. (U) MILITARY CONSTRUCTION: Not Applicable.

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

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207136F Project Number: 327B
PE Title: F-4G Wild Weasel Squadrons Budget Activity: #4-Tactical Programs

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
327B F-4G Wild Weasel Squadrons	7,621	4,487	2,000	0	0	59,226
3779 Follow-on Wild Weasel	0	0	1,149	12,085	Cont	Cont
Total	7,621	4,487	3,149	12,085	Cont	Cont

B. (U) BRIEF DESCRIPTION OF ELEMENT: This element provides funds for development and support of the Air Force's manned lethal defense suppression weapon system(s). The F-4G Wild Weasel is the only operational destructive defensive suppression weapon system currently in the Air Force inventory. It is specifically designed to automatically 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, Statement of Operational Need TAF 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. F-WW is a FY 1990 new start.

C. (U) JUSTIFICATION FOR PROJECTS LESS THAN $10.0 MILLION IN BOTH FY 1990 AND FY 1991:

(U) 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 1988 Accomplishments:
- (U) APR-38 PUP Phase II development contract terminated Mar 88 due to the contractor's failure to perform.
- (U) APR-38 PUP Phase I, WASP computer, production deliveries began first quarter of FY 88.
- (U) F-4G/APR-38 PUP Phase I was IOC in Jul 88.

Program Element: #0207136F
Title: F-4G Wild Weasel Squadrons

Project Number: #327B
Budget Activity: #4-Tactical Programs

(U) FY 1989 Planned Program:
- (U) Complete production deliveries of WASP computers in third quarter FY 89.
- (U) Full operational capability, fourth quarter FY 89.
- (U) Complete residual tasks resulting from PUP Phase II termination.
- (U) Program management responsibility transfer, second quarter FY 89.

(U) FY 1990 Planned Program:
- (U) Trial install of the F-4G/F-16 Targeting Modem into the 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: Not Applicable.

(U) Program for Completion: Not Applicable.

(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) Program Element #0604270F (Electronic Warfare Development).
- (U) Program Element #0207313F (Imaging Infrared Maverick) and Program Element #0207126F (High Speed Anti-Radiation Missile).
- (U) Program Element #0207133F (F-16 Squadrons).
- (U) No unnecessary duplication of effort within the Air Force or the Department of Defense is being performed.

(U) Other Appropriation Funds:

	FY 1988 Actual	FY 1989 Estimated	FY 1990 Estimated	FY 1991 Estimated	To Complete
Targeting Modem (3010) BP 1100	0	0	12,300	8,700	1,100

(U) International Cooperative Agreements: Not Applicable.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207136F Project: #3779
PE Title: F-4G Wild Weasel Squadrons Budget Activity: #4-Tactical Programs
Project Title: Follow-on Wild Weasel (F-WW)

POPULAR NAME: Not Applicable

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones			MS I Mar 90		
Engineering Milestones					
T&E Milestones					
Contract Milestones				Dem/Val Oct 90	
BUDGET ($000)					
Major Contract				9600	TBD
Support Contract			700	2000	TBD
In-House Support			449	485	TBD
GFE/ Other			0	0	TBD
Total			1149	12085	TBD

Program Element: #0207136F Project: #3779
PE Title: F-4G Wild Weasel Squadrons Budget Activity: #4-Tactical Programs

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

a. (U) 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 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 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(s) must be developed and fielded in time to offset this shortfall. F-WW is an FY 90 new start.

b. (U) Threat base for lethal defense suppression includes the existing SAM threat systems plus large numbers of newer, highly mobile systems with radars having exotic waveforms capability, or low probability of intercept emitters.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments: Not Applicable.

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

3. (U) FY 1990 Planned Progam:
- (U) Complete system concept studies/evaluation.
- (U) Complete program Phase 0 documentation requirements.
- (U) Accomplish Milestone I review.
- (U) Initiate Demonstration/Validation (Dem/Val) phase.

4. (U) FY 1991 Planned Program:
- (U) Award Dem/Val contracts.
- (U) Update system concept, acquisition strategy and other program documents.

5. (U) Program Plan to Completion:
- (U) Complete Dem/Val.
- (U) Accomplish Milestone II, III, IV reviews.

Program Element: #0207136F Project: #3779
PE Title: F-4G Wild Weaseal Squadrons Budget Activity: #4-Tactical Programs

D. (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.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY: Not applicable. This is an FY 90 new start.

F. (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.

G. (U) RELATED ACTIVITIES:
- (U) Program Element #0207316F, Tacit Rainbow.
- (U) Program Element #0604242F, Advanced Tactical Aircraft (ATA).
- (U) Program Element #0603109F, INEWS/ICNIA.
- (U) Program Element #0207162F, High Speed Anti-Radiation Missile.
- (U) No unnecessary duplication of effort within the Air Force or the Department of Defense is being performed.

H. (U) OTHER APPROPRIATION FUNDS:

1. (U) PROCUREMENT: Not Applicable.

2. (U) MILITARY CONSTRUCTION: Not Applicable.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: To be determined during CE phase.

J. (U) TEST AND EVALUATION DATA: To be accomplished during Dem/Val phase.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2330 High Speed Antiradiation Missile	2,044	3,881	2,485	497	-0-	42.680

B. (U) BRIEF DESCRIPTION OF ELEMENT: This 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 new and anticipated threats. Block IV and LCS are interchangeable and are in direct competition for HARM C production beyond contract year 1992.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2330, HARM:

(U) FY 1988 Accomplishments:
- (U) Block III software CDR, coding and validation completed
- (U) Flight testing and aircraft OFP integration testing started
- (U) Block IV contractor test and evaluation (CTE) started

(U) FY 1989 Planned Program:
- (U) Block III - complete combined DT/IOT&E testing (163 captive flights and 9 firings).
- (U) Block IV - complete CTE (31 captives, 5 firings). Start delivery and developmental testing (DT) of pre-production missiles (PPM) seekers.
- (U) Develop and test support equipment hardware and software updates

(U) FY 1990 Planned Program:
- (U) Block III - Conduct OT-IIIB testing (12 captive flights, 6 firings). Develop support equipment updates.
- (U) Block IV - complete PPM delivery. Complete DT-IIIB testing (151 captives, 8 firings). Start OT-IIIA(IOT&E).

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

(U) FY 1991 Planned Program:
- (U) Block IV - Develop support equipment updates. Complete OT-IIIA(IOT&E).

(U) Program to Completion: Program will be completed in FY 1991.

(U) WORK PERFORMED BY: The Air Force program management is provided by the Armament 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)

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	360,500	212,270	59,436	0	478,870	2,534,276
Quantity	1531	893	276	0	2000	9023

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

A. (U) RESOURCES ($ in Thousands)

Project Title / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
AMRAAM Pre-Planned Product Improvement (P3I) / AMRAAM P3I	0	0	14,929	24,878	148,862	188,669

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, an FY 1990 new start, provides for a sustaining research and development program which enhances the missile's capability and operational flexibility against new projected threats, maximizes its compatibility with the Advanced Tactical Fighter (ATF), 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 1988 Accomplishments: Not Applicable

2. (U) FY 1989 Planned Program: Not Applicable

3. (U) FY 1990 Planned Program:
   - (U) Initiate ATF compatibility improvements for compressed carriage and data link upgrades.
   - (U) Initiate Electrically Erasable Programmable Read Only Memory (EEPROM) and advanced data processor development to provide for field level reprogramming of the missile and provide for expanded memory/throughput.
   - (U) Initiate Electronic Counter-Countermeasure (ECCM) upgrade to counter postulated countermeasures improvements.
   - (U) Initiate missile fuze improvements for increased performance against low radar cross section targets and fuze countermeasures.

4. (U) FY 1991 Planned Program:
   - (U) Continue development of improvements started in FY 1990.
   - (U) Provide for proof of manufacture and qualification hardware, missile integration, simulation, and free-flight missile testing.

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

5. (U) Program to Completion:
   - (U) Complete missile upgrade projects begun in FY 1990.
   - (U) Apply technology advances such as Very High Speed Integrated Circuits (VHSIC) for countermeasure enhancement and solid state electronic safe, arm and fuze devices for improved safety.
   - (U) Define and pursue additional changes required to enable the missile to counter the evolving threat.

D. (U) WORK PERFORMED BY: This project is managed by the AMRAAM Joint System Program Office at the Armament 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. P3I contracts will be competitively awarded.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Not Applicable. This is a new start for FY 1990.

F. (U) PROGRAM DOCUMENTATION:

- (U) ROC/JSOR Sep 78
- (U) MENS Nov 78
- (U) SOC Jul 86
- (U) TEMP Jun 87
- (U) DCP Apr 87
- (U) STAR Apr 87

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
  PE #0204136N, F/A-18
  PE #0604314N, AMRAAM (Navy)
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS

Missile Procurement (BA 4):

	FY 1988 Actual	FY 1989 Estimate	FY 1990* Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	673,127	801,117	913,745	922,752	3,485,183	7,646,682
Quantity	400	874	1,438	2,200	12,004	17,108

* Does not include $4.667 million and 12 missiles funded in PE 0207590F, SEEK EAGLE

00595

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

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) concerning development and production of the AMRAAM and the Advanced Short Range Air-to-Air (ASRAAM) missile. Under the MOU, GE and UK may establish their own production line, coassemble the missile, or buy through Foreign Military Sales to acquire the AMRAAM.

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)	Milestone IIIB (Full Rate Production)	September 1989
4.	(U)	Initial Operational Capability	October 1989
5.	(U)	Award Initial AMRAAM P3I Contracts	1st Qtr 1990
6.	(U)	P3I Missile Free Flight Test Initiated	1st Qtr 1993
7.	(U)	P3I First Production Delivery (Lot VII Block change)	3rd Qtr 1994
8.	(U)	Additional Production Changes (Through Lot X)	4th Qtr 1995
9.	(U)	Final Production Deliveries (Lot XI)	3rd Qtr 1999

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207168F
PE Title: F-111 Self Protection Systems
Project Number: 2827
Budget Activity: #4

A. (U) RESOURCES ($ In Thousands)

Project Title: Radar Warning Receiver for F/FB/EF-111

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
None	73	0*	10,560	11,609	2,046	24,288

* FY 1989 funds contained in PE 604270F

B. (U) BRIEF DESCRIPTION OF ELEMENT: This element funds the development, integration, and test of updated electronic countermeasures and radar warning systems for F/FB/EF-111

(Through FY 1988 this PE contained funding primarily for the ALQ-XXX jammer competition. This was cancelled in February 1987 due to excessively high bids. A restructured ECM upgrade plan that stays within previously programmed amounts was adopted in September 1987.) There was no RDT&E funding for the RWR in FY 1987 & FY 1988, but the RWR and jammer programs were begun in FY 1983 under special access program elements. All funds for these programs were transferred out of the special access program elements for FY 1987 and brought into Program Element 27168F. Budget is based on contractor estimates. The radar warning receiver (RWR) (ALR-62I) is in full-production stage for the F/FB-111; additional development is required to adapt it to the EF-111A. Funding shown is to complete this task.

C. PROGRAM ACCOMPLISHMENT AND PLANS

1. (U) FY 1988 Accomplishments:
   - (U) Entered production on ALR-62I for F/FB-111

2. (U) FY 1989 Planned Program:
   - (U) Define system configuration for the EF-111 RWR upgrade
   - (U) Develop System Performance Specifications
   - (U) Begin engineering design
   - (U) Procure GFE to equip integration test stand

3. (U) FY 1990 Planned Program:
   - (U) Continue engineering design
   - (U) Begin testing EF-111A and ALR-62I modications necessary to install and integrate ALR-62I on the EF-111A
   - (U) Procure four (4) production EF-111A configured systems to use for test and integration

Program Element: #0207168F Project Number: 2827
PE Title: F-111 Self Protection Systems Budget Activity: #4

4. (U) FY 1991 Planned Program:
   - (U) Continue integration and test of the ALR-62I/EF-111A configuration
   - (U) Define and develop unique support requirements for the ALR-62I/EF-111
   - (U) Define production configuration

5. Program to Completion:
   - (U) Incorporate final changes into production designs

D. (U) WORK PERFORMED BY: Dalmo Victor Corporation of Belmont, California is the primary contractor for the ALR-62I program. Air Force Systems Command is responsible for development, test, and integration. Warner Robins Air Logistics Center is responsible for procuring production systems and installation of the ALR-62I into the EF-111 aircraft.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	-100
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION: TAF SON 304-80

G. (U) RELATED ACTIVITIES: This effort is related to the EF-111A Tactical Jamming System Upgrade Program (PE207252F). There is no unnecessary duplication of effort within the Air Force or the Department of Defense

H. (U) OTHER APPROPRIATION FUNDS: ($ IN THOUSANDS)

	FY 1988 Actual	FY 1989 Estimated	FY 1990 Estimated	FY 1991 Estimated
Aircraft Procurement BA 7*	50,900	59,400	66,400	38,700

*ALR-62I production for F/FB-111

Program Element: #0207168F Project Number: 2827
PE Title: F-111 Self Protection Systems Budget Activity: #4

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

J. (U) MILESTONE SCHEDULE:

1.	(U)	Complete Project Definition Phase	Sep 89
2.	(U)	Begin FSD	FY 1/90
3.	(U)	Begin Flight Test	FY 1991
4.	(U)	Production Decision	FY 1992

FY 1990/1991 BIENNIAL 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 Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
TR-1	70,517	100,775	110,710	53,311	Continuing	N/A

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. This sensor information will be exploited in the TR-1 Ground Station (TRIGS) located

The TR-1 program develops nonsensor related segments of the ground station and integrates these elements into a warfighting capability. These segments of the ground station provide mission planning and control, communications, and imagery processing and exploitation. It also provides the means to coordinate the activities of the various sensor exploitation segments to form an integral battlefield reconnaissance system.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) The prototype of the TRIGS design (TR-1 Exploitation and Demonstration System (TREDS)) successfully underwent software security accreditation and received permission to provide computerized access to communications networks.
   - (U) A Critical Design Review of the TRIGS hardware and software was completed with the integrating contractor.
   - (U) Procurement of long lead hardware items began.
   - (U) Final approval of the construction site was received from the German government, and 100 percent design of the TRIGS bunker was finalized.

2. (U) FY 1989 Planned Program:
   - (U) Construction of the NATO funded bunker will begin.
   - (U) Major hardware procurement and assembly will continue.
   - (U) The ASARS Processing Segment will undergo acceptance tests and be delivered for integration at the contractor's facility.

00600

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

- (U) A program restructure contract will be awarded to perform extended CONUS testing and to compensate for the nonavailability of the TRIGS bunker.
- (U) A study to investigate the use of Enhanced Moving Target Identification in TRIGS will be initiated.
- (U) Development of a dual data link to support Army requirements will be initiated. Five engineering development models will be produced.

3. (U) FY 1990 Planned Program:
   - (U) Construction of the TRIGS bunker continues into final stages.
   - (U) System level integration of TRIGS will commence at the contractor's facility with delivery of the communications, imagery exploitation,
   - (U) CONUS flight testing of all the operational segments of TRIGS working together will begin.

4. (U) FY 1991 Planned Program:
   - (U) Construction of the TRIGS bunker will be finished.
   - (U) Testing at the contractors facility will be completed and the system shipped overseas for installation in the bunkered facility.

5. (U) Program to Completion:
   - (U) The first TRIGS will achieve initial operational capability in
   - (U) A transportable imagery capability will be developed in lieu of a second copy of the TRIGS capability, as originally planned.
   - (U) Operational testing of TRIGS will be conducted by AFOTEC and identified deficiencies will be corrected in the out-years.

D. (U) WORK PERFORMED BY: The program office for this effort is the Air Force Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contractors are Ford Aerospace Corp., San Jose, CA, and Hughes Radar Systems Group, Culver City, CA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	No Change	Delayed 14 months	See below
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.

00601

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

2. (W) SCHEDULE CHANGES: Construction start for the TRIGS bunker was delayed from Sep 87 until Nov 88. Local political problems with the German government prevented issue of a construction permit for the facility. The problem was with the use of land for military purposes. Primary impact is delay of the Initial Operational Capability until _ An additional $26 million in operational expense will be incurred to keep the prototype system running longer than planned.

3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION: TAF ROC 315-75, All Weather Target Acquisition Systems, Apr 75. Mission Element Need Statement for Continuous Battlefield Standoff Surveillance, Aug 79.

G. (U) RELATED ACTIVITIES: The Side Looking Airborne Radar (SLAR) Program Element 0604756F, Project 2037, SLAR Sensors funds development of the airborne radar and ground processing equipment used in the TR-1 aircraft and TR-1 ground station. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	Total Program
Aircraft Procurement, BA 04				
Funds	10,700	12,659	0	1,385,700
Quantity	0	0	0	18
Other Procurement, BA 04				
Funds	0	0	5,393	Continuing
Military Construction, BA 04				
Funds	0	3,850	3,800	Continuing

I. (W) INTERNATIONAL COOPERATIVE AGREEMENTS: The USAF has signed a memorandum of understanding with the to ensure that the TR-1

J. (U) MILESTONE SCHEDULE:

	DATE
1. (U) First TR-1 Contract	November 1979
2. (U) TREDS Contract Award	July 1981
3. (U) First TR-1 Delivered	September 1981
4. (U) ASARS II Operational Evaluation	November 1982
5. (U) ASARS II Production Award	September 1983
6. (U) TREDS Delivery to Europe	August 1985
7. (U) TR-1 Ground Station (TRIGS) Integration	November 1990
8. (W) TRIGS I Initial Operational Capability	_

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

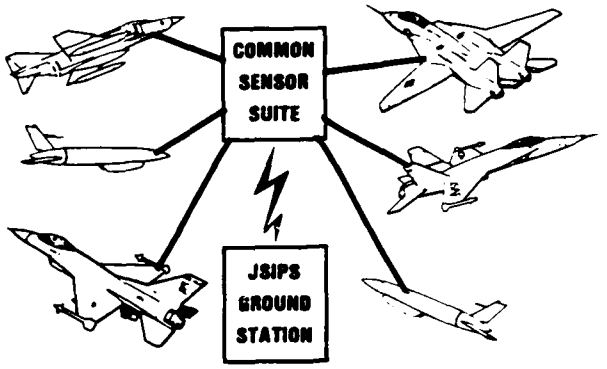
A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3201 Tactical Air Reconnaissance System	32,478	45,867	65,633	36,375	Continuing	TBD
3364 Joint Services Imagery Processing System	12,311	10,200	13,000	10,000	11,535	61,749
3792 RF-16	0	0	25,415	43,149	Continuing	TBD
Total	44,789	56,067	104,048	89,524	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Follow-on Tactical Reconnaissance System (FOTR) is a key program element under the Advanced Tactical Air Reconnaissance System (ATARS) umbrella concept. The program's primary objective is the upgrade of tactical penetrating reconnaissance systems. ATARS development efforts accomplished within the FOTR Program Element consist of three development projects: Project 3201, Tactical Air Reconnaissance System (TARS); Project 3364, Joint Services Imagery Processing System (JSIPS) and Project 3792, RF-16. 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, Marine Corps and Navy manned and unmanned reconnaissance systems. The Air Force will integrate TARS into a tactical reconnaissance pod for carriage on the RF-16. TARS equipment will be used as the reconnaissance payload for the Joint Services Common Airframe Multiple Purpose System (JSCAMPS). The Navy will also 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 manned and unmanned systems. The RF-16 Project will develop the follow-on tactical reconnaissance pod along with the necessary F-16 mechanization and missionization to allow this aircraft to perform the reconnaissance mission, i.e., a low-altitude, under-the-weather capability along with cockpit controls and display.

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Begin Full-Scale Devel.	N/A	N/A	Production Decision	Field System
Enginerng Milestones	N/A	Preliminary and Critical Design Rev.	Engineer. Model Delivery	Qualif. Testing	N/A
T&E Milestones	N/A	N/A	N/A	DT&E Complete	IOT&E Complete FY 92
Contract Milestones	FSD Contract Award	N/A	N/A	N/A	Complete FSD
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	31,574	43,919	52,275	33,202	Continuing (TBD)
Support Contract	135	264	0	0	Continuing (TBD)
In-House Support	139	389	11,532	1,684	Continuing (TBD)
GFE/ Other	630	1,295	1,826	1,489	Continuing (TBD)
Total	32,478	45,867	65,633	36,375	Continuing (TBD)

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

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Tactical Air Reconnaisance 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 Navy manned and unmanned reconnaissance systems. The Air Force will integrate TARS sensor suites into a reconnaissance pod to be used on the RF-16 and into the reconnaissance version of JSAMPS. The RF-4C will be used as a test vehicle for TARS.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Source selection completed and contract awarded May 88
   - (U) Full-scale development program for EO design started
   - (U) Independent Cost Analysis completed

2. (U) FY 1989 Planned Program:
   - (U) Preliminary Design Review in Oct 88
   - (U) Prime contractor initiates fabrication and assembly efforts for engineering models
   - (U) Contractor will initiate development of support equipment
   - (U) Complete Critical Design Review in Apr 89

3. (U) FY 1990 Planned Program:
   - (U Nine engineering models to be delivered
   - (U) Integration into platform begins

4. (U) FY 1991 Planned Program:
   - (U Flight Test begins
   - (U) Production decision

5. (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
PE Title: Follow-On Tactical Reconnaissance System
Project Number: 3201
Budget Activity: # 4 - Tactical Programs

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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) JMSNS, 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

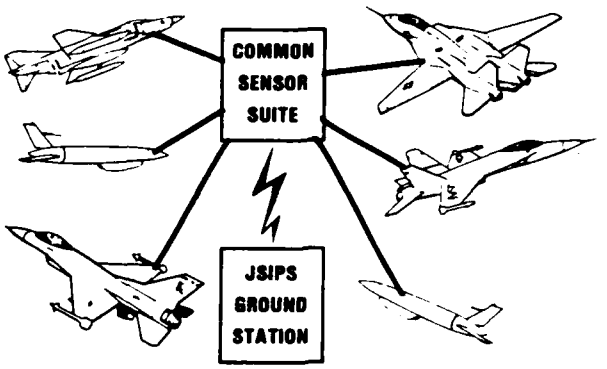
H. (U) OTHER APPROPRIATION FUNDS: Not Applicable

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: Not Applicable

FY 1990/1991 BIENNIAL 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	N/A	Production Decision Jan 90	N/A	Field System
Enginerng Milestones	Preliminary Design Review	Critical Des. Review, Sys Per. Valid.	Qualif. Testing	N/A	N/A
T&E Milestones	N/A	Test Readiness Rev. DT&E	IOT&E	N/A	N/A
Contract Milestones	S/W Spec.Rev. Preliminary Des. Rev.	N/A	Complete FSD	N/A	Production Options
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	10,719	7,900	11,800	8,800	52,354) (13,135)
Support Contract	1,400	2,000	1,000	1,000	7,903 (2,503)
In-House Support	192	300	200	200	1,492 (600)
GFE/ Other	0	0	0	0	0
Total	12,311	10,200	13,000	10,000	61,749 (16,238)

Program Element: # 0207217F
PE Title: Follow-On Tactical Reconnaissance System
Project Number: 3364
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 RF-4C aircraft. JSIPS will support the RF-16 and JSCAMPS.

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 1988 Accomplishments:
   - (U) Software Specification Review completed
   - (U) Preliminary Design Review completed
   - (U) Developed standard imagery console

2. (U) FY 1989 Planned Program:
   - (U) Critical Design Review
   - (U) Begin JSIPS integration
   - (U) Begin joint testing of the Air Force, Army and Marine Corps Engineering Models

3. (U) FY 1990 Planned Program:
   - (U) Continue testing

4. (U) FY 1991 Planned Program:
   - (U) Production decision
   - (U) Continue testing

5. (U) Program to Completion:
   - (U) Complete testing
   - (U) Begin fielding JSIPS

D. (U) WORK PERFORMED BY: The contractor of 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
PE Title: Follow-On Tactical Reconnaissance System
Project Number: 3364
Budget Activity: # 4 - Tactical Programs

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	Yes	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: Program restructured to compensate for FY 1989 funding shortfall
2. (U) SCHEDULE CHANGES: None
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 0603730A and PE 0604718M.
- (U) There is no unnecesary 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) TEST AND EVALUATION DATA: Not Applicable

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0207217F
PE Title: Follow-On Tactical Reconnaissance System
Project Number: 3792
Budget Activity: # 4 - Tactical Programs

Project Title: RF-16

POPULAR NAME: RECCE FALCON

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	N/A	N/A		Production Decision
Enginerng Milestones	N/A	N/A	Prelim. Design Review	Critical Design Review	N/A
T&E Milestones	N/A	N/A	N/A	N/A	DT&E, IOT&E
Contract Milestones	N/A	RFP Release	FSD Contract Award	N/A	Initial Production
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	0	0	TBD	TBD	Continuing (TBD)
Support Contract	0	0	TBD	TBD	Continuing (TBD)
In-House Support	0	0	TBD	TBD	Continuing (TBD)
GFE/ Other	0	0	TBD	TBD	Continuing (TBD)
Total	0	0	25,415	43,149	Continuing (TBD)

00610

Program Element: # 0207217F
PE Title: Follow-On Tactical Reconnaissance System
Project Number: 3792
Budget Activity: # 4 - Tactical Programs

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The RF-16 project focuses on providing the existing F-16 aircraft with a reconnaissance capability. This modification includes low-level, night/all-weather flight capability, together with a fully integrated tactical reconnaissance pod containing the TARS sensor suite. The cockpit will host reconaissance control mechanisms and a reconnaissance display on existing hardware. The RF-16 will be compatable with the JSIPS ground station. This project builds on planning and demonstrations previously conducted for the Follow-On Tactical Reconnaissance System.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments: Not Applicable

2. (U) FY 1989 Planned Program:
   - (U) Release Request for Proposal
   - (U) Conduct Source Selection
   - (U) Conduct Cockpit Missionization Simulations
   - (U) Conduct Analysis of Alternative Platforms

3. (U) FY 1990 Planned Program:
   - (U) Award Full-Scale Development (FSD) Contract
   - (U) Preliminary Design Review

4. (U) FY 1991 Planned Program:
   - (U) Critical Design Review
   - (U) Continue FSD
   - (U) Testing

5. (U) Program to Completion:
   - (U) Production Decision
   - (U) Field System

D. (U) WORK PERFORMED BY: Contractor not yet selected. The Aeronautical Systems Division, Wright-Patterson AFB OH, has in-house responsibility for system development.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	Addition of RF-16 as TARS platform	Delay IOC of manned TARS platform for USAF	$25415
Schd	None	None	None
Cost	None	None	None

Program Element: # 0207217F
PE Title: Follow-On Tactical Reconnaissance System
Project Number: 3792
Budget Activity: # 4 - Tactical Programs

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: The Deputy Secretary of Defense directed that the Advanced Tactical Air Reconnaissance System (ATARS) develop an F-16 derivative with a tactical reconnaissance pod to perform the tactical reconnaissance role. He further directed that the EO sensor upgrade for the RF-4C be cancelled. The RF-4C will still be used as a test vehicle for the sensors. For integration into the RF-16, $25,415 is added.
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) JMSNS, Mar 82
- (U) SDDM, 30 Mar 87
- (U) TAF SON, 14 Apr 88
- (U) PDM, 14 Jul 88

G. (U) RELATED ACTIVITIES: There is no unnecesary 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) TEST AND EVALUATION DATA: Not Applicable

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0001	TENCAP	312	322	335	345	Continuing	TBD
Total		312	322	335	345	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program responds to 1977 Congressional direction and has as its main objective the development of procedures, tactics and interface equipment/software to expand tactical use of within an operational combat framework as well as to influence the design and operation of capabilities to improve tactical support. Efforts will include participation in tactical exercises, system interface, software/hardware development, related developmental studies and the development of Congressional Impact Statements for major modifications and/or new starts in terms of their tactical combat operations utility.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 0001, TENCAP

(U) FY 1988 Accomplishments:
- (U) Development of tactical impact statement
- (U) For Special Project 1988 (PACEX), development of software and interface/connectivity/procedural evaluation planned.
- (U) Development of a prototype testbed for evaluation of CONSTANT SOURCE (a small ruggedized transportable UHF receipt exploitation system at wing/squadrons).

(U) FY 1989 Planned Program:
- (U) Continue study of methods to
- (U) Identification of requirements for information.
- (U) Procedural, software and hardware development and evaluation in support of

(U) FY 1990 Planned Program:
- (U) Refine software integration of multiple products for aircrew,
- (U) Integrate CONSTANT SOURCE, products.

00613

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

(U) FY 1991 Planned Program:
- (U) Develop down-sized wide-band transmission front end for tactical processors for (Air Force TENCAP is Executive Agent).

(U) Program to Completion:
- (U) This is a continuing program that will continue to develop tactical impact statements and support tactical exercises.

(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
- (U) Program Element
- (U) Program Element,
- (U) TENCAP formally interfaces with numerous 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.

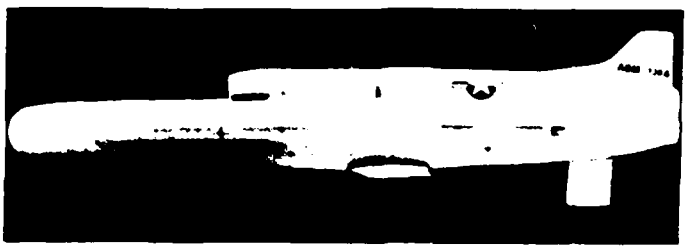
(U) International Cooperative Agreements: None.

00614

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

Project Title: Tacit Rainbow



POPULAR NAME: Tacit Rainbow

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	PPV Award	DAB IIIA	Lot 1 (LRIP) Award	DAB IIIB
Enginerng Milestones	1st free flt Apr 88	1st DT&E flt	N/A	N/A	N/A
T&E Milestones	N/A	DT&E/IOT&E starts	DT&E/IOT&E ends	FOT&E starts Navy OPEVAL	FOT&E ends
Contract Milestones	ongoing	ongoing	FSD ends	1st PPV Del 4Q FY91	1st Lot 1 Del 4Q FY 92
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total* (To Complete)
Major Contract	45,171	22,572	15,310	4,449	87,502* (0)
Support Contract	22,459	7,360	2,318	1,100	33,237* (0)
In-House Support	3,565	1,280	1,365	1,347	8,433* (876)
GFE/ Other	9,881	7,912	2,004	2,858	22,655* (0)
Total	81,076	39,124	20,997	9,754	151,827 (876)

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

Program Element: #0207316F
PE Title: Tacit Rainbow

Project Number: 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 and Navy A-6E 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 1988 Accomplishments:
   - (U) Continued Full Scale Development (FSD).
   - (U) Continued contractor development testing.
   - (U) Started development of Tacit Rainbow mission planning software.

2. (U) FY 1989 Planned Program:
   - (U) Continue FSD and begin the Air Force and Navy combined DT&E/IOT&E test program using the B-52G and A-6E.
   - (U) Continue development of the mission planning software which will reside on the Strategic Air Command's Phase III Strategic Mission Data Preparation System (SMDPS).
   - (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 1990 Planned Program:
   - (U) Make the Milestone IIIA low rate initial production decision for the missile.
   - (U) Continue development and begin testing of the mission planning system.

4. (U) FY 1991 Planned Program:
   - (U) Continue testing of the mission planning system.
   - (U) Award the Lot 1 production contract.

Program Element: #0207316F
PE Title: Tacit Rainbow

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

5. (W) Program to Completion:
   - (U) Conduct Follow-on Test and Evaluation with the B-52G and the Navy operational evaluation on the A-6 in FY 1992.
   - (U) The Milestone IIIB full rate production decision is planned for the beginning of FY 1993.
   - (U) Develop seeker upgrades needed to meet an expanded target base.
   - (U) Complete production for the Air Force and Navy
   - (W) The Air Force and Navy plan to buy a total of air launch vehicles, respectively.

D. (U) WORK PERFORMED BY: Northrop Corporation, Ventura Division, 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 being built 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, Golita CA for the mission computer. The Tacit Rainbow development and acquisition program is being managed by the Tacit Rainbow Joint System 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
TECH	NONE	NONE	+11.9M
SCHED	NONE	YES	NONE
COST	NONE	NONE	NONE

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: The $11.9 million increase in RDT&E is to develop the Tacit Rainbow (TR) mission planning software.
2. (U) SCHEDULE CHANGES: Milestone IIIA decision extended 14 months due to delay in start of combined DT&E/IOT&E.
3. (U) COST CHANGES: None.

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

00617

Program Element: #0207316F
PE Title: Tacit Rainbow

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

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.
- (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) and procurement of TR is included in Program Element #0207316N (Tacit Rainbow).
- (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.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement						
(U) Funds	0	24,403	6,950	18,943	10,914	61,210
(U) Quantity (launchers)	0	0	6	12	13	31
Missile Procurement						
(U) Funds	55.092	70.490	1.015	192.218	2.193.879	2.512.694*
(U) Quantity						
Military Construction						
(U) Funds	0	5,600	0	2,950	0	8,550

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

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207319F Budget Activity: #4 - Tactical Programs
Title: Standoff Land Attack Missile (SLAM)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1 Standoff Land Attack Missile (SLAM)						
	0	0	5,062	10,076	0	15,138

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Research, Development, Test and Evaluation (RDT&E) program was established to explore the cost effectiveness of SLAM and determine the modifications required to incorporate it on the B-52G aircraft. Efforts will include developing a Stores Management Overlay (SMO) software package for the B-52G's Integrated Conventional Stores Management System (ICSMS). This allows inflight planning and programming of SLAM by the B-52 crew after takeoff,

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project XXX1, SLAM: This project will develop an inflight mission planning and programming capability for SLAM on the B-52. When this capability is developed through an ICSMS SMO, it can be used by SLAM or any future standoff conventional weapon system.

(U) FY 1988 Accomplishments: Not Applicable

(U) FY 1989 Planned Program: Not Applicable

(U) FY 1990 Planned Program:
- (U) Develop SMO for B-52G ICSMS

(U) FY 1991 Planned Program:
- (U) Continue development of SMO for B-52G ICSMS
- (U) Develop and modify B-52 for SLAM carriage
- (U) Test B-52 inflight planning and programming system for SLAM

(U) Program to Completion: FY 1991

Program Element: #0207319F Budget Activity: #4 - Tactical Programs
PE Title: SLAM

(U) Worked Performed By: The B-52G aircraft modification development program for SLAM will be managed through the established ICSMS program office at Aeronautical Systems Division (AFSC), Wright-Patterson AFB, OH, and with the Navy's established SLAM program office, Program Manager, Air 258. Air Force Logistics Command, Oklahoma City Air Logistics Command, Oklahoma, will manage B-52 modification and contract Boeing Military Aircraft Company, Wichita, Kansas for the effort. McDonnell Douglas Astronautics Co., St. Louis, Missouri, will be under contract for development and testing of missile components.

(U) Related Activities:
- (U) Program Element #0603306N, Navy SLAM Program
- (U) Program Element #0604326F, Strategic Conventional Standoff Capability (HAVE NAP)
- (U) Program Element #0101113F, B-52 Squadrons (ICSMS)

(U) Other Appropriation Funds: None

(U) International Cooperative Agreements: None

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2704 EIFEL Follow-On	8,729	5,707	3,524	4,110	Continuing	TBD
Total	8,729	5,707	3,524	4,110	Continuing	TBD

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 United States Air Force will cooperate with the Federal Republic of Germany in the joint development of a follow-on system to augment and expand the current EIFEL I system from the ATOC down to the wing/squadron level.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2704, EIFEL Follow-On: Expansion and augmentation of current EIFEL program in cooperation with the Federal Republic of Germany.

(U) FY 1988 Accomplishments:
- (U) Application software development begun.
- (U) Interface between EIFEL and the Wing Command and Control System proof of concept demonstration accomplished.

(U) FY 1989 Planned Program:
- (U) Install new central processor in the ATOC.
- (U) Complete software development, integration, and testing.
- (U) Demonstrate proof of concept for the interface between EIFEL and the Force Level Automated Planning System.

(U) FY 1990 Planned Program:
- (U) Install EIFEL system and transition from EIFEL-I to EIFEL Follow-On.
- (U) Develop an interface between EIFEL and the Wing Command and Control System (WCCS).
- (U) Develop and intall the interface between EIFEL and the Force Level Automated Planning System (FLAPS).
- (U) Develop computer aided instruction packages for training EIFEL users.

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

(U) FY 1991 Planned Program:
- (U) Develop computer-aided instruction packages for EIFEL users.
- (U) Develop automated mission analysis/decision aids to support the battle manager in the ATOC.
- (U) Install the EIFEL/WCCS interface between EIFEL and all WCCS sites.

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

(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.
- (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 system. 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 German Dornier Corp was awarded the contract for software development in 1985. The US cost share for this contract is defined by a financial arrangement among the five participating nations. Negotiations are in process to restructure the Dornier contract due to late delivery of German GFE to Dornier. Initial operating capability is projected for November 1989.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

A. (U) RESOURCES ($ in thousands)

Project Title / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
TACS Improvements	15,733	13,290	22,322	28,648	Continuing	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 controls his forces to accomplish his assigned mission. This program provides major improvements to the existing TACS which was deployed in the 1960s and is nearing the end of its useful life. Improvements include developing a new transportable, modularized, automated air command and control system and two electronic countermeasure programs to enhance the survivability and capabilities of the AN/TPS-43E surveillance radar. The TACS Improvement RDT&E program consists of the Modular Control Equipment (MCE) Pre-Planned Product Improvement (P3I) and the Anti-Radiation Missile (ARM) Decoy programs. MCE P3I improves the baseline MCE to ensure it is interoperable and compatible with newly fielded systems. Block 1 includes JTIDS integration, an Automated Air Tasking Order capability, secure anti-jam VHF radios, an upgraded SATCOM interface, and a Ground Attack Control Capability. The ARM Decoy program will develop a set of decoys designed to lure ARMs from the ground surveillance radars of the TACS.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Completed development of the ARM Decoy.
   - (U) Began MCE P3I full scale development with contract award on 29 April 1988.

2. (U) FY 1989 Planned Program:
   - (U) Complete ARM Decoy DT&E.
   - (U) Continue MCE P3I development: begin in-plant brassboard and preliminary software testing.

3. (U) FY 1990 Planned Program:
   - (U) Award ARM Decoy production contract.
   - (U) Continue MCE P3I development: hardware fabrication and software integration testing near completion.

4. (U) FY 1991 Planned Program:
   - (U) Begin MCE P3I in-plant development testing.

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

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

D. (U) WORK PERFORMED BY: Major contractors are: Aydin Corporation, San Jose, CA, ITT Corporation, Van Nuys, CA, and LTV Corporation, Buffalo, NY for Anti-Radiation Missile (ARM) Decoy System; Litton Data Systems, Van Nuys, CA for MCE P3I.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

:Type of :CHANGE	: Impact on : System Capabilities	: Impact on : Schedule	: Impact on : FY 1989 Cost :
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION: TAF SON 316-80, "Improved Tactical Air Surveillance/Improved Tactical Air Control System," 17 Nov 80 (S), amended 15 Jul 83.

G. (U) RELATED ACTIVITIES: MCE P3I is a joint program, integrating the Joint Tactical Information Distribution System (JTIDS) Class 2 terminal (0604771D) into MCE and the US Marines' Tactical Air Operations Module (0206626M). Both the Marine (0604719M) and Air Force (0604754F) JTIDS programs are contributing to MCE P3I for JTIDS integration. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

H. (U) OTHER APPROPRIATION FUNDS:

Other Procurement (BA 4):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	0	0	8,822	24,684	Continuing	TBD
Quantities:						
ARM Decoy	0	0	2	14	49	65
MCE P3I	0	0	0	0	148	148

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

1. (U) Award ARM Decoy production contract 1 Qtr FY 1990
2. (U) Begin MCE P3I IOT&E 3 Qtr FY 1992

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207417F Project Number: N/A
PE Title: Airborne Warning and Control System 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		HQ A-Nets Prod Dec RSIP AFSARC	ESM Prod Dec	30/35 Prod Decision	RSIP Prod Decision
Engineering Milestones	ESM CDR 30/35 CDR		RSIP SDR RSIP PDR	RSIP CDR	
T&E Milestones			ESM IOT&E	30/35 IOT&E	RSIP IOT&E
Contract Milestones		RSIP FSD AWARD	ESM FCA/PCA	30/35 FCA/PCA	RSIP PCA
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Prog Total To Complete
Major Contract	68,034	87,336	105,678	109,052	Continuing
Support Contract	5,718	14,158	14,125	800	Continuing
In-House Support	11,222	7,836	5,573	4,209	Continuing
GFE/ Other	11,553	6,794	14,256	12,170	Continuing
Total	96,527	116,124	139,632	126,231	Continuing

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

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This program develops and integrates 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's inherent capabilities and keep pace with the evolving threat. These improvements include Electronic Support Measures (ESM), JTIDS Class 2H/TADIL J terminal integration, central computer memory upgrade, and the NAVSTAR GPS (collectively known as Block 30/35), the Radar System Improvement Program (RSIP), HAVE QUICK and Mark XV. 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 1988 Accomplishments:
   - (U) Block 30/35 full scale development (FSD) continued, system Critical Design Review (CDR) successfully accomplished.
   - (U) RSIP risk-reduction activities continue to select the best design approach.
   - (U) HAVE QUICK A-NETS development efforts continue, flight tests were completed, and production proposal in evaluation.
   - (U) Trainer External Simulation System FSD continues. Currently undergoing software testing, which is anticipated to continue until January 1989.

2. (U) FY 1989 Planned Program:
   - (U) The ESM system will complete engineering test and evaluation, and will begin system test in July 1989 with IOT&E from September to December 1989.
   - (U) The RSIP FSD will begin.
   - (U) TESS FSD will be completed.
   - (U) HAVE QUICK A-NETS FSD will be completed and production will begin.
   - (U) Mark XV Identification Friend or FOE (IFF) integration studies are scheduled to begin for the improved Identification Functional Group.

3. (U) FY 1990 Planned Program:
   - (U) Block 30/35 will continue FSD. Two kit proofs will be acquired. The ESM production decision will be made.
   - (U) Mark XV IFF pre-FSD activities will be completed.
   - (U) RSIP System Design Review and Preliminary Design Review will be accomplished.

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

4. (U) FY 1991 Planned Program:
   - (U) Block 30/35 flight testing will be completed with subsequent production decision.
   - (U) RSIP FSD will continue and Critical Design Review will be accomplished.
   - (U) Mark XV IFF integration into the E-3 will begin FSD.

5. (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 U.S. 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 integration); Westinghouse Electric Corporation, Baltimore, MD (radar); International Business Machines, Owego, NY (Data Processor); Singer Kearfott Corporation, Little Falls, NJ (JTIDS); UTL Corporation, Dallas, TX (ESM).

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	IMPACT ON SYSTEM CAPABILITIES	IMPACT ON SCHEDULE	IMPACT ON FY 1990 COST
Tech	Yes	Yes	
Schd	No	Yes	
Cost	Yes	Yes	+16,142

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: RSIP FSD is restructured to adopt a pulse compression waveform technical approach.
2. (U) SCHEDULE CHANGES: Restructured RSIP FSD starts in FY 1989 vice FY 1988 due to extended risk reduction efforts and Congressional funding reduction in FY 1989. Restructured RSIP Initial Operational Capability moves from FY 1993 to FY 1995.
3. (U) COST CHANGE: Block 30/35 RDT&E funds increased in FY 1990-92 to purchase two trial install production kits on the FSD contract (versus the production contract). RSIP FSD cost revised upward based on independent cost estimate (Production cost estimate revised downward).

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) US-NAPMO Cooperative R&D Agreement for E-3 ESM, 17 Nov 86
   - (U) Acquisition Plan 86-AP-019, 14 Nov 85, and J&A 86-J&A-019, 16 Sep 85.

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

00627

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 and development/integration of Single Channel Ground and Airborne Radio System (HAVE SYNC) are funded in PE 0207423F, Advanced Communications Systems.
- (U) Development and integration of the Mark XV improved Identification Functional Group is funded in PE 0604725F, Combat Identification Systems.
- (U) United Kingdom and France direct commercial E-3 purchases include, and are dependent upon, the USAF-developed E-3 integration of the Tactical Data Information Link J (TADIL J) and central computer memory upgrades.
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	Total Program
Aircraft Procurement, BA 11-Modifications (Class V Mod kits & initial spares)	20,900	13,200	24,800	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 U.S. 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 U.S. vendor for the ESM equipment. Total FSD cost is estimated at $150 million with NATO contributing a 35% share. NATO and the United Kingdom have indicated a desire to cooperatively participate in the RSIP program and other U.S. E-3 improvements. Discussions on participation are in the exploratory phase, and informal discussions between the USAF and OSD/ISA to develop a U.S. position have been initiated.

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	Planned Date	Remarks
ESM DT&E	July-August 1989	
ESM IOT&E	September-December 1989	
Block 30/35 DT&E	May-July 1990	
Block 30/35 IOT&E	October-November 1990	
RSIP DT&E	May-June 1992	
RSIP IOT&E	March-April 1993	

00628

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2614 HAVE SYNC	4,140	3,361	1,126	697	794	48,734
2982 HAVE QUICK II	25,350	7,017	10,102	6,253	6,150	92,907
Total	29,490	10,378	11,228	6,950	6,944	141,641

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 effort and a NATO Standardization Agreement (STANAG) for this system is in coordination. 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 (e.g., A-10, OV-10, and C-130), is fully interoperable with the Army's ground SINCGARS radio. In order to equip our own ground forces (Tactical Air Control Parties (TACPs), Combat Control Teams, etc.), the Air Force will procure ground SINCGARS radios from the Army.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(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 requiring 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 field Mean Time Between Failure (MTBF) requirement of 2,000 hours.

(U) FY 1988 Accomplishments:
- (U) Conducted qualification testing of engineering hardware.
- (U) Finalized planning for DT&E/IOT&E.

00629

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

(U) FY 1989 Planned Program:
- (U) Conduct DT&E/IOT&E Program.
- (U) Complete FSD of the HAVE SYNC radio.

(U) FY 1990 Planned Program:
- (U) Initiate development of Dual Communications-Navigation (COMNAV) control head and Depot Repair Capability.
- (U) Finalize Key Distribution Management System (KDMS) software.
- (U) Award production contract for initial lot of HAVE SYNC radios and begin procurement of ground SINCGARS equip.

(U) FY 1991 Planned Program:
- (U) Complete dual COMNAV control head and Depot Repair Capability development efforts.
- (U) Continue fielding of HAVE SYNC and SINCGARS radios.

(U) Program to Completion:
- (U) Complete all development and fielding activities.

(U) WORK PERFORMED BY: Air Force Systems Command, Electronic Systems Division (AFSC/ESD), Hanscom AFB, MA, has program management responsibility; Cincinnati Electronics Corp., Cincinnati, OH is the prime contractor with McDonnell Douglas Electronics Co., St Charles, MO, as a second source.

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

(U) OTHER APPROPRIATION FUNDS

PROCUREMENT FUNDS ($ in Thousands):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3010	0	0	3,751	7,024	200,025	210,800
3080	0	0	5,098	4,545	99,157	108,800

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0207423F Project Number: #2982
PE Title: Advanced Comm. Systems Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: HAVE QUICK II

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
HAVE QUICK II	25,350	7,017	10,102	6,253	6,150	92,907

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
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 (nicknamed HAVE QUICK IIA), 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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued development of the HAVE QUICK IIA airborne radio.
   - (U) Began development of a HQ IIA - capable ground radio.

2. (U) FY 1989 Planned Program:
   - (U) Complete development and initiate production of the HAVE QUICK IIA airborne radio.
   - (U) Complete development and begin production of the timing system upgrades.

3. (U) FY 1990 Planned Program:
   - (U) Complete development and initiate production of the 100-watt high power amplifier (HPA).
   - (U) Begin A-kit integration development effort to install the HPA on the F-15 aircraft.
   - (U) Complete development and initiate production of the HQ IIA capable ground radio.
   - (U) Begin development of a Modular Automatic Test Equipment (MATE) capability for HAVE QUICK IIA.

Program Element: #0207423F Project Number: #2982
PE Title: Advanced Comm. Systems Budget Activity: #4 - Tactical Programs

4. (U) FY 1991 Planned Program:
   - (U) Continue A-kit development to install HPA on the F-15.
   - (U) Initiate development of a software configuration management effort for HAVE QUICK IIA.
   - (U) Complete development of the HQ IIA MATE capability.
   - (U) Continue studies for additional system AJ improvements.

5. (U) Program to Completion:
   - (U) Complete development, production and installation of all improvements.

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

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	-1,198

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: None.
3. (U) COST CHANGES: Cost delta is the result of a transfer of funds to HAVE SYNC Program (Project 2614).

F. (U) PROGRAM DOCUMENTATION:
   - (U) Program Management Directive 3094(7) 10 Mar 1987
   - (U) Ground HAVE QUICK II/IIA Acquisition Plan 2 Jun 1987

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:

PROCUREMENT FUNDS ($ in Thousands):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3010	7,500	24,156	22,889	29,812	313,032	397,389
3080	5,059	4,409	5,334	11,157	53,313	113,679

Program Element: #0207423F Project Number: #2982
PE Title: Advanced Comm. Systems Budget Activity: #4 - Tactical Programs

I. (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.

J. (U) MILESTONE SCHEDULE:

1.	(U) FSD, HQ IIA Airborne Radio	May 1987 - Jun 1989
2.	(U) Production Award, New Control Head	Jun 1987
3.	(U) FSD, HQ IIA Ground Radio	Aug 1988 - Nov 199
4.	(U) Product. Award, HQ IIA Airborne Radio	Jul 1989
5.	(U) Product. Award, HQ IIA Ground Radio	Dec 1991

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3009 Intra-Theater Intelligence Communications Network (IINCOMNET)						
	1,930	0	462	472	0	3,375
Total	1,930	0	462	472	0	3,375

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3009, IINCOMNET:

(U) FY 1988 Accomplishments:
- (U) Phase I FOC - IINCOMNET hardware installed on main operating bases.
- (U) Achieve multilevel secure release capability on installed hardware.

(U) FY 1989 Planned Program:
- (U) Continue Phase II - install hardware on remaining bases.

(U) FY 1990 Planned Program:
- (U) Continue Phase II - develop software to interactively communicate with multilevel secure release system.
- (U) User equipment includes regional hosts in North, South, and Central European regions

(U) FY 1991 Planned Program:
- (U) Complete development of interactive software
- (U) Provide interface to NATO facilities with multi-net gateway
- (U) Phase II FOC - implementation of multi-net gateway

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

(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:

(U) Other Appropriation Funds:

Other Procurement (BA 4):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	675	0	0	0	0	675

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SEEK EAGLE	0	0	16,797	17,807	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 Dec 1988, there were 19 aircraft and 95 store types in work under SEEK EAGLE certification and/or accuracy verification. This, in turn, involved over 800 aircraft/store configurations in various stages of the process. Previously, SEEK EAGLE was funded through aircraft and store PEs. The inefficiencies and unacceptable delays in getting SEEK EAGLE products to the field surfaced the need for better overall control and efficiency through centralized management and funding.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Program: Funded through aircraft and store PEs.

2. (U) FY 1989 Planned Program: Funded through aircraft and store PEs.

3. (U) FY 1990 Planned Program:
   - (U) Initiate intensive ballistics accuracy verification program of MK-82, MK-84, CBU-87, CBU-89, MK-20, and BLU-107 stores on the F-15E.
   - (U) Accomplish certifications and/or accuracy verifications of

Program Element: #0207590F
PE Title: SEEK EAGLE

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

the GBU-12, CBU-87, CBU-89, and GBU-10 on the F-16 A/B/C/D, Harpoon on the F-16 C/D, and mixed loads of weapons on the F-111A/D/E/F. Also, complete the ALQ-176 and BLU-107 on the F-16A/B, and the AGM-65G on the F-16A/B and F-4D/E/G.

- (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.

4. (U) FY 1991 Planned Program:
   - (U) Work will be done on certifications and verifications of the GBU-24A/B and the GPU-5/A on the F-16A/B/C/D, and the AIM-120 (AMRAAM) on the F-15E.
   - (U) Complete SEEK EAGLE efforts on the AIM-120 with LAU-106A and LAU-128 on the F-15E. Continue CBU-87 on F-15E.
   - (U) High Speed Air Drop Container certification on the F-16 C/D.
   - (U) As in FY 1990, work will be accomplished on the hundreds of other aircraft/store configurations in addition to the above highlighted examples.

5. (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 AF Armament Division, Eglin AFB FL; AF Flight Test Center, Edwards AFB CA; Ogden Air Logistics Center (ALC), Hill AFB UT; Sacramento ALC, McClellan AFB CA; and the Oklahoma City ALC, Tinker AFB OK.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY: Not Applicable.

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.

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) 0207129F	F-111 Squadrons

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

Program Element	Title
- (U) 0207134F	F-15E Squadrons
- (U) 0207131F	A-10 Squadrons
- (U) 0207133F	F-16 Squadrons
- (U) 0207218F	TAC Fighter Training (Agressor) Squadrons
- (U) 0207248F	Special Tactical Unit Detachments
- (U) 0207597F	Training-Tactical Air Forces
- (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:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Missile Procurement/(BA 4,AMRAAM)						
Funds	0	0	4,667	0	Cont.	TBD
Quantities	0	0	12	0	Cont.	TBD
Other Procurement/(BA 4, I-2000)						
Funds	0	0	0	776	Cont.	TBD
Quantities	0	0	0	65	Cont.	TBD
Other Procurement/(BA 4, BIGEYE)						
Funds	0	0	2,306	1,577	Cont.	TBD
Quantities	0	0	95	65	Cont.	TBD
Other Procurement/(BA 4, SFW)						
Funds	0	0	0	24,281	Cont.	TBD
Quantities	0	0	0	188	Cont.	TBD
Military Construction: Not Applicable						

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE: Each of the SEEK EAGLE requests from the AF operational commands has a projected need date. Key milestones such as engineering analysis, ground test, flight test, OFP update, and TO publication for the roughly 800 requested loading configurations are established but are too numerous to list here. One example is the MK-82 LDGP on the F-15E, scheduled for separation effects tests in Feb-Jun 1990, final OFP verification flights in Aug-Oct 1991, and TO publication in Jan 1992

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
N/A Mission Planning System	0	0	2,485	6,950	Continuing	TBD
Total	0	0	2,485	6,950	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Mission Planning System (MPS) will support development and acquisition of Air Force automated mission planning systems for tactical, strategic, airlift and SOF forces; specifically to provide automated mission planning, intelligence, weather, weapons, electronic combat and navigation information to aircraft and associated weapons systems. Provides automated interface with Theater, Command, and Joint data bases. Loads and reads automated aircraft/weapon data systems cartridge units. Provides ground and aircraft support for all associated command and control systems. This is a new program element which consolidates ongoing efforts.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Mission Planning System (MPS) (No project number): Present TAF mission planning capabilities cannot adequately support the stated mission element need. Existing systems 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. This program was created to preclude unnecessary duplication of effort and consolidate the ongoing, fragmented mission support system development efforts by individual weapon programs such as the F-15, F-16, F-111, and F-4. These programs were developing weapon system unique Mission Support Systems (MSS's). MSS I was originally designed for the F-16 and MSS II builds upon MSS I to satisfy an increased portion of the total requirement. These interim systems will lead to and assist in the development of upgrades and follow-on systems satisfying the full requirement.

(U) FY 1988 Accomplishments: Not Applicable.

(U) FY 1989 Planned Program: Not Applicable.

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

(U) FY 1990 Planned Program:
- (U) Deploy validated software for MSS II. This will upgrade graphics capability, supportability, and increase memory and processing speed of the central processing unit.
- (U) Award contract for MSS III development program. This will start development of a competitively acquired mission planning software and associated hardware enhancements for tactical platforms and weapons. Primary emphasis will be on preliminary design leading to a Preliminary Design Review, with attention given to future planned enhancements to meet stated requirements as technology matures.

(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) Continue Full Scale Development of the MSS III system initiated in FY 1990. Complete the Critical Design Review of MSS III, begin hardware and software integration, and component test. Plan for future enhancements.

(U) Program to Completion:
- (U) Complete MSS III certification process.
- (U) Deploy initial hardware and software to user commands.
- (U) Accomplish planned software/hardware enhancements.

(U) Work Performed By: The Mission Planning System's development program is being managed by the Directorate for Battle Management, Electronic Systems Division, Hanscom AFB MA. They will manage a competition to select a contractor for development and production of an Advanced Mission Support System (MSS III). The Mission Support System II contractor is Fairchild Communications and Electronics Company, Germantown MD.

(U) Related Activities:
- (U) The Mission Support System I (MSS I) was developed in PE #0207133F, F-16 Squadrons.
- (U) The Mission Support System II (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) 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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2260 Communications Nodal Control Element	1,000	0	0	0	0	153,000
2266 Digital Troposcatter Terminal	4,600	0	0	0	0	64,000
2270 Support and Integration	830	4,234	3,536	4,713	N/A	N/A
Total	6,430	4,234	3,536	4,713	N/A	N/A

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 to improve interoperability during the transition period to TRI-TAC.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 2270 Support and Integration: Support to TRI-TAC acquisition and integration activities. Numerous tasks include the development of system manuals, planning aids, integration of TRI-TAC equipments into non-TRI-TAC Command and Control Systems, development of maintenance shelters, evaluation of Air Force TRI-TAC to Mobile Subscriber Equipment interoperability issues, equipment fielding support, and basic level of effort program office support.

(U) FY 1988 Accomplishments:
- (U) Delivery of AN/TTC-39 Mission Planning Software for field demonstration
- (U) Delivery of drawings for prototype AFCC Maintenance Van
- (U) Integration support for fielding of TRI-TAC Equipment into Radar Remoting Vans (RRV)
- (U) Development of rack design for integration of TRI-TAC into the Air Support Operations Center (ASOC)

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

(U) FY 1989 Planned Program:
- (U) Delivery of software for mission planning the TTC-39A
- (U) Continued support to ASOC and RRV integration
- (U) Planning to resolve TRI-TAC to Mobile Subscriber Equipment interoperability problem.
- (U) Quantification of residual integration tasks in preparation for FY 93 termination of AF TRI-TAC program.

(U) FY 1990 Planned Program:
- (U) Prior integration activities will continue.
- (U) Integration design to support NATO interoperability improvements.

(U) FY 1991 Planned Program:
- (U) Prior integration activities continue.
- (U) Acquisition planning to support Deployable Communciations Architecture

(U) Program to Completion:
- (U) This is a continuing 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 Coproration, Burlington, MA, amd MITRE Corporation, Bedford, MA, Systems Engineering Support.

(U) Related Activities: Work is conducted by all Services under overall direction of the Office of Assistant Secretary of Defense, Command, Control, and Communication and Intelligence, and the guidance of the Joint Tactical C³ Agency, Ft Monmouth NJ. 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
Other Procurement* Funds	147,633	151,333	126,360	115,290	Continuing	N/A

* These funds are for the procurment 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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Additional to Completion	Total Estimated Cost
374 - C3 PROTECTION/MULTI-MISSION, TECHNOLOGY AND SUPPORT						
TOTAL	0*	0*	2,490	2,697	Continuing	N/A

* Funds contained in PE 0604241F in FY88 and 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 exiting 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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

(U) FY 1988 Program Accomplishments/in progress:
- (U) Engineering evaluation for feasibility of using On Board Electronic Warfare Simulator on several different aircraft -- contract awarded SAIC
- (U) Develop prototypes for the following:
  -- (U)

  -- (U) EW/ESM modeling system for shipboard use -- an EMCON training tool -- in progress

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

— (U) Synthetic jamming system for naval ECCM training — to train communications operators -- contract awarded to Systems Planning Corporation

(U) FY 1989 Planned Program:

- (U) Complete testing of 1988 prototypes

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

- (U)

- (U)

- (U)

(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 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 Security Systems (NDSS) Department, Annapolis, MD. Under JEWC management, NDSS performs engineering analysis, procures, fabricates, tests and demonstrates engineering models to satisfy CINC identified operational shortfalls.

(U) RELATED ACTIVITIES: Program supports all service and joint electronic combat (EC) programs and builds upon technology demonstrated in PE 0604241F, Electronic Warfare Development, and other services applicable program elements. Technology that satisfies similar requirements for other PEs include those in PE 0603711A, Aircraft Survivability Equipment; PE 0603718A, Vulnerability Susceptibility; PE 0603755A, Tactical Electronic Countermeasures Systems; PE 0603214N, Tactical C3 Countermeasures.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3163 UHF Satellite Terminal System (USTS)	6,529	4,870	800	145	Continuing	TBD
3164 Ground Mobile Forces Terminals (GMFT)	200	4,890	4,155	4,795	Continuing	TBD
3594 Universal SHF Satellite Communications Modem (UM)	6,867	7,978	960	970	Continuing	TBD
Total	13,596	17,738	5,915	5,910	Continuing	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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 with the Navy developed 25 KHz UHF satellite DAMA systems.

(U) FY 1988 Accomplishments:
- (U) Continued development of USTS terminal and network control station.
- (U) Hardware Critical Design Review (CDR) May 1988.
- (U) Software CDR in July 1988.
- (U) Informal DT&E began September 1988.
- (U) Received Joint Chiefs of Staff direction to use Type I COMSEC to secure the DAMA channel controller.

(U) FY 1989 Planned Program:
- (U) Interoperability demonstration with Navy 25 KHz DAMA system.
- (U) Initiate Engineering Change Proposal (ECP) for Type I COMSEC to be added to the USTS baseline for securing the DAMA channel controller.

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Program Element: #0303605F Budget Activity: #4 - Tactical Programs
PE Title: Military Satellite Communications (MILSATCOM) Terminals

(U) FY 1990 Planned Program:
- (U) Complete development of the USTS terminal and network control system with Type I COMSEC and interoperable 5 KHz and 25 KHz DAMA schemes.
- (U) Initial Operational Test & Evaluation (IOT&E).
- (U) Begin production of USTS terminals and network control stations.

(U) FY 1991 Planned Program:
- (U) Conduct OT&E testing of USTS system.

(U) Program to Completion:
- (U) Complete production of 300 terminals by FY 1995.
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	-	1,926	7,300	6,758	Continuing	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).

Program Element: #0303605F Budget Activity: #4 - Tactical Programs
PE Title: Military Satellite Communications (MILSATCOM) Terminals

(U) FY 1988 Accomplishments:
- (U) Supported the continued fielding and follow-on testing of the multi-channel SHF terminals.
- (U) Supported the study and refinement of requirements for SHF manpack terminals as well as assessing the potential for state-of-the-art technology to be applied toward requirements.

(U) FY 1989 Planned Program:
- (U) Support integration of the AJCM modems into the multi-channel SHF terminals worldwide.
- (U) Conduct a demonstration/validation program for SHF lightweight manpack terminals.

(U) FY 1990 Planned Program:
- (U) Complete the integration of AJCM modems into the multi-channel SHF terminals.
- (U) Complete the demonstration/validation program for SHF light-weight manpack terminals.
- (U) Support Air Force participation in the Army SCOTT program.

(U) FY 1991 Planned Program:
- (U) Initiate Full-Scale Engineering Development (FSED) of the SHF lightweight manpack terminal program.
- (U) Continue Air Force participation in the Army SCOTT development 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 currently fielding SHF multi-channel terminals 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 4):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost	1,521	1,347	6,099	25,944	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

Program Element: #0303605F Budget Activity: #4 - Tactical Programs
PE Title: Military Satellite Communications (MILSATCOM) Terminals

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.

(U) FY 1988 Accomplishments:
- (U) Awarded brassboard (prototype) development contracts to two competing US/UK teams.

(U) FY 1989 Planned Program:
- (U) Conduct brassboard (prototype) demonstration testing.
- (U) Evaluate results of brassboard testing.
- (U) Downselect to one US/UK team for Full-Scale Engineering Development (FSED) contract.

(U) FY 1990 Planned Program:
- (U) Submit the Universal Modem waveform for validation as the DOD standard to the Joint Chiefs of Staff.
- (U) Do not proceed into FSED due to resource constraints but maintain a small cadre of techical experts to stay abreast of advances in SHF modem technology.

(U) FY 1991 Planned Program:
- (U) Continue to pursue and support the technology developments for SHF satellite modems.

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

(U) Work Performed By: Work is being performed by two US/UK leader/follower teams. The teams are M/A-COM of San Diego, CA with Plessey of Christchurh, UK and Raytheon of Marlboro, MA, Harris Corp of Melbourne, FL with Ferranti of Bracknell, UK.

(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: A formal Memorandum of Understanding (MOU) has been negotiated with the United Kingdom by the Office of Assistant Secretary of Defense for Command, Control, Communications and Intelligence. The UK provides a Deputy Program Manager for the Joint Program Office and has contributed funding ($2 Million) towards the program. The potential exists for French participation in the program, and agreements are being pursued.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2907	Electronic Combat (EC) Intelligence Support	*	*	1744	1793	Continuing	TBD
Total				1744	1793	Continuing	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 files (EWIS) and 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 efforts in software development of digital intelligence products (Reference Threat Packages) specifically targeted for application to digital computer models and simulations to support the entire life cycle of EC weapon systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(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 EWIS program provides the intelligence information and parametric data to program these systems to meet the hostile emitter threat. 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 1988 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 1989 Planned Programs
- (U) Continued subfile development of threat EO/IR systems.
- (U) Continued update/expansion of EWIS data base to support IDIP and SIMVAL efforts.

- (U) Initiated RMA effort to develop digital intelligence products (Reference Threat Packages) for digital computer models and simulators.

(U) FY 1990 Planned Program:
- (U) Continue data base development to support IDIP and SIMVAL efforts.
- (U) Expand RMA digital software capability to meet present and future requirements.

(U) FY 1991 Planned Program:
- (U) Continue EWIS database maintenance/development and SIMVAL efforts.
- (U) Continue IDIP production and expand RMA program.

(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 Sverdup 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.

(U) Other Appropriation Funds:

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate
N/A	N/A	N/A	N/A

(U) International Cooperative Agreements: None.

FY 1990/FY 1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0401840F
Title: Military Airlift Command Command and Control System (MAC C2)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)

Project Title / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MAC Command and Control System						
MAC C2	6,486	8,907	10,989	11,446	Continuing	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 C^2 system. It satisfies essential elements of the MAC C^2 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. Increment II will build on Increment I by adding hardware and software *to support mission execution monitoring.* Increment III will continue to build by adding mission planning and scheduling functions.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) IPS concept definition work completed.
   - (U) Began selection of implementation phase contractor.

2. (U) FY 1989 Planned Program :
   - (U) Select implementation phase contractor.
   - (U) Develop system design and architecture.
   - (U) Begin development of Increment I applications software.

3. (U) FY 1990 Planned Program:
   - (U) Continue software development.
   - (U) Begin hardware buy and IPS Increment I installation.

4. (U) FY 1991 Planned Program:
   - (U) Continue installation of Increment I.
   - (U) Begin development of Increment II applications software.

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

D. (U) WORK PERFORMED BY: The IPS Implementation Phase contractor is Computer Sciences Corporation, Moorestown, NJ.

Program Element: #0401840F
PE Title: MAC Command and Control System (MAC C2)
Project Number: N/A
Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	+5 months	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: The IPS maintenance concept was redone because all hardware proposed for the Implementation Phase was off-the-shelf. The original maintenance concept planned for maintaining developmental hardware. This change required a reproposal from each competitor in how they approached system maintenance.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION: MAC Statement of Need 3-81.

G. (U) RELATED ACTIVITIES: RDT&E funding for Ultra High Frequency (UHF) satellite terminals is in PE 0303605F, Satellite Communications Terminals.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	FY 1992 Estimate
Other Procurement*	100	100	1,985	15,207	26,708

* Only that portion of the total procurement funding in PE 0401840F dedicated to the Information Processing System is shown above. There are other programs (e.g. Automatic Communications Processor) within MAC C2 which do not have any development funds; they use procurement funds only.

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

J. (U) MILESTONE SCHEDULE:

1. (U) Implementation Phase contract award — Dec 88
2. (U) First node installed with Increment I — Oct 90
3. (U) Begin development of Increment II — Oct 90

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0502610F Budget Activity: # 4 - Tactical Programs
Title: A-7 Squadrons (ANG)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3275 A-7 Avionics Test Station Replacement	6,084	9,546	5,759	38	0	24,427
3606 A-7 Upgrade	48,570	73,014	24,186	4,894	0	179,982
3661 CAS Study	4,760	0	0	0	0	9,760
Total	59,414	82,560	29,945	4,932	0	214,169

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: The aging A-7 "Big Eight" testers are rapidly becoming logistically unsupportable and unreliable and are projected to be totally unsupportable by 1990. The new, deployable test stations 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 1988 Accomplishments:
- (U) Preliminary Design Review (PDR) - April 1988.
- (U) Hardware Critical Design Review (CDR) - July 1988.
- (U) Software Critical Design Review (CDR) - September 1988.
- (U) Independent Verification and Validation (IV&V) support.

(U) FY 1989 Planned Program:
- (U) Prototype delivery - May 1989.
- (U) Development test and evaluation (DT&E) complete - November 1989.
- (U) IV&V support.
- (U) Production go-ahead.

(U) FY 1990 Planned Program:
- (U) Operational Test and Evaluation (OT&E) complete - August 1990.
- (U) IV&V support.
- (U) Production deliveries.

Program Element: #0502610F Budget Activity: # 4 - Tactical Programs
Title: A-7 Squadrons (ANG)

(U) FY 1991 Planned Program:
- (U) Initial operational capability (IOC) established - October 1990.
- (U) IV&V support.
- (U) Production deliveries.
- (U) Engineering Change Proposals (ECPs).

(U) Work Performed By: Project 3275 (A-7 Avionics test Station Replacement Program) is on contract with allied Bendix Corp., Teterboro NJ and managed by the San Antonio Air Logistics Center, Kelly AFB TX.

(U) Related Activities:
- (U) Modular Automatic Test Equipment (MATE) program, PE 0604247F, which provides the A-7 test stations control and support software as government furnished equipment (GFE) -- NOTE: test stations are fully 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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
A-7 Plus	48,570	73,014	24,186	4,894	0	179,982

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 cost-effective 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 1988 Accomplishments:
   - (U) Continuation of the FY 1987 program leading to production of two prototype aircraft and data packages.
   - (U) TAC, AFSC, AFLC, NGB, and SAF/AQ have agreed on an A-7F configuration and have validated cost estimates.
   - (U) Initial indications in studies conducted by independent contractors, AFSC, and AF/SA indicated that the A-7F appears to be a cost-effective solution to meet the requirements.

2. (U) FY 1989 Planned Program:
   - (U) Continuation of RDT&E Program and initiation of flight testing of the two prototypes.

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)
Project Number: 3606
Budget Activity: # 4 - Tactical Program

- (U) Prototypes will be configured with an augmented engine, associated airframe, and aerodynamic mods required to provide the desired handling qualities and survivability improvements.
- (U) Efforts include extensive data reduction and data package development.
- (U) Integration of all avionics mods will be accomplished separately and are not part of this prototype effort.
- (U) A-7F survivability study will be completed.

3. (U) FY 1990 Planned Program:
   - (U) Completes 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) Engineering Change Orders (ECOs) generated during flight test will be incorporated into the reprocurement data.
   - (U) Survivability and vulnerability enhancements recommended by the OSD-directed aircraft survivability analysis will be assessed.

4. (U) FY 1991 Planned Program:
   - (U) Completes the incorporation of ECOs and finalizes the data.
   - (U) Approved survivability and vulnerability enhancements will be incorporated.

5. (U) Program to Completion:
   - (U) Not applicable. Final year of RDT&E funding is FY 1991.

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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:
   - (U) Program Budget Decision (PBD) 235A, 19 Dec 86.
   - (U) SON TAF/ANG/AFRES 503-86, 19 Feb 87.

G. (U) RELATED ACTIVITIES:
   - (U) None.

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)
Project Number: 3606
Budget Activity: # 4 - Tactical Program

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, (BA 5)						
Cost*	10,000	0	0	0	TBD	TBD

Military Construction: Not Applicable.

* These funds are a portion of the total BP 1100 (Class V modification) monies allocated to the A-7 Upgrade under Budget Activity #05 (modification of In-Service Aircraft).

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

J. (U) MILESTONE SCHEDULE:

Milestones	Dates
- (U) Contract Award	May 1987
- (U) First Flight	May 1989
- (U) Production Decision	Sep 1989

Maj Phillips/SAF/AQPN/43960/27 Dec 88

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
A-7 Plus	48,570	73,014	24,186	4,894	0	179,982

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 cost-effective 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 1988 Accomplishments:
   - (U) Continuation of the FY 1987 program leading to production of two prototype aircraft and data packages.
   - (U) TAC, AFSC, AFLC, NGB, and SAF/AQ have agreed on an A-7F configuration and have validated cost estimates.
   - (U) Initial indications in studies conducted by independent contractors, AFSC, and AF/SA indicated that the A-7F appears to be a cost-effective solution to meet the requirements.

2. (U) FY 1989 Planned Program:
   - (U) Continuation of RDT&E Program and initiation of flight testing of the two prototypes.
   - (U) Prototypes will be configured with an augmented engine, associated airframe, and aerodynamic mods required to provide the desired handling qualities and survivability improvements.
   - (U) Efforts include extensive data reduction and data package development.

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)
Project Number: 3606
Budget Activity: # 4 - Tactical Program

- (U) Integration of all avionics mods will be accomplished separately and are not part of this prototype effort.
- (U) A-7F survivability study will be completed.

3. (U) FY 1990 Planned Program:
   - (U) Completes 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) Engineering Change Orders (ECOs) generated during flight test will be incorporated into the reprocurement data.
   - (U) Survivability and vulnerability enhancements recommended by the OSD-directed aircraft survivability analysis will be assessed.

4. (U) FY 1991 Planned Program:
   - (U) Completes the incorporation of ECOs and finalizes the data.
   - (U) Approved survivability and vulnerability enhancements will be incorporated.

5. (U) Program to Completion:
   - (U) Not applicable. Final year of RDT&E funding is FY 1991.

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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:
   - (U) Program Budget Decision (PBD) 235A, 19 Dec 86.
   - (U) SON TAF/ANG/AFRES 503-86, 19 Feb 87.

G. (U) RELATED ACTIVITIES:
   - (U) None.

Program Element: #0502610F
PE Title: A-7 Squadrons (ANG)
Project Number: 3606
Budget Activity: # 4 - Tactical Program

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement, (BA 5)						
Cost*	10,000	0	0	0	TBD	TBD

Military Construction: Not Applicable.

* These funds are a portion of the total BP 1100 (Class V modification) monies allocated to the A-7 Upgrade under Budget Activity #05 (modification of In-Service Aircraft).

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

J. (U) MILESTONE SCHEDULE:

Milestones	Dates
- (U) Contract Award	May 1987
- (U) First Flight	May 1989
- (U) Production Decision	Sep 1989

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3129
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: MC-130H

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Combat Talon II	6,451	33,051	1,600	6,413	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project initially provided for development of intermediate and depot-level peculiar support equipment (PSE) for those avionics systems previously common between the MC-130H and the HH-60A programs. PSE development is complete. The project now develops an MC-130H Combat Talon II integrated defensive system (CIDS) as a Phase II prototype for Project Number 3284, Interactive Defensive Avionics System (IDAS). CIDS would integrate the radar warning receiver, radar jammer, infrared warning receiver, and chaff/flare dispenser. As the prototype for IDAS, a solid foundation is established for further integration efforts.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Completed development of intermediate and depot-level avionics PSE.
   - (U) Funding required in FY 1988 is 1,007; remainder will be used to forward finance portion of FY 1989 requirements.

2. (U) FY 1989 Planned Program:
   - (U) Begin definition, design, and development of CIDS which is Phase II of IDAS.
   - (U) Funding required in FY 1989 is 11,438; remainder will be used to forward finance portion of FY 1990 requirements.

3. (U) FY 1990 Planned Program:
   - (U) Continue development and prototyping of CIDS.
   - (U) Begin to address application of CIDS towards IDAS for other SOF aircraft.
   - (U) Funding required in FY 1990 is 29,129; shortfall will be met by prior year forward financing.

4. (U) FY 1991 Planned Program:
   - (U) Conduct ground and flight testing.
   - (U) Funding required in FY 1991 is 6,453.

5. (U) Program to Completion:
   - (U) Complete flight testing and begin MC-130H fleet retrofit.

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3129
Budget Activity: #4 - Tactical Programs

D. (U) WORK PERFORMED BY:

1. (U) SOF Program Office — Wright-Patterson AFB OH
2. (U) Lockheed Aeronautical Systems Company (Airframe) — Marietta GA
3. (U) Lockheed Aircraft Service Company (Air Refueling) — Ontario CA
4. (U) IBM Federal Systems Division (Avionics Integration) — Owego NY

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:

1. (U) MAC SON 05-83, Special Operations COMBAT TALON II/COMBAT TALON I IMPROVEMENTS, 21 Jan 1983.
2. (U) MAC SORD 05-83 III, COMBAT TALON II, 5 Jun 1987.

G. (U) RELATED ACTIVITIES:

1. (U) Interactive Defensive Avionics System (IDAS), Project Number 3284, will continue the integration effort for the rest of the SOF fleet.
2. (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Aircraft Procurememt	383,308	350,639	277,833	49,512	1,630,800
Quantity	7	4	2	0	24
Military Construction	4,000	2,900	7,600	3,300	24,500

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3129
Budget Activity: #4 - Tactical Programs

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

1. (U) CIDs Contract Award	March 1989
2. (U) Critical Design Review	September 1990
3. (U) CIDs Flight Test Complete	September 1991
4. (U) Begin Deliveries	October 1992

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3284
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: Interactive Defensive Avionics System (IDAS)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
IDAS	4,730	1,648	10,412	20,638	Continuing	TBD

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

This project provides funds for requirements definition, development, and test for integration of electronic warfare equipment. The project will identify hardware for each SOF aircraft that will reduce vulnerability, detectability, and threat engagement by increasing the overall survivability of Air Force SOF assets. Once on-going studies provide mission related requirements definition, development of an IDAS with a common architecture and essentially common components will be accomplished under this project for the SOF fleet: AC-130H, AC-130U, MC-130E, MC-130H, MH-53J, MH-60G, HC-130N/P, C-141B Special Operations Low Level (SOLL) II, C-130E SOLL II, and CV-22A. IDAS is a three-phase program. Phase I is the installation of nonintegrated defensive avionics on SOF aircraft. Phase II integrates the Phase I avionics. Phase III provides a fully interactive defensive suite to meet 1996 and beyond requirements. The MC-130H electronic warfare equipment will be integrated initially during Phase II, under Project 3129 (MC-130H). The architechture developed on the MC-130H Combat Talon II Integrated Defensive System (CIDS) will serve as a foundation for the IDAS development and will be transportable in part or whole to the remaining SOF platforms. Software modules will also be transportable to these remaining platforms. An integrated maintenance concept support plan for the IDAS will be developed. This plan will be tailored to the SOF mission requirements and will consider factors such as mission readiness, deployment limitations, software reprogramming, spares and support pipelines, vertical testability, and organic depot capabilities and requirements. Subsequent efforts under this project will also provide for later development of passive terrain following and terrain avoidance systems for MC-130s and Gunships to reduce detection and increase survivability. Other efforts will enhance munitions to increase combat effectiveness and improve high-speed airdrop systems to reduce vunlnerability.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments: (For MC-130E, AC-130H, & EC-130E)
   - (U) Initiated modeling of mission tasks and threats using representative mission profiles.

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3284
Budget Activity: #4 - Tactical Programs

(U) FY 1988 Accomplishments (Continued):
- (U) Conducted trade study of candidate subsystems to drive the development of an interactive architecture.
- (U) Conducted system analysis of existing and propsed architectures.
- (U) Investigated integrated maintenance support concept.

2. (U) FY 1989 Planned Program: (For MC-130E, AC-130H, & EC-130E)
- (U) Complete modeling of mission tasks and threats using representative mission profiles.
- (U) Develop provisions for cross-communication (interaction) between previously stand-alone systems.
- (U) Begin assessing implication of these efforts for remaining SOF aircraft.
- (U) Complete trade study analysis of candidate subsystems for development of common architecture.

3. (U) FY 1990 Planned Program:
- (U) Initiate modeling of tasks and mission threats for remaining SOF aircraft using representative mission profiles.
- (U) Conduct trade study of candidate subsystems for remaining SOF aircraft for fusion into the common architecture.
- (U) Initiate contract for IDAS development and prototyping of MC-130H to IDAS configuration.
- (U) Strive to include AC-130U at this stage of development.

4. (U) FY 1991 Planned Program:
- (U) Complete development and testing of the prototype IDAS for the MC-130H Combat Talon II aircraft.
- (U) Continue development and test of AC-130U IDAS trial aircraft.
- (U) Identify installed systems performance requirements for remaining SOF aircraft.
- (U) Apply common SOF architecture to remaining SOF aircraft.

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

D. (U) WORK PERFORMED BY:

1. (U)	Northrop Defense Systems Division	Elk Grove Village IL
2. (U)	AFLC/Special Projects Division	Wright-Patterson AFB OH
3. (U)	Electronic Warfare Programs Office	Wright-Patterson AFB OH
4. (U)	SOF Program Office	Wright-Patterson AFB OH

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3284
Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:

1. (U) HQ USAF/RD-U AFSOF Review of Capabilities & Cost Briefing, 12 Sep 86
2. (U) DEPSECDEF Memorandum, Cost Accounting for SOF Aircraft, 31 Oct 86
3. (U) HQ USAF Special Operations Forces Master Plan, 17 Feb 87
4. (U) SAF/AQU Msg, 102000Z Apr 87, IDAS for SOF Aircraft
5. (U) Under Secretary of Defense Memorandum - Acquisition, DOD Electronic Combat Policy Execution, 3 Aug 87

G. (U) RELATED ACTIVITIES:

1. (U) Phase II Prototype will occur on the MC-130H, and funding for Phase II is in Project Number 3129, MC-130H.
2. (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.
3. (U) Interface control working groups will be established to insure commonality issues are addressed within the SOF fleet and also between the SOF fleet and the airlift fleet.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

1. (U) Contract Award January 1990
2. (U) Flight Test Complete January 1994
3. (U) Begin Delivery June 1994

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #1110011F
Title: SOF Force Enhancements - Active
Project Number: 3326
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: AC-130U

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
AC-130U GUNSHIP	69,510	63,803	37,828	17,893	10,207	249,734

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

(U) This program funds development and procurement of 12 C-130s and converts these aircraft to the side-firing gunship configuration. The new AC-130U aircraft will have an enhanced capability, improved reliability and maintainability, more and survivability than the existing AC-130H aircraft, and be more deployable than the older AC-130A gunships which are programmed for retirement. The new aircraft subsystems will include precision navigation, target acquisition radar, fire control computers integrated on redundant 1553B data buses, electronic countermeasures, infrared countermeasures, aerial refueling, covert lighting, trainable weapons, and secure communications systems. These subsystems will provide the gunship the capability to strike targets with surgical accuracy, to loiter safely in the target area for extended time periods, and to perform these tasks in night or adverse weather conditions. Where practical, every effort will be made to adapt off-the-shelf equipment, and to the maximum extent, these subsystems will be common with systems on other Air Force SOF aircraft.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued design, laboratory/integration-facility testing, and concept proofing for the prototype AC-130U.
   - (U) Continued developing Peculiar Support Equipment (PSE).
   - (U) Began developing related technical data.
   - (U) Began fabrication of prototype aircraft.
   - (U) Continued software development and integration design for avionics, target acquisition, and ordnance ballistics computers.

2. (U) FY 1989 Planned Program:
   - (U) Complete integration of low-light-level TV and target acquisition radar, following Critical Design Review.
   - (U) Continue development and refinement of ballistics and navigation software.
   - (U) Define and develop required PSE for intermediate and depot support levels.

Program Element: #1110011F
Title: SOF Force Enhancements--Active

Project Number: 3326
Budget Activity: #4 - Tactical Programs

3. (U) FY 1990 Planned Program:
   - (U) Complete development of the prototype AC-130U.
   - (U) Begin flight test and evaluation.

4. (U) FY 1991 Planned Program:
   - (U) Complete flight test and evaluation

5. (U) Program to Completion:
   - (U) Complete development of PSE in FY 1993.

D. (U) WORK PERFORMED BY:

1. (U) Special Operations Forces Program Office Wright-Patterson AFB OH
2. (U) Rockwell International (Systems Integration) El Segundo CA
3. (U) Lockheed Aeronautical Systems Company (Airframe) Marietta GA

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:

1. (U) Deputy Secretary of Defense Program Decision Memorandum, 22 Aug 85
2. (U) HQ USAF SON 08-85, AC-130 Replacement Gunship
3. (U) HQ MAC Concept of Operations for AC-130s, 15 Mar 85

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

Program Element: #1110011F
Title: SOF Force Enhancements--Active

Project Number: 3326
Budget Activity: #4 - Tactical Programs

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Aircraft procurement	18,200	325,237	269,140	42,413	654,990
Quantity	0	6	5	0	12
Military Construction	0	0	0	0	5,013

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

1. (U) Contract Award	July 1987
2. (U) Critical Design Review	March 1989
3. (U) Start Prototype Flight Testing	April 1990
4. (U) Complete Combined Flight Testing	August 1992
5. (U) Initial Operational Capability (4 aircraft)	October 1992
6. (U) Full Operational Capability (12 aircraft)	September 1993

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3642
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: AC/MC-130 Aircrew Training System (ATS)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SOF ATS	1,287	27,627	2,054	55,712	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project will develop an integrated, state-of-the-art SOF fixed-wing ground-based aircrew training system (ATS) to support MC-130 Combat Talon and AC-130 Gunship initial qualification, continuation training, update training, and combat mission rehearsal requirements. While the focus is on fixed-wing aircraft, options are also planned for MH-53J and CV-22 which will be exercised as funding becomes available. The ATS requirement is driven by existing training restrictions caused by airspace limitations, weather restrictions, and mission safety considerations that dictate rehearsing certain critical tasks in a ground-based device. The proposed solution is to acquire a SOF fixed-wing training system composed of weapon system trainers, Combat Talon air refueling part task trainer, computer based training equipment, courseware development and instruction for all crewmembers of each aircraft. The system will provide a mix of academics, simulator training, and aircraft flight training to produce a combat qualified crewmember.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Prepared and released two draft request for proposals.

2. (U) FY 1989 Planned Program:
   - (U) Release request for proposal.
   - (U) Conduct source selection.
   - (U) Contract award to two contractors (Phase I) for preliminary design and system definition.
   - (U) Conduct initial system design reviews for fixed wing aircraft.
   - (U) Funding required in FY 1989 is 8,200; remainder will be used to forward finance portion of FY 1990 requirements.

3. (U) FY 1990 Planned Program:
   - (U) Down select to one contractor (Phase II).
   - (U) Award full scale development contract.
   - (U) Complete system design for MC-130H/E and AC-130U/H aircraft.
   - (U) Funding required in FY 1990 is 21,900; shortfall will be met by prior year forward financing.

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3642
Budget Activity: #4 - Tactical Programs

4. (U) FY 1991 Planned Program:
   - (U) Continue full scale development.
   - (U) Conduct preliminary and critical design reviews.
   - (U) Funding required in FY 91 is 41,000; remainder will be used to forward finance portion of FY 1992 shortfall of 27,700.

5. (U) Program to Completion:
   - (U) Perform system design for MH-53J and CV-22 aircraft.
   - (U) This is a continuing program.

D. (U) WORK PERFORMED BY: Training Systems Program Office, Wright-Patterson AFB OH

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:

1. (U) MAC SON 05-83, Special Operations COMBAT TALON II/ COMBAT TALON I Improvements, 21 Jan 1983.
2. (U) MAC Concept of Operations for AC-130s, 15 Mar 85.
3. (U) MAC SORD 05-83 III, COMBAT TALON II, 5 Jun 1987.

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:

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Procurement	0	0	53,100	2,400	55,500
Military Construction	0	4,600	0	0	4,600

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3642
Budget Activity: #4 - Tactical Programs

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:

1. (U) Release Request for Proposal	January 1989
2. (U) Contract Award (Phase I)	May 1989
3. (U) Contract Award (Phase II)	May 1990
4. (U) Critical Design Review	December 1990
5. (U) Validation Complete	January 1994

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #1110011F
PE Title: SOF Force Enhancements - Active
Project Number: 3752
Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES ($ in Thousands)
Project Title: CV-22

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
OSPREY	32,335	25,738	22,090	21,461	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project will result in a CV-22A configured to satisfy SOF mission requirements. Starting with the baseline Marine V-22 aircraft, we will provide the contractor with additional communication, navigation, and electronic warfare equipment for integration and testing. Fuel tank configuration will be developed and tested to extend operational range. In addition, logistics support and training aspects of these Air Force unique systems will be developed to give us aircraft optimally suited for the SOF mission.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued integration of Air Force unique avionics in the Systems Integration Laboratory (SIL), including medium accuracy inertial navigation system and multi-function radar development under Project 3753, Integrated Digital Avionics.
   - (U) Began procuring electronic warfare systems and integration into the SIL.
   - (U) Procured non-avionics systems for flight test in 1990.
   - (U) Conducted wind tunnel testing of extended range fuel tank designs.
   - (U) Continued engine structural integrity program to determine the durability of the Allison engine as it enters the Air Force inventory.
   - (U) Submitted request for ECP for AF unique effort.
   - (U) Fact found and prepared for negotiation on the AF unique engineering change proposal (ECP).
   - (U) Submitted Request for Proposal (RFP) for RF jammer study. Prepared for negotiation.

2. (U) FY 1989 Planned Program:
   - (U) Continue work on Air Force unique avionics.
   - (U) Complete procurement of SOF unique navigation, communication, and electronic warfare equipment so that initial testing in the SIL can begin.

Program Element: #1110011F Project Number: 3752
PE Title: SOF Force Enhancements - Active Budget Activity: #4 - Tactical Programs

(U) FY 1989 Planned Program (Continued):
- (U) Continue engine structural integrity program. Begin work on Forces Structural Maintenance Plan.
- (U) Research and select best solution for extended range fuel tank configuration.
- (U) Awards contract and begin work on Air Force unique ECP effort. This includes navigation, communications, and electronic warfare system enhancements. Designs for hardware mods for armament, fast rope and lighting improvements will also begin.
- (U) Place RF jammer study on contract.
- (U) Start combined contractor/government tooling of prototype air vehicles with emphasis on verifying actual system performance.

3. (U) FY 1990 Planned Program:
- (U) Complete RF jammer study and implement, if necessary.
- (U) Complete Enhanced Structural Integrity Program (ENSIP) effort. Take delivery of Force Structural Maintenance plan.
- (U) Continue integration of Air Force unique avionics.
- (U) Continue work on Air Force unique ECP effort.
- (U) Continue contractor and government testing of six prototypes vehicles with emphasis on verifying actual system performance.
- (U) Request proposal for extended range fuel configuration, design, fabrication, and flight test. Negotiate and begin work.
- (U) Complete RFP for CV-22A trainer mods.

4. (U) FY 1991 Planned Program:
- (U) Continue combined contractor/government Development Test and Evaluation/Operational Test and Evaluation of the CV-22A.

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

D. (U) WORK PERFORMED BY:

1. (U)	SOF Program Office	Wright-Patterson AFB OH
2. (U)	Naval Air Systems Command	Washington DC
3. (U)	Bell Helicopter Textron	Fort Worth TX
4. (U)	Boeing Helicopter	Philadelphia PA
5. (U)	IBM Federal Systems Div (Avionics Integration)	Owego NY

Program Element: #1110011F Project Number: 3752
PE Title: SOF Force Enhancements - Active Budget Activity: #4 - Tactical Programs

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

F. (U) PROGRAM DOCUMENTATION:

1. (U) Joint Services Operational Requirement (JSOR), 14 Dec 1982 (USAF SON 14-82) Revised Apr 85
2. (U) V-22 Program Acquisition Plan, 22 Jul 1986
3. (U) Secretary of Defense Decision Memorandum, V-22 OSPREY Program, 1 May 1986, with Decision Coordinating Paper
4. (U) Systems Operational Concept (SOC), 8 Dec 1987

G. (U) RELATED ACTIVITIES:

1. (U) V-22 is a joint-service program led by the Navy. The Navy funds airframe and engine development, while the Air Force funds development, integration, and testing of systems unique to the SOF mission.
2. (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:

1. (U) Preliminary Design Contract Award April 1983
2. (U) Full Scale Development (FSD) Contract Award May 1986
3. (U) Long Lead Release (USMC) 3rd Qtr FY 90
4. (U) Operational Test and Evaluation 2nd Qtr FY 92
5. (U) Full Production Release 1st Qtr FY 93
6. (U) First USAF Delivery 1st Qtr FY 95
7. (U) USAF Initial Operational Capability 4rd Qtr FY 95

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #1110011F Budget Activity: #4 - Tactical Programs
PE Title: SOF Force Enhancements - Active

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3129 MC-130H Combat Talon II	6,451	33,051	1,600	6,413	Continuing	TBD
3174 SOF Sensor Upgrade	2,255	100	0	0	0	2,355
3284 Interactive Defensive Avionics Systems	4,730	1,648	10,412	20,638	Continuing	TBD
3326 AC-130U Gunship	69,510	63,803	37,828	17,893	10,207	249,734
3642 AC/MC-130 Aircrew Training System	1,287	27,627	2,054	55,712	Continuing	TBD
3752 CV-22A	32,335	25,738	22,090	21,461	Continuing	TBD
3753 Integrated Digital Avionics	269	0	0	0	0	17,188
3758 SOF C2 Upgrade	378	989	395	398	Continuing	TBD
3778 SOF Automated Mission Planning System	0	0	200	200	Continuing	TBD
TOTAL	117,215	152,956	74,579	122,715	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT:

This program element contains RDT&E and procurement funding required to procure and support 24 MC-130H Combat Talon II aircraft and 12 AC-130U Gunships, as well as 55 CV-22As which will provide the Air Force SOF with the ability to conduct long-range infiltration, resupply, and exfiltration missions requiring vertical/short takeoff and landing (V/STOL) capabilities in the 1990s and beyond. RDT&E funds are requested for Interactive Defensive Avionics Systems (development of a common electronic warfare architecture for SOF fleet); AC/MC-130 Aircrew Training System (trainer and mission rehearsal system for MC-130/AC-130 with provisions for MH-53J and CV-22A); SOF C2 Upgrade (enhancements to initial deployable C2 capabilities for SOF elements); and SOF Automated Mission Planning System (provides aircrews with ability to conduct full mission planning).

Program Element: #1110011F Budget Activity: #4 - Tactical Programs
PE Title: SOF Force Enhancements - Active

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 3174, SOF Sensor Upgrade: An improvement to AC-130 40mm ammunition.

(U) FY 1988 Accomplishments:
- (U) Continued development of improved visual sensors (low-light television and infrared sensors).
- (U) Continued development of improved electronic sensors (new laser target illumination system).
- (U) Continued development of improved 40mm munitions for use with these sensors.

(U) FY 1989 Planned Program: Completed development.

(U) FY 1990-1991 Planned Program: Not Applicable.

(U) Work Performed By:
- (U) Air Force Armament Division — 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: None

(U) International Cooperative Agreements: None

2. (U) Project 3753, Integrated Digital Avionics: Reconfiguring the APQ-174 multi-function radar for the V-22.

(U) FY 1988 Accomplishments:
- (U) Developed hardware and software changes required to both apply the LANTIRN radar (APQ-174) to the V-22 and to integrate displays from the MH-53J.

(U) FY 1989-1991 Planned Program: Not Applicable.

(U) Work Performed By:
- (U) SOF Program Office — Wright-Patterson AFB OH
- (U) Naval Air Systems Command — Washington DC
- (U) Bell Helicopter Textron — Fort Worth TX
- (U) Boeing Helicopters — Ridley Park PA
- (U) IBM Federal Systems Division — Owego NY

(U) Related Activities: 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

Program Element: #1110011F Budget Activity: #4 - Tactical Programs
PE Title: SOF Force Enhancements - Active

3. (U) Project 3758, SOF C2 Upgrade: Develops enhanced capabilities for an ongoing program to acquire a deployable C2 capability for SOF. Requirements include development of a secure, light-weight, long-range radio system, and mission planning systems.

(U) FY 1988 Accomplishments:
- (U) Developed control software for a C2 modem.

(U) FY 1989 Planned Program:
- (U) Continue to expand capabilities of C2 modem through development of voice compression and embedded encryption capabilities.
- (U) Continue development of promising technologies for application to the Joint Advanced Special Operations Radio System (JASORS).

(U) FY 1990 Planned Program:
- (U) Develop control system for the network.
- (U) Develop multi-tasking input/output terminals for the system to reduce size/weight and enhance operational capabilities.

(U) FY 1991 Planned Program:
- (U) Continue development of technology leading to the final JASORS objective system.

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

(U) Work Performed By:
- (U) Naval Electronics Systems Eng Activity Patuxent River MD
- (U) Space Division Los Angles AFS CA
- (U) Electronic Systems Division Hanscomb AFB MA

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

(U) Other Appropriation Funds: None

(U) Internatinal Cooperative Agreements: None

4. (U) Project 3778, SOF Automated Mission Planning System (AMPS): Capabilities include storage and processing of threat intellligence to include near-real time ELINT, imagery, and digital terrain mapping data from Defense Mapping Agency to provide route selection, optimization and deconfliction, aircraft performance, and data transfer capability to program aircraft mission computers.

(U) FY 1988 Accomplishments: Not Applicable

(U) FY 1989 Program: Not Applicable

Program Element: #1110011F Budget Activity: #4 - Tactical Programs
PE Title: SOF Force Enhancements - Active

(U) FY 1990 Program:
- (U) Conduct trade study of available equipment meet requirements.
- (U) Begin development of interface architecture to host required capabilities.

(U) FY 1991 Program:
- (U) Begin development of SOF aircraft software.
- (U) Test system capability.

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

(U) Work Performed By:
- (U)Mission Planning SPO Hanscom AFB

(U) Related Activities: 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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0301357F
Title: NUDET Detection System (NDS)

Project Number: XXX1
Budget Activity: 5 -Intelligence and Communications

A. (U) RESOURCES ($ in Thousands)

Project Title NUDET Detection System Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
NDS						

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

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.

A broad range of users (National Command Authorities, Strategic Air Command, US Space Command, other Unified and Specified Commands) will 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 satellite. This program compliments PE 0102433F which develops and integrates EMP sensors into GPS satellites and develops/procures G/AITs.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Program: None funded.

(U) FY 1989 Planned Program: None funded.

(U) FY 1990 Planned Program:

- (U) Initiate development for requalification and integration of NDS next generation optical and X-ray sensors into GPS replenishment satellites begun in FY 89 in PE 0305999F.

00581

Program Element: #0301357F
Title: NUDET Detection System (NDS)
Project Number: XXX1
Budget Activity: #5 -Intelligence and Communications

- (U) Build prototype NDS next generation optical and X-ray sensors for GPS Block IIR satellites begun in FY 89 in PE 0305999F.

(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.

(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:

Rockwell International, Seal Beach, CA, integrates the NDS sensors on GPS satellites and produces the EMP sensor. 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 and will produce the G/AIT. E-Systems, Garland, TX, is developing the EMP receiver/processor for the satellite.

E. (U) COMPARISON WITH FY 1988 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Sched	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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

00682

Program Element: #0301357F
Title: NUDET Detection System (NDS)
Project Number: XXX1
Budget Activity: #5 -Intelligence and Communications

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.
- (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):

Missile Procurement, BA 27

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Quantity	4	0	0	0	Continuing	TBD

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

J. (U) MILESTONE SCHEDULE:

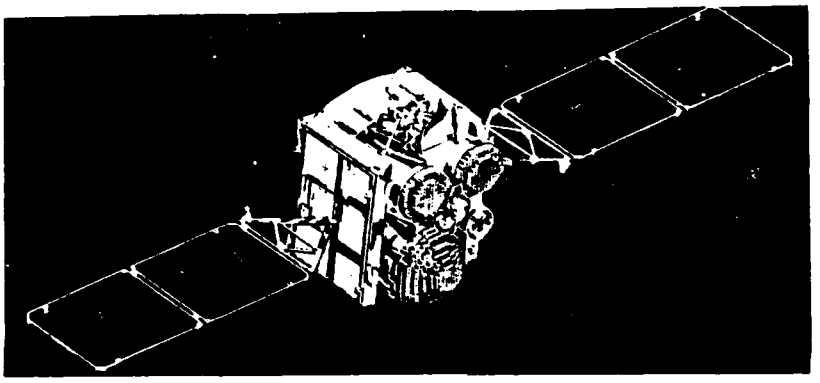
- (U) Defense Systems Acquisition Review Council II	June 1979
- (U) Begin Satellite Production	September 1982
- (U) Launch 1st NDS Equipped GPS Spacecraft	July 1983
- (U) Defense Acquisition Board IIIA (LRIP)	June 1986
- (U) Launch First Operational Satellite	2nd Qtr FY 89
- (U) Award GPS/NDS Block IIR Contract	3rd Qtr FY 89
- (U) Award G/AIT Production Contract	3rd Qtr FY 89
- (U) Defense Acquisition Board IIIB (Full Prod)	4th Qtr FY 89
- (U) Start G/AIT DT&E	1st Qtr FY 90
- (U) Achieve Worldwide 2-Dimensional NUDET Location Capability*	2nd Qtr FY 91
- (U) Achieve Worldwide 3-Dimensional NUDET Location Capability*	4th Qtr FY 92

* Launch Schedule Dependent

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

Project Title: DSCS



POPULAR NAME: DSCS

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Satellite Deliveries	3	3	Last MYP Deliveries:2	0	Continuing
Satellite Launches					
BUDGET ($000)	43.325	33.733	28.105	15.579	Continuing
Major Contract	38.1	27.252	21.4	11.1	TBD
Support Contract	1.8	2.7	2.9	2.4	TBD
In-House Support	.915	.981	.905	.879	TBD
GFE/ Other	2.51	2.8	2.9	1.2	TBD
Total	43.325	33.733	28.105	15.579	Continuing

00684

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

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

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Procured last satellite of multiyear satellite buy (III-B14).
   - (U) Delivered DSCS satellites III-B8 and B9.
   - (U) Remaining DSCS satellites continued in storage.
   - (U) Developed Integrated Apogee Boost Stage (IABS) to make DSCS III satellites compatible with the ATLAS-II booster.
   - (U) First time integration development activities DSCS/ATLAS-II.
   - (U) Performed studies and system requirements reviews for satellites acquired after completion of current multiyear buy.

2. (U) FY 1989 Planned Program:
   - (U) Delivery of DSCS satellites III-10,11,12.
   - (U) Continue development of IABS and first time integration with the ATLAS-II.
   - (U) First time integration of DSCS with the Titan IV completed.
   - (U)
   - (U) Studies continue to determine DSCS III follow-on requirements and capabilities.
   - (U) Procure first three IABS for launch in FY 1991.

3. (U) FY 1990 Planned Program:
   - (U) Deliver DSCS satellites III-B13 and B14.
   - (U) Store DSCS satellites until launch.
   - (U) Continue production of IABS.
   - (U) Begin activation activities in preparation to launch three DSCS satellites in budget year two.
   - (U) Perform first time DSCS integration on the ATLAS-II.
   - (U) Produce Integrated Apogee Boost Stages to allow DSCS launch using the ATLAS-II booster.
   - (U) Modify satellites in storage to correct deficiencies and incorporate improvements.

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

4. (U) FY 1991 Planned Program:
   - (U) Continue storage of DSCS satellites until launch.
   - (U) Support launch of three DSCS satellites.
   - (U) Begin activation activities for launch of two DSCS satellites in the year following budget year two.
   - (U) Integrate DSCS satellites on the ATLAS-II.
   - (U) Continue Production of Integrated Apogee Boost Stages for launch of DSCS using the ATLAS-II booster.
   - (U) Modify satellites in storage to correct deficiencies and incorporate improvements.

5. (U) Program Plan to Completion: DSCS is a continuing program.
   - (U) Remaining satellites to be launched using the ATLAS-II booster.
   - (U) Conduct low level development on replenishment satellites to accommodate parts obsolescence, develop improvements to life cycle costs, reliability, maintainability, and producability.
   - (U) Efforts will be made to find an affordable solution to the increased communications requirements projected for post 1995.
   - (U) First DSCS III follow-on should be available by 1997.

D. (U) WORK PERFORMED BY: The Air Force Space Division, Los Angeles, CA, is responsible for the space segment of the Defense Satellite Communication System. TRW Redondo Beach, CA is the prime contractor for the DSCS II satellites. General Electric Company, Valley Forge, PA, is the prime contractor for the DSCS III spacecraft. The Aerospace Corporation, El Segundo, CA provides general systems engineering and integration to the Systems Program Office.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	Yes	None	None
Sched	None	Yes	None
Cost	None	None	$45,061

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES:
   - (U) FY 88 initiated Full Scale Development of Integrated Apogee Boost Stage (IABS).
   - (U) Fy 89 continue development of IABS.
   - (U) Fy 89 Procure 3 IABS for launch of DSCS satellites using the MLV-II booster.

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

- (U) Fy 89 first time integration of DSCS III on Titan IV as a backup to assure continued access to space.

2. (U) SCHEDULE CHANGES:
   - (U) DSCS IIIc indefinitely deferred.
   - (U) IABS will be available for FY 91 launch with ATLAS-II.

3. (U) COST CHANGES: Cost changes reflect change in DSCS program content. Full Scale Development of DSCS IIIC deferred while the Air Force completes concept development studies to determine the optimum configuration for the DSCS follow-on. The cost changes also reflect the development and procurement of the Integrated Apogee Boost Stage (IABS) to allow launch of the DSCS satellites on the ATLAS-II booster.

F. (U) PROGRAM DOCUMENTATION:

- (U) DCP No 144 DSCS Phase III SHF Space Segment (S), Rev 4, 8 May 81.
- (U) DSCS Test and Evaluation Master Plan, 23 Nov 1981.
- (U) DCA DSCS Program Plan 1990-1994 (S), Nov 1987.

G. (U) RELATED ACTIVITIES:
- (U) Defense Communications Agency is responsible for over all DSCS program management, system engineering, and operation direction.
- (U) The Army procures ground terminals under PE 0303142A, DSCS.
- (U) The Navy procures shipborne terminals under PE 0303109N, Satellite Communications System.
- (U) The Air Force is funding for ground equipment,construction, operation and maintenance, and manpower to support its portion of the ground segment in PE 030605F, Satellite Ground Terminals.
- (U) The Air Force is developing the ATLAS-II under PE 0305119F, Space Boosters.
- (U) There is no unnecessary duplication effort within the Air Force or the Department of Defense.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	FY 1992 Estimate	To Complete	Total Program
(U) MISSILE BA 23							
PROCUREMENT	68,991	54,412	51,913	60,301	49,287	Cont.	N/A
(U) QUANTITY:							
SATELLITES	1	-	-	-	-	*	*
IABS	-	4	2	2	2	*	*
(U) O & M BA 34	6,300	4,569	8,079	15,340	11,285	*	*

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

J. (U) TEST AND EVALUATION DATA: N/A

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

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

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2022 Automated Digital Communications Processing Techniques	2,085	1,643	1,057	1,125	Continuing	TBD
2155 *Systems Control*	1,789	1,746	1,167	1,376	Continuing	TBD
2157 Transmission Improvements	1,010	1,159	831	800	Continuing	TBD
2206 Digital European Backbone (DEB)	180	180	180	180	Continuing	TBD
Total	5,064	4,728	3,235	3,481	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element 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, switched telecommunications network to satisfy requirements of the National Command Authority, the Department of Defense, and certain 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project: 2022, Automated Digital Communications Processing: This project develops and tests systems designed to exploit new capabilities of the DCS as it transitions from an analog to an all digital system. The first new system is a Multinet Gateway device which enables multilevel secure interfaces between the DCS and other digital networks (e.g., commercial systems). This capability significantly improves survivability by providing more alternate routing possibilities should segments of the DCS fail in crisis situations. The second effort comprise an initial series of tests to define and evaluate performance parameters for the Defense Switched Network, the follow-on to the current Automatic Voice Network.

(U) FY 1988 Accomplishments:
- (U) Rome Air Development Center (RADC) in-house and contractual efforts to evaluate voice/data integration technologies.
- (U) RADC initiated studies and investigations to define advanced network concepts such as advanced switching technologies, network operating systems, and routing and information flow control.
- (U) RADC developed and demonstrated technologies for multi-media (e.g.,voice, facsimile, data, and video user applications.

00589

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

(U) FY 1989 Planned Program:
- (U) Complete the formal certification of the multinet gateway at the Military Airlift Command Global Decision Support System site at Scott AFB, Illinois.
- (U) Implement a routing algorithm design in the multinet gateway advanced development model to improve significantly the survivability of the DCS.
- (U) Complete development of a protocol to enable the multinet gateway to coordinate routing functions with dissimilar gateways in order to enhance survivability.
- (U) Initiate development of an advanced model of a voice/data integrator developed under PE 62702F to increase communications capability by at least 30%.
- (U) Initiate development of a communications network operating system (CNOS) as an advanced management and control mechanism for highly adaptive and survivable communications networks.

(U) FY 1990 Planned Program:
- (U) Complete development and design of the CNOS algorithms.
- (U) Initiate development of the network management and control functions which will integrate multi-level security (MLS) traffic in future networks.
- (U) Complete design of detection algorithms designed to identify and subvert sophisticated attacks on a communications network.

(U) FY 1991 Planned Program:
- (U) Complete the voice/data integrator and install units at RADC and possibly USAFE.
- (U) Conduct a preliminary design review (PDR) of the MLS network architecture.
- (U) Implement the CNOS and the detection algorithms at RADC to demonstrate their potential to operational systems.

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 restoral and reconstitution on a worldwide basis. RADC is developing operational concepts, deployment strategies, and software programs to permit multiple Digital Patch and Access units within a subregion to be netted together for real-time coordinated operation. A continuing effort through FY 1989 will evaluate use of selected commercial equipment in DoD communications networks. The goal is an integrated DCS control system which is adaptive to wartime communications requirements and constraints.

(U) FY 1988 Accomplishments:
- (U) Completed the Base Information System Management Center. Air Force Communications Command (AFCC) incorporated the results into the Base Information Digital Distribution System.

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

- (U) Developed operational concepts, deployment strategies, and software programs to permit multiple digital patch and access units within a subregion to net together for real-time coordinated operation.
- (U) Contracted System Management and Control study for Integrated Communications Architectures for the 1995-2005 period. Results defined longterm DCS control requirements and implications for DCA and AFCC.
- (U) Using results from a prototype system at Andrews AFB, Md, RADC implemented customer identified functions that an expert technical controller should perform.

(U) FY 1989 Planned Program:
- (U) Award contract to investigate areas where expert system technologies could benefit Air Force and DCA management and control of worldwide communications assets.
- (U) Accept delivery of the Digital Patch and Access (DPAS) control software documentation.
- (U) Complete the simulation and study of the DCS control in the year 2005.
- (U) Complete a technical control expert system prototype testbed for assessing expert system benefits to operational Air Force sites.
- (U) Accept delivery of software for use in studying distibuted problem solving technologies as applied to geographically disbursed communication sites.

(U) FY 1990 Planned Program:
- (U) Complete the conceptual design for an expert system and begin a proof of concept effort.
- (U) Conduct field testing of an expert technical control system at a base selected by AFCC.

(U) FY 1991 Planned Program:
- (U) Integrate prototype cooperative expert systems into a testbed at RADC for evaluation.
- (U) Expand field test program of the expert technical control to include "adjunct base" operation.

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 1988 Accomplishments:
- (U) Continued development of narrowband high frequency radios with jam resistance, high data rates, and improved voice recognition features.

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

- (U) RADC built an advanced development model of multimode, multirate digital microwave radios with ECCM features, including adaptive antenna nulling and a high power amplifier for troposcatter radios which increases efficiency by 70 % and reliability by 300 %.
- (U) Continued development of a troposcatter angle diversity retrofit kit for use in Digital European Backbone (DEB) radios. Kit employs advanced diversity combining techniques to use the frequency spectrum more efficiently.
- (U) Initiated development of algorithms and protocols to provide multi-band transmission capabilities using a combination of diverse propagation media and network communications subsystems.
- (U) Tested support for a prototype frequency hop modem.

(U) FY 1989 Planned Program:
- (U) Complete test and evaluation of an HF Frequency Hop Modem.
- (U) Conduct critical design review (CDR) of the meteor burst network simulator.
- (U) Initiate development of a multi-media communication radio based on the brassboard design produced under Project 2335.

(U) FY 1990 Planned Program:
- (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 multi-media radio.

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

4. (U) Project: 2206, Digital European Backbone (DEB): DEB is the approved 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 and Spain. In FYs 1987, 1988, and 1989, the majority of the installations will be in the United Kingdom. The Air Force is the lead military department for the overall upgrade.

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

(U) FY 1988 Accomplishments:
- (U) Installed DEB sites in the United Kingdom and Europe.

(U) FY 1989 Planned Program:
- (U) Continue installation of DEB sites.

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

(U) FY 1991 Planned Program:
- (U) Continue installation of DEB sites.

(U) Program to Completion: All projects within this program are continuing.

(U) Work Performed By: Air Force Systems Command manages this program element through the Electronic Systems Division (ESD), Hanscom Air Force Base, MA (Project 2206) and the Rome Air Development Center (RADC), Griffiss AFB, NY (Projects 2022, 2155 and 2157). ESD receives technical support from the MITRE Corporation, Bedford, MA, and Computer Engineering Associates, Avon, MA. Major contractors for Project 2206 are TRW, San Luis Obispo, CA, and GTE, Needham, MA. Major contractors for projects 2022, 2155, and 2157 are: Computer Sciences Corporation, Falls Church, VA; Honeywell, Tampa, FL; and Signatron Inc, Lexington, MA. All of these support the tasks managed by RADC. Other contractors are: Motorola, Scottsdale, AZ (Project 2157); Ford Aerospace and Communications Corporation, Colorado Springs, CO (Project 2022); Harris Corporation Melbourne, FL (Project 2157); and Raytheon, Sudbury, MA (Project 2157).

(U) Related Activities: The Digital European Backbone (DEB) project (2206) involves Tri-Service funding and includes installation of equipment at Army, Navy, and Air Force sites. Overall program management for this project is exercised by the Defense Communications Agency (DCA). DCA's Management Engineering Plan (MEP) tasks the Army to procure the digital radios and multiplexer equipment. The MEP tasks the Air Force to develop and procure the digitaltroposcatter modem. RDT&E for the Secure Conferencing Project, part of Secure Telephone Systems, is funded under Program Element #0603735F, Worldwide Military Command and Control System Architecture.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3080	60,761	21,736	70,988	16,692	Continuing	TBD
3300	2,550	1,220	1,350	1,300	Continuing	TBD
3400	280,679	290,970	318,377	320,847	Continuing	TBD
3500	103,507	104,261	110,508	116,621	Continuing	TBD

(U) International Cooperative Agreements: Not Applicable.

00692

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Total	8,083	8,395	8,746	9,101	Continuing	N/A

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Completed software for CONUS portion of WWFMESS; installed hardware in frequency management offices in the Washington DC area; began phased operational testing.
- (U) Evaluated frequency management infrastructure of 11 countries, as specified by the JCS, and provided to CINCs.
- (U) Successfully tested prototype of Battlefield HF Assignment Management System in Europe during FLINTLOCK 88 exercise.
- (U) Successfully tested EW Frequency Spectrum Deconfliction Model during REFORGER 88 exercise.
- (U) Managed/maintained/operated the Frequency Resource Record System on a daily basis.

(U) FY 1989 Planned Program:
- (U) Complete software for CINC portion of Worldwide Frequency Management Engineering Support System (WWFMESS); extend system to CINCPAC, CINCLANT, and CINCEUR; test this portion of the system.
- (U) Initiate study on architecture of interconnections to the Worldwide Military Command and Control System (WWMCCS).
- (U) Develop on-line capability to DOD Intelligence Information System (DODIIS).

Program Element: #0303144F Budget Activity: #5 - Intelligence & Communications
PE Title: Electromagnetic Compatibility Analysis Center (ECAC)

- (U) Enhance and further test prototype Electronic Warfare (EW) Deconfliction System.
- (U) Modify HF Assignment Management software for CINCPAC.
- (U) Manage/maintain/operate the Frequency Resource Record System on a daily basis.

(U) FY 1990 Planned Program:
- (U) Integrate NATO data into the 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 EW 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) Program to Completion: This is a continuing program.

(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.

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

Operations & Maintenance (BA 5)

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Completion	Total Program
Cost	4,917	5,102	2,643	3,064	Continuing	N/A

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0303401F Budget Activity: 5-Intelligence & Communications
PE Title: Communications Security

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete
Project 033401F, Communications Security (COMSEC).					
Total					Continuing

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 033401F, Communications Security:
Develops general purpose cryptographic equipment and ancillary systems to meet national communication security requirements.

(U) FY 1988 Accomplishments:
- (U) Development of a broad-band, impulse signal detection antenna was completed.
- (U) High quality, 4800bps digital voice system (sinusoidal transform coder) was implemented in hardware.
- (U) A canonical transform process for digital-digital conversion between different secure voice systems was implemented on a systolic array in the laboratory.
- (U) Development and demonstration of a prototype Black Disk Encryption system was accomplished. This resolved the technical risks in developing a secure workstation for the USAF Electronic Key Distribution System.

(U) FY 1989 Planned Program:
- (U) Initiation of a broad-band time domain collection system for ESC.
- (U) Continue development of fiber optic antennas and optical signal processing for TEMPEST testing.

Program Element: 0303401F Budget Activity: 5-Intelligence & Communications
PE Title: Communications Security

- (U) Initiate development of a Tier Two system for the USAF Electronic Key Distribution System.
- (U) Research on appropriate error metrics for candidate uses of the canonical transform will be completed and a real-time implementation of the digital voice algorithm will be achieved.

(U) FY 1990 Planned Program:
- (U) A broad-band time domain collection system will be transitioned to ESC.
- (U) A Tier Two USAF Electronic Key Distribution system will undergo DT&E at an operational site.
- (U) Digital-digital tandeming of wide-band and narrow-band secure voice systems at a Gateway will be demonstrated using the canonical transform.
- (U) Development of a NONSTOP system for ESC will achieve in-plant demonstration prior to fabrication of prototypes.

(U) FY 1991 Planned Program:
- (U) Complete development of NONSTOP Automated Data Acquisition System.
- (U) Deliver Tier Two System.
- (U) Continue TEMPEST, COMSEC and secure voice research and development to ensure Air Force fielded systems are capable of countering exploitation efforts.

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

(U) Work Performed By: All tasks under this program are managed through the Rome Air Development Center (RADC) of the Air Force Systems Command (AFSC), 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 1990/1991 BIENNAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

A. (U) RESOURCES ($ In Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2026 System Support	424	420	426	423	N/A	Continuing
2759 Mobile Microwave Landing System (MMLS)	13,093	9,944	7,200	0	0	37,731
2966 New Mobile RAPCON	3,818	TBD	TBD	TBD	N/A	TBD
2967 Air Traffic Control Survivability	6,591	5,000	0	0	N/A	16,000
3042 BAMBOO TREE	418	400	317	200	N/A	Continuing
3587 Microwave Landing Systems (MLS) Avionics	1,447	13,286	15,466	19,950	Continuing	78,800
TOTAL	25,791	29,050	23,409	20,573	Continuing	Continuing

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program provides the Air Force with the Air Traffic Control And Landing Systems (ATCALS) (formerly call 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2026, System Support: Continued support for ATCALS programs including several joint efforts with the Federal Aviation Administration (FAA).

(U) FY 1988 Accomplishments:
- (U) Definition of USAF air traffic control facilities and their interface with FAA National Airspace Systems Plan (NASP).
- (U) Definition requirements for the Microwave Landing Systems.
- (U) Establishing requirements for the next generation mobile/tactical radar systems.

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

(U) FY 1989 Planned Program:
- (U) Continued definition of the USAF - FAA interface for the NASP.
- (U) Work will begin on 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).

(U) FY 1990 Planned Program:
- (U) Continued support for all ATCALS projects.
- (U) Increased role for USAF and the NASP.
- (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 NASP.

(U) Program to Completion:
- (U) This is a continuing project keeping pace with military and civil air traffic control modernization.

(U) Work Performed By: Air Force Systems Command Electronic Systems Division, Hanscom AFB, MA manages the overall ATCALS effort. ARINC Research Corporation, Annapolis, MD; and Mitre Corporation, Bedford, MA, provide cost data and system support.

(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: None.

(U) International Cooperative Agreements: None.

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 1988 Accomplishments:
- (U) MMLS contract award for system development in FY 1988.

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

(U) FY 1989 Planned Program:
- (U) System breadboarding and architecture development.

(U) FY 1990 Planned Program:
- (U) Developmental Test and Evaluation (DT&E)

(U) FY 1991 Planned Program:
- (U) Initial Operational Test and Evaluation (IOT&E).
- (U) Production decision.
- (U) Start production of 33 systems in first procurement option.

(U) Program to Completion:
- (U) MMLS Initial Operating Capabilities (IOC)
- (U) Production completion of 60 MMLS in FY 1994.

(U) Work Performed By: Bell Aerospace, Buffalo, NY. Air Force Systems Command Electronic Systems Division, Hanscom AFB, MA, manages the MMLS effort. ARINC 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:

Other Procurement:

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0	0	0	17,907	18,000	35,907

(U) International Cooperative Agreements: None.

3. (U) Project 2966, New Mobile RAPCON: Provides a mobile, tactical, and rapidly deployable radar system for air traffic control.

(U) FY 1988 Accomplishments:
- (U) Defined requirements for New Mobile RAPCON (NMR).
- (U) Purchased one AN/TPS-73 radar under the Marine Air Traffic Control And Landing Systems (MATCALS) contract.
- (U) Contract award for an operations shelter subsystem prototype.

(U) FY 1989 Planned Program:
- (U) Delivery of an AN/TPS-73 radar to conduct operational testing and evaluations.
- (U) Monitor contractor progress on operations shelter production.

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

(U) FY 1990 Planned Programs:
- (U) Production decision for AN/TPS-73 radar.
- (U) Evaluate the operations shelter prototype.
- (U) Begin Full Scale Development of the operations shelter.

(U) FY 1991 Planned Program:
- (U) Initial production of the AN/TPS-73 radar.
- (U) Contract award for the operations shelter production.

(U) Program to Completion:
- (U) Production of 19 NMR systems through FY 1993.

(U) Work Performed By: Testing of the AN/TPS-73 by Air Force Communications Command, Scott AFB, IL. The prototype operations shelter is under construction by Aydin Corporation, Horsham, PA. Air Force Systems Command Electronic Systems Division manages the NMR effort.

(U) Related Activities: None.
- (U) There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriations Funds:

Other Procurement:

FY 1988 Actual	FY1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0	19,959	TBD	TBD	TBD	TBD

(U) International Cooperative Agreements: None

4. (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 Vehicle (SRV).

(U) FY 1988 Accomplishments:
- (U) Definition of TRV and SRV system requirements.

(U) FY 1989 Planned Program:
- (U) Development contract to be awarded providing prototypes of the TRV and SRV for test and evaluations.

(U) FY 1990 Planned Program:
- (U) Continued development of the TRV and SRV.
- (U) Begin test and evaluation.

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

(U) FY 1991 Planned Program:
- (U) Complete testing of the TRV and SRV systems.

(U) Program To Completion:
- (U) Production of 38 systems (19 TRV and 19 SRV) with production complete in FY 1993.

(U) Work Performed By: Contract award for the TRV/SRV is expected in May 1989 for ful scale development. 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.

(U) Other Appropriation Funds:

Other Procurement:

FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0	0	TBD	TBD	TBD	TBD

5. (U) Project 3042, BAMBOO TREE: BAMBOO TREE provides contiued support to ensure the United States has air access to the Berlin corridors.

(U) FY 1988 Accomplishments:
- (U) Integration of communications and radar systems.

(U) FY 1989 Planned Program:
- (U) Upgrade of the Templehof Central Airport radio system.

(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) Program To Completion:
- (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.

Program Element: 0305114F Budget Activity: #5-Intelligence/Communications
PE Title: Air Traffic Control And Landing Systems (ATCALS)

(U) Other Appropriation Funds:

Other Procurement:

FY 198 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1,100	443	1,364	TBD	Continuing	TBD

(U) International Cooperative Agreements: None.

00702

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: # 0305114F Project Number: 3587
PE Title: Air Traffic Control And Landing Systems 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 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		FSD Decision Aug 89			IOC Jan 95
Engineerng Milestones					
T&E Milestones	FSED Complete Sep 88			OT&E Mar 91	DT&E/IOT&E Sep 92
Contract Milestones		FSD RFP FSD Contract Award			Production Decision Mar 94
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	(To Complete)
Major Contract		3 Contracts Jun 89 10,286	3 Contracts Continues 10,214	3 Contract Continues 14,820	Contract Continues 12,000
Support Contract	MITRE 300 ARINC 640 SSAI 278	MITRE 1,800 ARINC 750 SSAI 150	MITRE 1,800 ARINC 830 SSAI 250	MITRE 2400 ARINC 1800 SSAI 480	MITRE 5,800 ARINC 2,600 SSAI 1,900
In-House Support	Logistics, Travel, SPO 229	Logistics Travel, SPO 300	Logistics, Travel, SPO 300	Logistics, Travel,SPO 300	Logistics, Travel, SPO 1,329
GFE/ Other			A-Kit Integration 2,072	A-Kit Integrat. 150	
Total	1,447	13,286	15,466	19,950	23,629

Program Element: #0305114F Project Number: 3587
Project: Military Microwave Landing System Avionics 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 (10,000 hour fielded MTBF planned).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) MMLSA contract award in Jun 87 to five corporations to provide a breadboard system.
   - (U) Design and testing of breadboard systems complete.

2. (U) FY 1989 Planned Program:
   - (U) FSD RFP Release Feb 89.
   - (U) FSD decision Aug 89.
   - (U) Contract award Aug 89.

3. (U) FY 1990 Planned Program:
   - (U) Continued MMLSA development.

4. (U) FY 1991 Planned Program:
   - (U) Continued MMLSA development.

5. (U) Program to Completion:
   - (U) Early Operational Assessment (EOA) in FY 1992.
   - (U) Production decision Mar 94.
   - (U) IOC Jan 1995.
   - (U) Acquisition of 7256 systems through FY 2005.

D. (U) WORK PERFORMED BY: The MMLSA contract was awarded to Allied Corp., Eaton Corp., Hazeltine Corp., Rockwell International, and Singer Corp. to provide demonstration breadboard systems. Three contractors will be selected for FSD with down selection to two contractors for production.

Program Element: #0305114F Project Number: 3587
Project: Military Microwave Landing System Avionics Budget Activity: # 5
Intelligence and Communications

E. (U) COMPARISION WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

:TYPE OF: :CHANGE	: Impact on System Capabilities:	Impact on Schedule	: Impact On : FY 1990 Cost:
Tech	None	None	None
Sched	None	+ 6 Months	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.
2. (U) SCHEDULE CHANGES: Funding was partically removed in FY 90 and restored in FY 92 causing the six month slip.
3. (U) COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
- (U) Air Force Communications Command General Operating 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(7)/35114F, PMD for MLS, 20 Apr 88.

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

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

Program Element: #0305114F Project Number: 3587
PE Title: Air Traffic Control And Landing Systems Budget Activity: # 5
Intelligence and Communications

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
FSED	Sep 88	Five contractors successfully completed FSED.

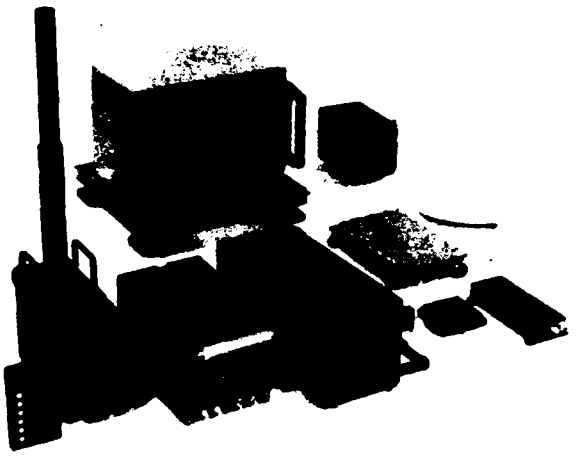
T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
EOA	1st Qtr 92	Start
EOA	2nd Qtr 92	End
FAT	3rd Qtr 92	Start
FAT	1th Qtr 94	End
OT&E	1st Qtr 94	Start
OT&E	3rd Qtr 94	End

FY 1990/1991 BIENNIAL BUDGET 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	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	N/A	N/A	Milestone IIIB Jun 90	User Equipment Prog Mgt Resp Trnsfr--3Q 91	Production Continues Thru 1990s
Engineng Milestones	N/A	N/A	N/A	N/A	N/A
T&E Milestones	Phase III DT&E Jul 88-Mar 89	FOT&E Apr89-Jul89	N/A	N/A	N/A
Contract Milestones	Phase III, LRIP Option 4--Apr	Phase III, LRIP Option 5--Apr	Full-Rate Pdtn Begins--July	Full-Rate Prod Option--1Q 90	Rate Prod Options Cont.
BUDGET	FY 1988	FY 1989	FY 1990	FY 1991	Program Total
Major Contract (UE Prod/ Install)	31,350	35,600	29,667	29,503	Continuing
Support Contract	3,545	5,000	3,786	1,817	Continuing
In-House Support	1,660	3,329	825	725	Continuing
GFE/ Other	1,684	3,076	1,277	871	Continuing
Total	38,239	47,005	35,555	32,916	N/A

00707

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

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 11,000 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). 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 (funded in PE 0305165F) is the satellite constellation which provides the worldwide navigation signals. GPS satellites will also carry Nuclear Detonation (NUDET) Detection System sensors as additional payloads to detect and locate nuclear detonations. 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 1988 Accomplishments:
- (U) Development of integration software for B-52G, F-111A/E, MH-53J and RC-135 was completed.
- (U) Other previously initiated development activities continued.
- (U) Integration development began for F-16, F-4, F-15 and C-135 families, A-10, C-17, E-4, F-111D/F, MH-60, E-8 and KC-10 aircraft.
- (U) Phase III user equipment testing began.

(U) FY 1989 Planned Program:
- (U) Integration software development to be completed for TR-1, U-2 and for initial C-130s.
- (U) Begin design of system status reporting for user mission planning.
- (U) Other previously initiated development activities continue.
- (U) Integration development begins for B-1B and C-141B aircraft.
- (U) Follow-on testing to be completed in preparation for full rate production decision in Jun 90.

(U) FY 1990 Planned Program:
- (U) Complete integration development for EF-111A, VC-25 and for additional C-130 aircraft types.
- (U) Other previous integration development activities continue.
- (U) Continue development of system status reporting for users.
- (U) Integration development begins for C-18, C-20, CV-22, C-137, C-5, UH-1 and OV-10 aircraft.

00708

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

(U) FY 1991 Planned Program:
- (U) Complete integration development for initial F-15E, B-52H, MH-60G and additional C-130 types.
- (U) Other previously initiated development activities continue.
- (U) Integration development begins for FB-111A, OA-37, C-12, H/CH-3 and T-37.

(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 Division, Los Angeles AFB, CA. User equipment is produced by Rockwell International, Collins Government Avionics Division, Cedar Rapids, 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 AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	+ 9 mos	None
Cost	None	None	-16,201

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.

2. (U) SCHEDULE CHANGES: Milestone IIIB decision delayed from Sep 89 to Jun 90 to accommodate delays in operational satellite launch, user equipment and test platform availability and test data analysis/report preparation cycle.

3. (U) COST CHANGES: Delay integration engineering for F-16, B-1, C-141 and KC-10 and delay system status reporting capability for user mission planning.

F. (U) PROGRAM DOCUMENTATION:
- (U) DCP 133 (Rev A), 17 Jan 78
- (U) SDDM, 11 Jul 86
- (U) Integrated Multi-Service TEMP, Nov 87

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

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 anti-jamming 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) PE 0305165F, 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 0305171F, Space Launch Support, funds Space Shuttle launches and Payload Assist Module Delta Class II (PAM-DII) upper stages.
- (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)

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Aircraft Procurement, BP 11, 16, 19					
Funds	104,801	84,202	105,331	132,027	N/A
Quantities (Receivers)	(377)	(258)	(397)	(770)	
Other Procurement, BA 83					
Funds	15,579	18,342	13,886	8,393	N/A
Quantities (Manpacks)	(303)	(531)	(609)	(250)	

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:

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

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
IOT&E (Full Scale Engineering Development User Equipment)	Jun-Nov 85 (Army) Nov 85-Jan 86 (Army) Sep-Dec 85 (Navy) Nov-Dec 85 (Air Force)	Verified satisfactory technical performance and capability enhancement of user equipment. Identified reliability/maintainability concerns for which corrective actions have been implemented.

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
FOT&E (Multi-Service)	Apr-Sep 89	N/A

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) (Space/Ground)
Project Number: # N/A
Budget Activity: 5 - Intelligence and Communications
Project Title: GPS

POPULAR NAME: GPS

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	Control Segment Prgm Mgt Resp Trnsfr--Oct 87	First Prod Sat Launch--Jan 89	Prod Satellite Launches Cont	2-D Coverage Milestone Mar 91	3-D Coverage FY 92
Enginerng Milestones	N/A	N/A	Block IIR Crit Design Review Feb 90	N/A	N/A
T&E Milestones	N/A	Control Segment Opnl Software Tst Nov88-Jun89	N/A	N/A	N/A
Contract Milestones	Award Replen Sat Phase I Cont--Jun 88	Award Replen Sat Phase II Cont--May 89	N/A	Begin Replen Sat Production Feb 91	Deliver First Block IIR 4Q 95
BUDGET	FY 1988	FY 1989	FY 1990	FY 1991	Program Total
Major Contract	21,450	42,010	26,897	24,801	Continuing
Support Contract	284	874	423	264	Continuing
In-House Support	1,557	1,660	1,482	1,517	Continuing
GFE/ Other	2,913	2,994	4,508	4,087	Continuing
Total	26,204	47,538	33,310	30,669	N/A

Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) (Space/Ground)
Project Number: # N/A
Budget Activity: 5 - Intelligence and Communications
Project Title: GPS

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; preplanned product improvements to improve survivability of both the space and control 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 needs 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). 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 (NDS) sensors as additional payloads to detect and locate nuclear detonations. The control segment consists of five monitor stations and three ground antennas located around the world and a Master Control Station (MCS) which is a tenant in the Consolidated Space Operations Center. The monitor stations measure satellite performance parameters which are evaluated and corrected by the MCS and then forwarded to the satellites via the ground antennas. The control segment also provides a user interface to system operation. 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 1988 Accomplishments:
- (U) Control segment support to development satellites continued.
- (U) Control segment software modifications were accomplished.
- (U) Engineering efforts supported preparation of the first GPS production satellite for launch.
- (U) Payload box second source preliminary design completed, providing the industrial base for replenishment satellite development and procurement.

(U) FY 1989 Planned Program:
- (U) Operational satellite launches will begin.
- (U) Control segment support to development and production satellites (as launched) will continue. Development of status monitoring/reporting system begins for constellation management.
- (U) Operational testing of control segment software will begin.
- (U) Engineering efforts supporting satellite launches will continue.
- (U) Development of GPS replenishment satellites will begin.

Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) (Space/Ground)
Project Number: # N/A
Budget Activity: 5 - Intelligence and Communications
Project Title: GPS

(U) FY 1990 Planned Program:
- (U) Operational satellite launches will continue.
- (U) Development of GPS replenishment satellites will continue.
- (U) Control segment support to on-orbit constellation will continue.
- (U) Development of constellation management/system status reporting capability continues.
- (U) Operational testing of control segment software will be completed.

(U) FY 1991 Planned Program:
- (U) Operational satellite launches and on-orbit support will continue.
- (U) Qualification of GPS replenishment satellites will be conducted, and replenishment satellite procurement will begin.
- (U) Development of constellation management/system status reporting capability continues.

(U) Program to Completion:
- (U) This is a continuing program. Support of the operational satellite constellation and development and deployment of replenishment satellites will continue. System engineering for continued management of the GPS service will be required.

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 Division, Los Angeles AFB, CA. The Block II satellite contractor is Rockwell International Space Operations and Satellite Systems Division, Seal Beach, CA. Replenishment satellite development is being performed by Rockwell International and by the General Electric Company, East Windsor, NJ. 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. User Equipment is produced by Rockwell International Collins Government Avionics Div., Cedar Rapids, IA. Operational control segment development/deployment is being done by International Business Machines/ Federal Systems Div., Gaithersburg, MD.

E. (U) COMPARISON WITH AMENDED FY 1988/1989 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	-6,104

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None.

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Program Element: #0305165F
PE Title: Navstar Global Positioning System (GPS) (Space/Ground)
Project Number: # N/A
Budget Activity: 5 - Intelligence and Communications
Project Title: GPS

2. (U) SCHEDULE CHANGES: None.

3. (U) COST CHANGES: Delays completion of development for constellation management/system status reporting capability by one year.

F. (U) PROGRAM DOCUMENTATION:
- (U) DCP 133 (Rev A), 17 Jan 78

G. (U) RELATED ACTIVITIES:
- (U) GPS development and operational implementation are joint activities.
- (U) Other agencies are Army, Navy, Marine Corps, Defense Mapping Agency, Department of Transportation and North Atlantic Treaty Organization.
- (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 the satellites.
- (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 0305171F, Space Launch Support, funds Space Shuttle launches and Payload Assist Module Delta Class II (PAM-DII) upper stages.
- (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)

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Program
Missile Procurement, BA 23					
Funds (Satellites)	91,385	74,558	70,291	200,752	N/A
Quantity (Order/Full Fund)	(0/4)	(0/0)	(0/0)	(20/0)	
Other Procurement, BA 83					
Funds	4,008	907	0	0	N/A

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

J. (U) TEST AND EVAULATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
Satellite Compatibility Tests	Apr-Jun 87, Jan-Jul 88	Verified acceptable satellite performance

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Control Segment Software Operational Testing	Feb 89-Nov 89	N/A

Program Element: #603402F
PE Title: Space Test Program (STP)

Budget Activity: #6 Defense Wide Mission Support

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

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total
2617 Free-Flyer Spacecraft Missions	17,194	20,530	45,104	58,430	continuing	TBD
2618 Quick Response Shuttle Missions	240	1,554	3,087	5,819	continuing	TBD
2619 Teal Ruby Mission	9,800	-	-	-	0,000	211,653
2620 Shuttle Sortie Missions	17,631	22,220	26,398	12,756	continuing	TBD
3662 Starscan	3,534	-	-	-	0,000	TBD
TOTAL	48,399	44,304	74,589	77,005		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/or 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 technology designs. These experiments are flown based on priority relevance to existing military requirements and the availability of cost effective means of spaceflight on expendable launch vehicles or Shuttle. The 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, incremental designed, man-aided experiments. The experience gained from this approach will be a key element in fully defining military man's role in space.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLAN:

(U) Project 2618, Quick Response Shuttle Missions: This STP project supports the flight of Quick Response Shuttle Payloads (QRSPs) which account for 90% of all tri-Service ranked secondary experiments. Due to the simplified integration involved, these QRSP experiments maximize the use of near-term flight opportunities on both DOD and NASA Space Shuttle missions. QRSP experiments make use of Shuttle mid/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. As a newly directed outgrowth of the QRSP Program, the Military Man-In-Space (MMIS) effort will develop/evaluate equipment and human tasking in the space environment for specific military applications.

Program Element: #603402F
PE Title: Space Test Program (STP)

Budget Activity: #6 Defense Wide Mission Support

1. (U) FY 1988 Accomplishments:

- (U) No QRSP's were flown in FY 1988 due to the standdown of the Shuttle fleet.
- (U) Approved flight plan for the first MMIS mission, M88-1.
- (U) Completed development of an extended GAS container

2. (U) FY 1989 Planned Program:

- (U) Continue efforts to manifest 11 backlogged and over thirty new QRSP and MMIS experiments.
- (U) Continue development of standard hardware and services including power supplies, data recorders and telescopes.
- (U) Continue development of flight integration procedures.

3. (U) FY 1990 Planned Program:

- (U) Continue manifesting backlogged experiments and support new experiments as much as Shuttle capacity allows.

4. (U) FY 1991 Planned Program:

- (U) Continue supporting new experiments and manifest flights as much as the Shuttle capacity permits.

5. (U) Program to Completion: N/A - continuing program.

(U) Work Performed By:

Air Force Systems Command, Space Division, Los Angeles AFB, CA, NASA/Johnson Space Center, Houston, TX. The Aerospace Corporation, El Segundo, CA.

(U) RELATED ACTIVITIES:

- (U) Program Element #35171F (Space Shuttle Operations)
- (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: The AF Technical Application Center's GAS experiment HIEN-LO contains a sensor developed by the Max-Plank Institute, Munich, West Germany.

Program Element ##603402F
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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total
	17,194	20,530	45,104	58,430	continuing	N/A

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 or "refurbished" free-flyer spacecraft. Approximately 70% 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 1989, 30% of the 51 ranked experiments can be satisfied by small satellite (100 to 500 pound class) missions, 20% require medium satellite (500 to 4,000 pounds) missions, 20% can potentially use "piggyback" missions, and the remaining 30% require Shuttle sortie missions (see Project 2620). The Free-Flyer project supports spacecraft development and on-orbit operations for the joint DOD/NASA Combined Release and Radiation Effects Satellite (CRRES) mission, P86-1, and the "Stacksat" P87-2 mission.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
- (U) Successful launch and recovery of the first high altitude balloon mission over Antarctica during January 1988 with DARPA's Gamma-Ray Advanced Detector (GRAD) experiment.
- (U) CRRES spacecraft removed from storage for Atlas modifications
- (U) Completed feasibility study of an STP mission (P89-D) using the GPS Block II Qualification spacecraft for ten STP experiments.
- (U) Signed MOA with NOAA on the flight of three Navy experiments on the TIROS satellites.
- (U) MOA signed between STP and the Office of Naval Research (ONR) to secure secondary capacity on the French SPOT-3 spacecraft for ONR's Polar Ozone and Aerosol Measurement (POAM II) experiment.

2. (U) FY 1989 Planned Program:
- (U) Launch of P87-2 "Stacksat" mission.
- (U) Commence procurement of small satellites and associated Scout class launch vehicles for the spaceflight of 16 STP experiments.
- (U) Complete CRRES modifications and reintegrate 26 DOD instruments.
- (U) Secure flight opportunity for Air Force Geophysics Laboratory's (AFGL) Automated Charge Control at Geosynchronous (CHARGE CON-GEO) experiment on NOAA's GOES-I.

Program Element ##603402F
PE Title:Space Test Program (STP)

Project Number: 2617
Budget Activity:#6 Defense Wide Mission Support

- (U) Secure spaceflight approval for AFGL's Shuttle Potential and Return Electron Experiment (SPREE) on the joint NASA/Italian Tethered Spacecraft Mission aboard the Shuttle.
- (U) Develop designs for accommodating small ejectable payloads from expendable launch vehicles.
- (U) Approve Scout mission for the flight of ONR's Passive Radio Frequency Interference Location Experiment (PROFILE) and Navy Space Systems Activity (NSSA) Low Earth Orbit Polar Demonstration (LEOPARD) experiment.
- (U) Approve Scout class mission for RADC'S Radiation Experiment (REX) and Los Alamos National Laboratory's Array of Low Energy X-ray Imaging Sensors (ALEXIS) experiment.

3. (U) FY 1990 Planned Program:
- (U) Complete system testing and launch P86-1 CRRES.
- (U) Award small satellite development 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, AFWAL's Survivable Concentrating Photovoltaic Array (SCOPA) experiment and Naval Research Laboratory's (NRL) Advanced Clock and Ranging Experiment (ACRE).

4. (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 MAXIE and EHIC upon launch of the TIROS-I mission.

5. (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.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	IMPACT ON SYSTEM CAPABILITIES	IMPACT ON SCHEDULE	IMPACT ON FY 1990 COST
Tech	see below	see below	see below
Schd	see below	see below	see below
Cost	see below	see below	see below

NARRATIVE DESCRIPTION OF CHANGES

Program Element ##603402F
PE Title: Space Test Program (STP)

Project Number: 2617
Budget Activity: #6 Defense Wide Mission Support

1. (U) Technical Changes:
   (a) (U) P86-1, CRRES, designed for a Shuttle mission, modified to make the spacecraft compatible with an Atlas-I/Centaur launch vehicle
   (b) (U) The P89-D, ARCAS, mission redefinition for a Shuttle flight due to removal of the originally assigned Atlas-II booster.
   (c) (U) STP missions originally planned for Shuttle polar missions now require expendable boosters.

2. (U) Schedule Changes:
   (a) (U) P86-1, CRRES, originally scheduled for a July 1987 Shuttle flight, has been manifested for a June 1990 Atlas-I/Centaur.
   (b) (U) NOAA's Television Infra-Red Observation Satellites (TIROS), flights I and J were rescheduled on Atlas-E boosters.
   (c) (U) The P87-2, Stacksat, mission schedule was changed from 2Q FY 1989 to 4Q FY 1989 due to Atlas-E schedule requirements.
   (d) (U) Budget reductions in FY 1988 forced a two year delay of the P89-D (formerly P87-B) mission start.
   (e) (U) Budget reductions in FY 1988 forced the Light Detection and Ranging (LIDAR) (mission P87-A) experiment sponsor to withdraw.
   (f) (U) Budget reductions in FY 1988 forced deletion of an Atlas-II for the P89-D mission.

3. (U) Cost Changes: None.

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

H. (U) OTHER APPROPRIATION FUNDS: None

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	Fourth Quarter 1989
(U)	Atlas-I/Centaur launch of P86-1, CRRES	June 1990
(U)	TIROS-I launch with Navy MAXIE and EHIC experiments	October 1990
(U)	Shuttle launch of Tethered Satellite/SPREE experiment	FY 1991
(U)	Scout class launch of PROFILE and ALEXIS spacecraft	FY 1991
(U)	Scout class launch of SIDEX and LEOPARD spacecraft	FY 1991

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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total
	17,631	22,220	26,398	12,756	continuing	TBD

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:
This STP project supports approximately 30% of the tri-Service "primary" experiment spaceflight requirements and approximately 10% of the "secondary" experiment spaceflight requirements. The project advances DOD space technology by providing for the spaceflight of experiments on Shuttle sortie missions (payloads/experiments which are returned) for demonstrating new system 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/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 Quadrupole Ion Neutral Mass Spectrometer (QUINMS). The project also supports the P88-1 mission for the initial flight of the STP Spartan experiment carrier program called Deploy and Retrieve Experiments on Spartan (DARES).

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
- (U) Terminated the Sortie Pallet for Shuttle (SPAS) program with NASA/Jet Propulsion Laboratory due to budget reductions.
- (U) AFP-675 support structure and the five DOD experiments were removed from storage and flight preparation efforts started for a mid-1990 flight.
- (U) AFP-675 mission/payload specialists training initiated.
- (U) The first STP Spartan, the Deploy and Retrieve Experiments on Spartan-1 (DARES-1) (P88-1) mission was approved.
- (U) Reassigned Air Force Rocket Propulsion Laboratory's (AFRPL)

Program Element:#0603402F
Title:Space Test Program (STP)

Project Number: 2620
Budget Activity:#6 Defense Wide Mission Support

Acoustical Measurement of Spacecraft Experiment (AMOSE) to P88-1 mission.

2. (U) FY 1989 Planned Program:
- (U) Continue the AFP-675 spacecraft and experiment integration, system test and ground operations planning for a FY 1990 flight.
- (U) Complete integration of P88-1, DARES-1, Spartan and store.
- (U) Begin planning the P90-C, DARES-2, mission for NRL's Middle Atmosphere High Resolution Spectrograph (MAHRS) and High Resolution Airglow/Aurora Spectrograph (HIRAAS) experiments.

3. (U) FY 1990 Planned Program:
- (U) Support the AFP-675 sortie Shuttle flight scheduled on STS-39, associated mission operations, post-flight recovery, and data distribution.
- (U) Remove P88-1, DARES-1, from storage and resume flight preparations for an estimated opportunity in FY 1991.
- (U) Begin planning for the P91-B DARES-3 mission.
- (U) Continue flight opportunity feasibility studies.

4. (U) FY 1991 Planned Program:
- (U) Support planned launch and recovery of the P88-1, DARES-1, spacecraft, process and distribute recorded science data, and de-integrate the experiments.
- (U) Ready DARES spacecraft for P90-C, DARES-2, mission.
- (U) Continue feasibility studies for the NASA Space Station and other commercial space platforms to host STP experiments.

5. (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. NASA/Goddard Space Flight Center, Greenbelt, MD; Lockheed Space and Missile Company, Sunnyvale,CA.

E. (U) COMPARISON WITH FY 1988/1989 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	IMPACT ON SYSTEM CAPABILITIES	IMPACT ON SCHEDULE	IMPACT ON FY 1990 COST
Tech	see below	see below	see below
Schd	see below	see below	see below
Cost	see below	see below	see below

NARRATIVE DESCRIPTION OF CHANGES

1. (U) Technical Changes:
   (a) (U) The DARPA Gamma-Ray Advanced Detector (GRAD) was de-integrated from AFP-675 for flight on the P87-3 Antarctica balloon flight.
   (b) (U) Degraded expected scientific results by remanifesting AFP-675 at

Program Element:#0603402F
Title:Space Test Program (STP)

Project Number: 2620
Budget Activity:#6 Defense Wide Mission Support

a lower inclination orbit.

2. (U) Schedule Changes:
   (a) (U) Remanifesting AFP-675 from the scheduled 1987 Vandenberg AFB, CA, polar flight to low inclination flight in mid-1990 from Kennedy Space Center, FL.
   (b) (U) NASA's post-Challenger accident manifesting policies restrict P88-1, DARES-1, mission to a DOD flight and limits flight opportunities.
   (c) (U) Budget reductions in FY 1988 forced termination of SPAS development effort with NASA/JPL.
   (d) (U) Mission opportunities reduced due to backlog of higher priority payloads, lower Shuttle flight rates, and off-loading of DOD missions onto expendable launch vehicles.

3. (U) Cost Changes: Continued slippage in the Shuttle recovery program has increased funding requirements for the AFP-675 program.

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:

(U)	Shuttle launch of AFP-675 mission on STS-39	Mid-1990
(U)	First flight of STP's Spartan, P88-1, DARES-1	Planned for 1991
(U)	DARES-2 Shuttle flight	Planned for 1992
(U)	DARES-3 Shuttle flight	Planned for 1993

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0603438F Budget Activity: #6-Defense Wide Mission Support
PE Title: Space Systems Survivability

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

Project Number	Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2611	Survivability Planning and Analysis	500	250	500	500	continuing	TBD
2612	Satellite Survivability	2,510	4,753	9,361	9,054	continuing	TBD
2613	Ground Station/ Link Survivability	160	0	500	1,000	continuing	TBD
TOTAL FOR PROGRAM ELEMENT		3,170	5,003	10,361	10,554	continuing	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) -

Survivability technologies under this program are made available to all satellite Program offices for system level implementation.

Program Element: #0603438F Budget Activity: #6-Defense Wide Mission Support
PE Title: Space Systems Survivability

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project: 2611, Survivability and Planning Analysis:
Performs analysis and planning to meet space survivability requirements.

(U) FY 1988 Accomplishments:
- (U) Annual update of Space Mission Survivability Plan
- (U) Continued analyses of evolution of the threat, technology needs, development priorities and operational requirements.

(U) FY 1989 Planned Program:
- (U) Annual update of Space Mission Survivability Plan
- (U) Continuing analyses of evolution of the threat, technology needs, development priorities, and operational requirements.

(U) FY 1990 Planned Program:
- (U) Annual update of Space Mission Survivability Plan
- (U) Continuing analyses of evolution of the threat, technology needs, development priorities, and operational requirements.

(U) FY 1991 Planned Program:
- (U) Annual update of Space Mission Survivability Plan
- (U) Continuing analyses of evolution of the threat, technology needs, development priorities, and operational requirements.

(U) Program to Completion:
- (U) Annual update of Space Mission Survivability Plan
- (U) Continuing analyses of evolution of the threat, technology needs, development priorities, and operational requirements.
- (U) Identification of needed initiatives will continue.

(U) Work Performed By: Air Force Systems Command's Space Division, Los Angeles AFB, CA has overall responsibility for program management. Space Division executes the program, has responsibility for contractor overview and performs technical analysis in support of all projects. General Research Corp, Santa Barbara, CA is the contractor for survivability planning and analysis.

(U) Related Activities: Strategic Defense Initiative (SDI) Key Technology Programs (PE 063224C) contain complementary Survivability Projects which are managed by the Department of Defense, the Army and the Air Force.

(U) Other Appropriation Funds: None.

Program Element: #0603438F Budget Activity: #6-Defense Wide Mission Support
PE Title: Space Systems Survivability

(U) International Cooperative Agreement: Not applicable.

2. (U) Project 2612, Satellite Survivability:
Develops Satellite On-Board Attack Reporting System (SOARS).

(U) FY 1988 Accomplishments:
- (U) SOARS Phase I program completed Feb 88
- (U) Laser Warning receiver,

- (U) High Power mircrowave circuitry tested.

(U) FY 1989 Planned Program:
- (U) Award SOARS Phase II contract to design, build, integrate and test a

- (U) Deliver SOARS A-specs developed under Phase I to satellite developers to transition the technology

(U) FY 1990 Planned Program:
- (U) Continue SOARS development to Critical Design Review (CDR) in 3Q FY90.
- (U) Evaluate need for new detection sensors based on current threat projections (e.g., neutral particle beam sensor).

(U) FY 1991 Planned Program:

- (U) Continue sensor analysis/development based on evolving threat.

(U) Program to Completion:

- (U) Continue sensor development for evolving threat.

(U) Work Performed By: The Satellite On-Board Attack Reporting System (SOARS) design phase contracts are with Lockheed, Sunnyvale, CA, and TRW, Los Angeles, CA. The Aerospace Corporation, Los Angeles, CA, provides system engineering support and developing technology for the, efforts.

(U) Related Activities:
- (U) Program Elements 0602601F, Advanced Weapons, and PE 0604711F Systems Survivability, develop nuclear hardening technology which is applied in PE 063438F.

00726

Program Element: #0603438F Budget Activity: #6-Defense Wide Mission Support
PE Title: Space Systems Survivability

- (U) Program Element 0603431F, Advanced Space Communications Capabilities, develops communication systems technology which supports survivable tracking, telemetry, and control (TT&C) stations.
- (U) Program Element 0603211F, Aerospace Structures and Materials, develops laser-hardened satelllite components and material.
- (U) There is no unnecesssary duplication of effort within the Air Force of the Department of Defense.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreement: Not applicable.

3. (U) Project 2613, Ground Station/Link Survivability: Develops techniques to improve survivability of satellite ground stations and communications links.

(U) FY 1988 Accomplishments:
- (U) Initiated efforts to design improvements for link survivability.
- (U) Initiated design of jamming warning unit for satellite ground stations.
- (U) Investigated techniques to improve security, and anti-jam capabilities of commercial communications.

(U) FY 1989 Planned Program:
- (U) Continue link security, anti-jam development for commercial communications.
- (U) Initiate fabrication of jamming warning device for ground stations.

(U) FY 1990 Planned Program:
- (U) Continue link security, anti-jam development for commercial communications.
- (U) Continue jam warning unit development.

(U) FY 1991 Planned Program:
- (U) Start prototype development for link security and anti-jam communications.
- (U) Begin demonstration phase of jam warning unit.

(U) Program to Completion:
- (U) Transition technology developed for jam warning and other devices.

(U) Work Performed By: Air Force Systems Command's Space Division, Los Angeles AFB, CA, is conducting systems analyses in support of this project.

Program Element: #0603438F Budget Activity: #6-Defense Wide Mission Support
PE Title: Space Systems Survivability

(U) Related Activity: None.

(U) Other Appropriation Funds: None.

(U) International Cooperative Agreement: Not applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2459 Target Payload Systems	2,105	3,693	6,955	7,179	Continuing	N/A
3165 QF-106 Full-Scale Aerial Target Systems	5,800	0	0	0	0	21,800
Total	7,905	3,693	6,955	7,179	Continuing	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-106 development provides a follow-on to the QF-100 full-scale targets which completed procurement in FY 1987.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 closest 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.

(U) FY 1988 Accomplishments:
- (U) QOT&E of APC-4 IR plume generator pod on MQM-107B initiated
- (U) Efforts to develop an afterburner plume generator using pyrophoric materials were discarded
- (U) Development, integration and testing of target ECM and the M130 flare/chaff dispenser initiated

00729

Program Element: #0604211F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: Advanced Aerial Targets Development

- (U) Request for Proposals (RFP) for Missile End Game Scorer (MEGS) full scale development (FSD) were released
- (U) IR imagery measurement of USAF fighter aircraft continued

(U) FY 1989 Planned Program:
- (U) FSD of MEGS, a vector scoring system to replace the current scoring system on both subscale and full scale targets
- (U) Competitive contract for MEGS will be awarded in Jan 89
- (U) Concept exploration for afterburner IR source will continue
- (U) Analysis of IR measurements of aerial targets and aircraft fuselage and plume IR imagery will be completed
- (U) QOT&E of the APC-4 on the MQM-107D will be completed
- (U) Testing of QF-106 completed and production initiated
- (U) QOT&E of MQM-107D/M130 will be completed

(U) FY 1990 Planned Program:
- (U) Development 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) Development of MEGS will be completed
- (U) Continue planning the QF-4 program

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

(U) WORK PERFORMED BY: Honeywell Inc., Sperry Defense Systems Division, Albuquerque, NM (Project 3165); Hayes International, Leeds, AL (Project 2459 - APC-4); Sverdrup Technology Inc, Tullahoma, TN, (Project 2459 - Afterburner Simulator); and Northrup, Chicago, IL (Project 2459 - 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 unnecessary duplication within the Air Force or Department of Defense. Targets are procured under PE 0305116F.

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

	FY 1988	FY 1989	FY 1990	FY 1991	To	Total
Missile Procurement	Actual	Estimate	Estimate	Estimate	Complete	Program
PE 0305116F	11,040	24,179	22,497	22,821	Continuing	N/A

(U) International Cooperative Agreements: Not Applicable.

00730

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604227F
PE Title: Flight Simulator Development

Budget Activity: #6 - Defense-Wide Mission Support

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

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2325 Simulator Development Activities	5,362	2,110	3,085	3,500	Cont	TBD
2769 Simulator Update Development	8,428	5,600	2,000	2,044	Cont	TBD
2851 Standard Department of Defense (DOD) Simulator Data Base/Common Transformation Program	2,057	3,230	2,300	2,500	Cont	TBD
2901 B-1B Weapon Systems Trainer	3,649	6,778	5,500	0	0	132,465
2968 Modular Simulator Design	472	2,020	300	500	600	7,202
2997 GBU-15 Part Task Trainer	2,222	530	0	0	0	18,239
2998 LANTIRN Simulator	4,503	7,600	600	0	0	25,024
2999 LANTIRN Part Task Trainer	6,554	260	0	0	0	13,434
3000 KC-135 Operational Flight Trainer	3,745	90	0	0	0	27,252
3105 F-15E Weapon System Trainer	115	130	0	0	0	33,717
3135 Advanced Training System	1,620	2,690	10,000	15,000	9,800	47,492
3143 Advanced Tactical Fighter	1,900	1,980	0	0	238,300	247,049
3282 C-17 Aircrew Training System	9,874	29,700	31,801	5,520	400	96,941
3772 C-141 Aircrew Training System	0	3,080	9,100	16,200	4,300	32,550

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Flight Simulator Development

3775 Manpower, Personnel, and Training	0	0	500	500	Cont	TBD
TOTAL	50,501	65,798	65,186	45,764	Cont	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This is a continuing program element for the development of aircrew flight simulator techniques and training devices. The objectives are to adapt flight simulation technology developed in the laboratories and industry to satisfy current and future training requirements, and to develop prototype training devices.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2325 - Simulator Development Activities: Funds engineering development of training system technology techniques and preproduction of first article training devices to satisfy current and future training requirements. The project also identifies deficiencies in training capabilities, improves concurrency between aircraft and flight simulators, and reduces life cycle costs.

(U) FY 1988 Accomplishments:
- (U) Developed and evaluated low cost helmet mounted visual display systems.
- (U) Evaluated the utility of motion cueing and impact of simulator delays on training effectiveness.
- (U) Analyzed threat data requirements for training systems.
- (U) Established standardized data item description to identify needed aircraft data for simulators.
- (U) Developed generic modular software system for instructor operator system.
- (U) Developed transportable system test methodology for the digital radar land mass system (DRLMS) image generator.

(U) FY 1989 Planned Program:
- (U) Assessment of current embedded training opportunities for total tactical mission.
- (U) Survey of state-of-the-art technology alternatives for low cost tactical simulator.
- (U) Evaluate computer based instructional techniques for application in aircrew training devices.
- (U) Determine G-seat drive algorithms for providing more effective flight motion in the simulator.
- (U) Determine maximum tolerable simulator induced time delays.

(U) FY 1990 Planned Program:
- (U) Develop generic software system to support instructor operator station features.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Flight Simulator Development

- (U) Develop generic instructor operator station design capable of handling interfaces with multiple student stations.
- (U) Develop process standard to complement data item for assuring adequate aircraft data for simulators.

(U) FY 1991 Planned Program:
- (U) Determine limited excursion platform utility and drive laws for simulators.
- (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) Program to Completion: This is a continuing project.

(U) Work Performed By: The Training Systems Systems Program Office (SPO) located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manages this effort. Contractors include General Electric, Daytona Beach FL; SIMTEC, Manassas VA; Ball Systems Engineering Division, San Diego CA; Singer-Link, Binghamton NY; INFOTEC Development Inc, Costa Mesa CA; General Dynamics, Ft Worth TX; Logicon, San Diego 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.

2. (U) Project 2769 - Simulator Update Development: Develops updates to training systems to maintain and improve their supportability and effectiveness. It includes development of a C-130 aircrew training system (ATS) and an air-to-air simulator to lead-in fighter training.

(U) FY 1988 Accomplishments:
- (U) C-130 ATS preliminary design review for modifications completed: Jan 88.
- (U) C-130 ATS self contained navigation system (SCNS/Radios) critical design review conducted and completed: Apr 88.

(U) FY 1989 Planned Program:
- (U) Complete C-130 ATS course readiness reviews.

(U) FY 1990 Planned Program:
- (U) Conduct C-130 ATS operative evaluation.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Flight Simulator Development

- (U) C-130 ATS readiness review: Aug 90.
- (U) C-130 ATS program management responsibility transfer: Aug 90.
- (U) C-130 ATS options for operation, management and support through FY 1999.
- (U) Develop air-to-air simulator to lead-in fighter training.

(U) FY 1991 Planned Program:
- (U) Continue development of the air-to-air simulator to lead-in fighter training.

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

(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 is the Singer Co., Stamford CT.

(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.

3. (U) Project 2851 - Standard DOD Simulator Data Base/Common Transformation Program: Develops a standard DOD digital data base that uses Defense Mapping Agency data for displays for aircrew training that will be furnished as Government Furnished Equipment to the contractors.

(U) FY 1988 Accomplishments:
- (U) Industry/Service Working Group established.
- (U) Preliminary design review completed.
- (U) Critical Design Review completed.

(U) FY 1989 Planned Program:
- (U) Produce prototype data base.
- (U) Complete test readiness review.

(U) FY 1990 Planned Program:
- (U) Acceptance testing of development system: Nov 89.
- (U) Interim production and exercise validation option: Nov 89.
- (U) Procure turn-key production capability: May 90.

(U) FY 1991 Planned Program:
- (U) Test and accept turn-key production capability: May 91.

(U) Program to Completion:
- (U) Continue evolution of transformation program to reflect technical advances in industry.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Flight Simulator Development

(U) Work Performed By: The Training Systems SPO located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manages this effort. Contractors for the project are Planning Research Corporation, McLean VA (prime contractor); General Electric/SCSD, Daytona Beach FL (subcontractor); Autometrics, Inc, Alexandria VA (subcontractor); Hughes Aircraft Corporation, Long Beach CA (subcontractor).

(U) Related Activities:
- (U) Defense Mapping Agency (DMA) Exploitation Modernization Program.
- (U) Rome Air Development Center (RADC) Cartographic Applications for Tactical and Strategic Systems (CATSS) Program (PE 0603227F).
- (U) US Army Program Manager for Training Devices (PMTRADE) Rapidly Reconfigurable Data Base (RRDB) Program.
- (U) Joint Technical Coordinating Group for Training systems and Devices (JTCG-TSD): established by the Joint Logistics Commanders; members include acquisition and support executives from all services; Project 2851 is sponsored and approved by the JTCG-TSD, project status briefed to them quarterly.
- (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 for takeoff and landing, navigation, air refueling, threat analysis/countermeasures, low-level penetration, weapons delivery, and emergency procedures.

(U) FY 1988 Accomplishments:
- (U) Completed independent mode system verification test.
- (U) Completed acceptance tests on six cockpit procedure trainers (CPT).
- (U) Awarded contract for Block 3.5 and 4.5 software updates to WSTs and Block 3.5 update to CPTs.

(U) FY 1989 Planned Program:
- (U) Complete DT&E of Support Center System for WST and Mission Trainer (MT).
- (U) Accept WST # 1,3,4,5 and MT # 2.
- (U) Complete design on Block 3.5/4.5 software updates.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Flight Simulator Development

(U) FY 1990 Planned Program:
- (U) Complete system verification test on Block 3.5/4.5 updates for WST, MT and CPT.
- (U) Deliver updates for aerodynamics on operational flight trainer and WST.
- (U) Deliver Block 3.5/4.5 updates for WST, MT and CPT.

(U) FY 1991 Planned Program: Not applicable.

(U) Program to Completion: Not applicable.

(U) Work Performed By: The Training Systems SPO, located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manages this effort. Prime contractor is the 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: Develops a modular design for simulators in order to reduce life cycle cost, reduce development lead time, improve our ability to deliver simulators to the field concurrently with the aircraft, and increase the competitive contractor base.

(U) FY 1988 Accomplishments:
- (U) Fabricate the Modular Validation testbed.
- (U) Establish Functional Baseline Requirements.
- (U) Preliminary Design Review (PDR)--Part I: Mar 88.
- (U) Interfaces defined.

(U) FY 1989 Planned Program:
- (U) Conduct Critical Design Review (CDR)--Part I.
- (U) Complete Phase III--Part I with publication of draft military standard for modular simulators.
- (U) Obtain SAF decision to enter Phase III--Part II.
- (U) Modular software (modules) developed.

(U) FY 1990 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: Flight Simulator Development

(U) FY 1991 Planned Program:
- (U) Complete validation on the testbed simulator.

(U) Program to Completion:
- (U) Implement standard on other contractors' systems to complete validation.
- (U) Publish military standard for modular simulator.

(U) Work Performed By: The Training Systems SPO located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manages this effort. Prime contractor is the 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 2998 - Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) Simulator: Develops a LANTIRN simulator system which when integrated with an Operational Flight Trainer (OFT) provides the capability to fully train pilots in a high threat, night, adverse weather, heavily task loaded environment simulating combat.

(U) FY 1988 Accomplishments:
- (U) Completed Critical Design Review: Dec 87.
- (U) Exercised options to purchase four production F-16 LANTIRN simulators.
- (U) Began avionics hardware/software integration.
- (U) Began fabrication of subsystems.

(U) FY 1989 Planned Program:
- (U) Integration of hardware and software.
- (U) Contractor in-plant tests and Air Force development tests.
- (U) Integration of simulator with F-16 OFT.
- (U) Reliability testing and ready for training.

(U) FY 1990 Planned Program:
- (U) Complete manufacture, delivery, and acceptance test.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Flight Simulator Development

(U) FY 1991 Planned Program: Not applicable, project ends in FY 1990.

(U) Program to Completion: Not applicable, project ends in FY 1990.

(U) Work Performed By: The Training Systems SPO located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manages this effort. Prime contractor is the Singer Company, Houston TX.

(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.

7. (U) Project 3143 - Advanced Tactical Fighter (ATF) Training System: The Tactical Air Forces require an ATF Training System to meet Manpower, Personel and Training needs to support operations personnel assigned to the weapon system. This will fund front end analysis (FEA) to define total ATF training system requirements. PBD 673 deferred further development until FY 92.

(U) FY 1988 Accomplishments:
- (U) Major training system trade studies.
- (U) FEA process continues.

(U) FY 1989 Planned Program:
- (U) FEA completed.
- (U) ATF Training System defined.
- (U) Facilities and concurrency plans complete.

(U) FY 1990 Planned Program:
- (U) ATF aircraft prototypes will be flying.
- (U) Training system definition reports reviewed by government and acquisition strategy formed.

(U) FY 1991 Planned Program:
- (U) Release Request for Proposal (RFP).

(U) Program to Completion:
- (U) Full scale development (FSD) source selection.
- (U) FSD contract award.
- (U) Develop, test and deploy training system.
- (U) Initial operating capability (IOC): Sep 96

Program Element: #0604227F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Flight Simulator Development

(U) WORK PERFORMED BY: The Training Systems SPO and the Advanced Tactical Fighter SPO located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manage this effort. The weapon system demonstration/validation/FEA effort was a dual award to Northrop Corp Air Division, Hawthorne CA and Lockheed Aeronautical Sytem Co., Burbank CA.

(U) RELATED ACTIVITIES: The updated PMD for ATF includes direction to plan for meeting Navy pilot and maintenance training needs. To accomplish this task, the appropriate Navy training elements will participate in the Training Planning Team meetings to address Navy requirements. Details of the actual implementation plan must still be worked with the Navy program office. 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 3775 - Manpower, Personnel and Training (MPT): This project will provide for the front end analyses and studies to ensure MPT (Integrated Logistics Support elements) factors and constraints are developed for use during the early phases of the weapon system acquisition process (WSAP). It will establish the needed data sources, analytical tools, and procedures which support MPT trade-off anaylses in the design. These analyses will emphasize life cycle cost-effective use of critical manpower, personnel and training resources.

(U) FY 1988 Accomplishments: Not applicable.

(U) FY 1989 Planned Program: Not applicable.

(U) FY 1990 Planned Program:
- (U) Develop a Manpower, Personnel, and Training (MPT) Education 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) Instruct MPT Education Course.
- (U) Evaluate MPT models development.
- (U) Continue development of MPT CSNAS prototype.
- (U) Develop MPT specialty structuring system.

Program Element: #0604227F Budget Activity: #6 - Defense-Wide
PE Title: Flight Simulator Development Mission Support

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

(U) Work Performed By: In-house efforts will be accomplished by the Training Systems SPO and the Deputy for Acquisition Logistics, Wright-Patterson Air Force Base 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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604227F
PE Title: Flight Simulator Development
Project Number: 3135
Budget Activity: #6 Defense-Wide Mission Support

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

Project Title: Advanced Training System (ATS)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
ATS	1,620	2,690	10,000	15,000	9,800	47,492

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
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. With increased emphasis on sortie generating skills and the need to train more complex material in the electronic and mechanical fields, ATC has been increasingly unable to conduct remedial or individual instruction. In view of today's current efficiencies in automated support, computer based instruction and computer based management, the manual ATC system is becoming increasingly inefficient and inflexible. Without this system, a proliferation of discrete systems will continue to be acquired that are more costly and less efficient than the ATS. ATS will support all four major functions in the Technical Training arena: instructional development, delivery, evaluation, and management. Its main goals are to free instructors for remedial instruction in complex, highly technical tasks; promote efficient training methods; and provide rapid course creation and updating. The ATS program responds to the Defense Science Board 1982 Summer Study on Technical Training which recommended improvements to our training approach. The ATS is a four-phased program to provide a computer-based training support system to alleviate this deficiency. It will be designed for hardware independence and will use ADA language for development.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Front End Analysis completed: Feb 88.
   - (U) Phase II contract developing the System Specification awarded: Dec 87.
   - (U) System Design Review: Sep 88.

2. (U) FY 1989 Planned Program:
   - (U) Phase III--Full Scale Development (FSD) begins: Mar 89.
   - (U) Design and development of software and identify hardware suite.
   - (U) Software Specification Review: Jul 89.

Program Element: #0604227F Project Number: 3135
PE Title: Flight Simulator Development Budget Activity: #6 - Defense-Wide Mission Support

3. (U) FY 1990 Planned Program:
   - (U) Phase III FSD continues with the preliminary and critical design reviews (PDR and CDR, respectively) of the hardware and software suites. PDR is scheduled during the 2nd quarter and CDR is scheduled during the 4th quarter.
   - (U) Begin software coding.

4. (U) FY 1991 Planned Program:
   - (U) Completion of coding and unit test of the first computer software configuration item (CSCI): Jun 91.
   - (U) Design, test and evaluation: Jun 91.
   - (U) Begin Initial Operational Test & Evaluation (IOT&E) at Kessler Technical Training Center (KTTC).

5. (U) Program to Completion:
   - (U) Complete test & evaluation.
   - (U) Begin preplanned product improvements.
   - (U) Phase IV contract award for production at remaining Technical Training Centers.

D. (U) WORK PERFORMED BY: In-house efforts will be accomplished by the Advance Training System (ATS) System Program Office (SPO), Human Systems Division, Brooks Air Force Base TX. Phase II prime contractor is (SAIC) ComSystems, McClean VA. In addition, the Human Interface Specification is being done by RJO Enterprises, Cambridge MA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None.
2. SCHEDULE CHANGES: None.
3. COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:
1. (U) Air Training Command (ATC) Statement of Need (SON) 1-81, Advanced Instructional Delivery and Evaluation System (AIDES), 6 Mar 81.
2. (U) SAC Mission Element Need Analysis (MENA) Supporting ATC SON 1-81, 20 Sep 82.

Program Element: #0604227F Project Number: 3135
PE Title: Flight Simulator Development Budget Activity: #6 - Defense-Wide Mission Support

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: Not applicable.

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

J. (U) MILESTONE SCHEDULE:

- (U) Phase I Start	Jul 87
- (U) Phase II Contract Award	Dec 87
- (U) System Requirements Review	Apr 88
- (U) Phase III Contract Award (FSD)	Mar 89
- (U) Preliminary Design Review (PDR)	Feb 90
- (U) Critical Design Review (CDR)	Aug 90
- (U) Test & Evaluation Site Activation	Nov 90-May 91
- (U) Test & Evaluation	Jun 91-Jul 92
- (U) Initial Operating Capability (IOC)	Sep 92
- (U) System Support & Preplanned Product Improvements	Sep 92-Nov 97
- (U) Phase IV Contract Award	Jan 93

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604227F
PE Title: Flight Simulator Development
Project Number: 3282
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RESOURCES: ($ in Thousands)
Project Title: C-17 Aircrew Training System (ATS)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
C-17 ATS	9,874	29,700	31,801	5,520	400	96,941

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
This project is designed to meet the needs of Military Airlift Command (MAC), Air National Guard (ANG) and Air Force Reserve (AFRES) in supplying initial and continuation training for C-17 aircrew members and engine maintenance personnel. Training will be totally contractor administered and supported, with MAC evaluating the final product--a fully qualified aircrew member. There will be a main facility for initial through instructor training, training facilities at four active duty bases and four Air Reserve component bases for continuation training. Emphasis will be on integrated crew training and training tasks that cannot be accomplished in the aircraft, including those related to safety of flight, emergency procedures, and others for which a suitable flight training environment does not exist. 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 formation of initial squadron. Acquisition of the actual C-17 Aircrew Training System (ATS) has been divided into two phases to sustain competition as long as possible. Phase I was full and open competition to determine which company has the best capability to field and support an ATS. Three contractors were chosen to provide detailed functional designs of their total training systems. Phase II will begin in FY 1989 after selecting one contractor to complete the final design, development, testing, deployment, activation, operation, and support of the training system. The system will be developed using best commercial practices.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Three, Phase I, C-17 ATS contractors developed functional descriptions of their system to best accomplish training for C-17 aircrews.
   - (U) Front end analysis completed.
   - (U) ATS defined.

2. (U) FY 1989 Planned Program:
   - (U) Downselect from three to one contractor.
   - (U) Continue full scale development effort.
   - (U) Conduct preliminary design review.

Program Element: #0604227F Project Number: 3282
PE Title: Flight Simulator Development Budget Activity: #6 - Defense-Wide Mission Support

3. (U) FY 1990 Planned Program:
   - (U) Conduct critical design review.
   - (U) Begin fabrication of training devices.
   - (U) Initiate development of courseware.

4. (U) FY 1991 Planned Program:
   - (U) Deliver a set of training devices to the first operational site and begin training.
   - (U) Continue fabrication of training devices for successive ATS sites.

5. (U) Program to Completion:
   - (U) Activate and support the successive ATS sites.

D. (U) WORK PERFORMED BY: The Training Systems SPO located at Aeronautical Systems Division, Wright-Patterson Air Force Base OH manages this effort. Phase I contractors are: The Singer Company, Singer Systems Division, Stamford CT; United Airlines Services Corporation, Lakewood CO; and McDonnell Douglas Corporation, Douglas Aircraft Company Division, Long Beach CA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None.
2. SCHEDULE CHANGES: None.
3. COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION: Program Management Directive (PMD) 0020(21)/64231/41130F, 16 Jun 88.

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

Program Element: #0604227F Project Number: 3282
PE Title: Flight Simulator Development Budget Activity: #6 - Defense-Wide Mission Support

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. AIRCRAFT PROCUREMENT:	0	0	39,500	37,600	263,000	340,100
2. MILITARY CONSTRUCTION: Included in aircraft program efforts.						

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

J. (U) MILESTONE SCHEDULE:

- (U) Draft Proposal Instruction Package (PIP) #1 Mar 88
- (U) Draft PIP #2 Release Apr 88
- (U) PIP Release Jun 88
- (U) Proposals Submitted Jul 88
- (U) Contract Award Oct 88
- (U) Preliminary Design Review May 89
- (U) Critical Design Review Oct 89
- (U) ATS Ready for Training at first MOB Jun 91

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604227F Project Number: 3772
PE Title: Flight Simulator Development Budget Activity: # 6 - Defense-Wide Mission Support

A. (U) RESOURCES: ($ in Thousands)
Project Title: C-141 Aircrew Training System (ATS)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
C-141 ATS	0	3,080	9,100	16,200	4,300	32,550

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 HQ MAC, HQ AFRES and ANG C-141 primary crew members. Additionally, the contractor will 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 1988 Accomplishments: Not applicable.

2. (U) FY 1989 Planned Program:
   - (U) Full scale development contract award with options for operation and maintenance support.
   - (U) Begin training System Requirements Analysis (SRA).
   - (U) Conduct Training System Review #1.
   - (U) Begin media design.

3. (U) FY 1990 Planned Program:
   - (U) Conduct Training System Review #2.
   - (U) Begin courseware development.
   - (U) Begin media development.

4. (U) FY 1991 Planned Program:
   - (U) Begin course readiness reviews.

5. (U) Program to Completion:
   - (U) Activate and support ATS sites.
   - (U) Program management responsibility transfer to Air Force Logistics Command: Oct 94.

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 has not yet been selected.

Program Element: #0604227F Project Number: 3772
PE Title: Flight Simulator Development Budget Activity: #6 - Defense-Wide Mission Support

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None.
2. SCHEDULE CHANGES: None.
3. COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:

1. (U) Military Airlift Command (MAC) Statement of Need (SON) 01-87, C-141 Aircrew Training System (ATS), 28 Oct 87.

2. (U) Program Management Directive (PMD) 5220(2)/64227F, Phase-out of the Aircrew/Missile Training Device Maintenance Career Field (AFSC 341XX), 3 Feb 88 (as amended).

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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. AIRCRAFT PROCUREMENT:	0	0	100	2,300	20,100	22,500

2. MILITARY CONSTRUCTION: Not applicable.

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

J. (U) MILESTONE SCHEDULE:

- (U) Contract Award Dec 88
- (U) Training System Review (TSR) #1 Aug 89
- (U) TSR #2 Mar 90
- (U) Course Readiness Review (CRR) Dec 91
- (U) Required Assets Available (RAA) Site 1 Apr 92
- (U) System Validation Oct 94
- (U) Program Management Responsibility Transfer Oct 94

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3817 Forcewide Training Systems	0	0	497	695	Continuing	TBD
Total	0	0	497	695	Continuing	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: This new start program element provides engineering development of maturing manpower, personnel, and training (MPT) technologies to ensure transition of those 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 inneffective due to a lack of a formal program to consider such things as long term reliability, maintainability, and logistics support. 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(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. Thus, the AF will have to rely more heavily upon on-the-job training and more efficient methods of training. Personnel programs, such as RIVET WORKFORCE, which combine related AF specialties, require maintenance technicians to be proficient on a broader range of systems and will require effective job site training programs to augment initial and follow-on technical 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 1988 Accomplishments: Not applicable.

(U) FY 1989 Planned Program: Not applicable.

(U) FY 1990 Planned Program:
- (U) Begin full scale development of an AF advanced on-the-job 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) Begin full scale development of F-15 Avionics Troubleshooting Tutors for Tactical Air Command, 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 critical design review of F-15 Avionics Troubleshooting tutors.
- (U) Conduct critical design review of the advanced on-the-job training system.
- (U) Begin fabrication of F-15 Avionics Troubleshooting Tutors.

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

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

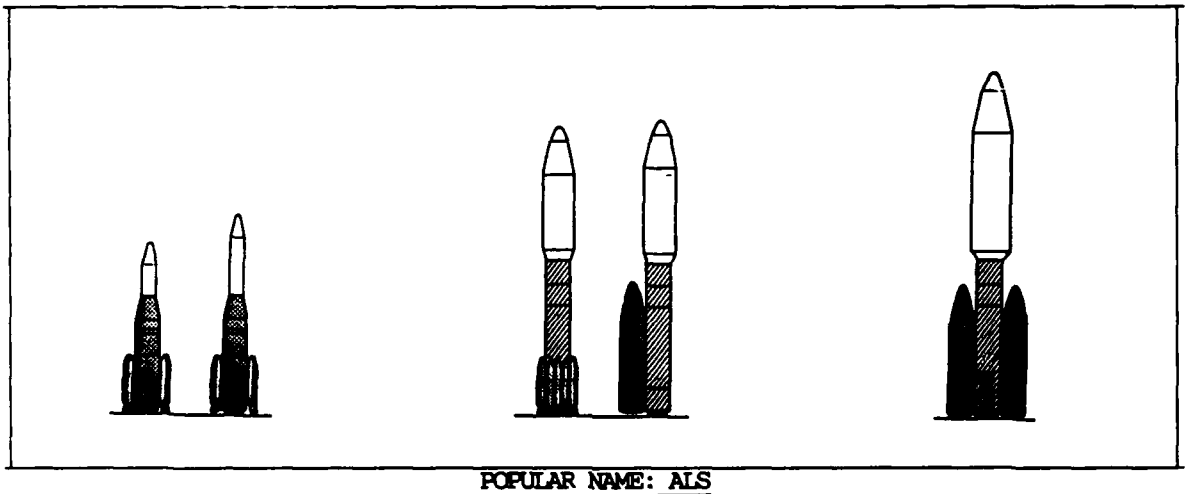
(U) Other Appropriation Funds: Not Applicable.

(U) International Cooperative Agreements: None.

Program Element:#0604408F
PE Title:Advanced Launch System (ALS)

Project Number:XXXI
Budget Activity:#6 Defense Wide Mission Support

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY
Project Title: Advanced Launch System (ALS)



POPULAR NAME: ALS

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	DAB Milestone 0		DAB Milestone I		
Engineering Milestones	SDR	Delta SDR	PDR	Delta PDR	
T&E Milestones		TEMP	Begin technology demo's		
Contract Milestones	Phase One Contracts End	Phase Two Award			
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Major Contract			34,600	45,867	
Technology & Support Contracts			56,500	46,222	
In-House Support					
GFE/ Other			8,252	7,183	
Total	SDIO funds only	SDIO funds only	99,352 plus SDIO	99,272 plus SDIO	continuing

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: A new family of space launch vehicles that can provide responsive, reliable, flexible, low cost access to space across the broad range of expected payload sizes, orbits and launch rates. The program has three objectives. In the near term, the program is to mature technology and define concepts to develop lower cost to orbit launch systems; as technology is matured, to transition that technology to existing launch systems; and, in the long term, to develop a new family of vehicles to satisfy operational assured access requirements across the spectrum of payloads. Although begun with SDIO funding in the FY 87 urgent supplemental appropriation, this is a new start for the Air Force in FY 90. A DAB milestone 0 was held in September, 1988 to approve the new start. Goals identified in the MNS include the following:

Parameter	Goal
Payload lift to low earth orbit east	1,000 to 200,000 lbs across family, 90,000 to 120,000 lbs tentative range for near-term national heavy lift vehicle
Launch reliability	above 98%
Launch on schedule probability	95%
Call-up	30 days or less, payload substitution within 5 days of launch, surge capacity of 6 payloads to mission orbit in 5 days (across family)
Cost (heavy lift)	recurring cost of $300/lb at high rate and maturity; life cycle cost competitive for mission models ranging from 1 to 5 million lbs/year
Schedule (heavy lift)	First launch 1998, IOC 2000 (to meet SDIO requirement)

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Phase 1 (concept definition) contracts complete
   - (U) System Design Review held
   - (U) DAB Milestone 0 complete

2. (U) FY 1989 Planned Program:

Program Element:#0604408F
PE Title:Advanced Launch System (ALS)
Project Number:XXX1
Budget Activity:# 6 Defense Wide Mission Support

- (U) Initiate preliminary design efforts
- (U) Environmental Assessment Review complete
- (U) Delta System Requirements Review (Nov 88)
- (U) Engine Requirements Review (May 89)
- (U) Delta System Design Review (July 89)
- (U) DAB Milestone 1 complete
- (U) Build critical components

3. (U) FY 1990 Planned Program:
   - (U) Begin DDT&E subsystem testing (Oct 89)
   - (U) Environmental Impact Statement (Feb 90)
   - (U) Award ground facilities design contract (Aug 90)
   - (U) Engine Definition Review (June 90)
   - (U) Preliminary Design Review (Sep 90)

4. (U) FY 1991 Planned Program:
   - (U) Engine focused technology fabrication complete (Dec 90)
   - (U) Delta Preliminary Design Review (Sep 91)

5. (U) Program to Completion:
   - (U) Initial Launch Capability 1998, Initial Operational Capability 2000 (pending DAB Milestone I determination)
   - (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 Co., Seattle, Washington; General Dynamics Space Systems Division, San Diego, California; and Martin Marietta Astronautics Group, Denver, Colorado. The major Air Force in-house developing organizations include Air Force Space Division, Air Force Astronautics Laboratory, Air Force Wright Aeronautical Laboratories. The major NASA in-house 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY: This is a new start.

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	NONE	NONE	NONE
Schd	NONE	NONE	NONE
Cost	NONE	NONE	NONE

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: NONE

Program Element:#0604408F
PE Title:Advanced Launch System (ALS)

Project Number:XXX1
Budget Activity:# 6 Defense Wide Mission Support

2. SCHEDULE CHANGES: NONE

3. COST CHANGES: NONE

F. (U) PROGRAM DOCUMENTATION:
- (U) Statement of Operational Need (AFSPACECOM) 12 Aug 88
- (U) Mission Need Statement 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.
- (U) There is no unnecessary duplication of effort within the Air Force or 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
None		

T&E ACTIVITY (TO COMPLETION)

Event	Date	Remarks
TEMP Submission	Mar 90	
Advanced Development DDT&E tests start	Oct 89	Subsystem and component demonstrations by prime contractors and government lab sponsored technology activities
Engine First Test	Jun 95	
Pathfinder	Jan 97	
First Launch	Feb 98	

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
RAMTIP	13,984	18,500	22,531	23,014	Contin.	N/A

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: The Air Force recently 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 initiatives into a cohesive program. This action will provide 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 1988 Accomplishments:
   - (U) Advanced Rocket Nozzle Inspection System; a nondestructive inspection technique using low energy x-ray computed tomography for testing carbon-carbon rocket nozzles. Reduced costs by a factor of five and enhanced production quality.
   - (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) Development of boron/epoxy, graphite/epoxy, and kevlar/epoxy repair patches for metal surfaces. Applications will improve the fastener fatigue rates of the C-141 and C-130 while reducing depot repair time five-fold.
   - (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.

Program Element: #0604609F Project Number: N/A
PE Title: Reliability & Maintainability Technology Insertion Program (RAMTIP) Budget Activity: #6-Defense Wide Mission Support

- (U) Started field intermediate level repair techniques for bladed disks. As used on the Advanced Tactical Fighter's (ATF) engine will reduce engine turnaround time, decrease spare inventory requirements, and increase sortie generation capability.

2. (U) FY 1989 Planned Program:
   - (U) Very High Speed Integrated Circuit (VHSIC) project to facilitate VHSIC retrofit in fielded systems. Develop and demonstrate (in the F-16 Fire Control Radar) a VHSIC insertion concept consisting of VHSIC modules and high reliability power supplies.
   - (U) Demonstrate high-strain and post-buckled repair concepts and techniques for field and depot repair of the CV-22A aircraft. Maintenance cost avoidances are expected to exceed $28 million over a 20 year life for the system.
   - (U) Incorporate 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 average time between failure from 3.5 days to 7 months and will reduce on-site manpower by 50%.

3. (U) FY 1990 Planned Program:
   - (U) Develop F-16, and F-15 frameless canopies. These frameless canopies will reduce replacement time/aircraft downtime, and have a superior bird strike capability while greatly reducing canopy cost.
   - (U) Smart built-in test implementation in the AF/Army Joint surveillance target attack radar system. Use artificial intelligence-based techniques to improve built-in test, reduce false alarms by 80%, improve detection and correct isolation of intermittent failures. Improve mean-time-between-failures by 20% and manpower by 10% with reduced pipeline spares.
   - (U) Develop accept/reject criteria for solid rocket motors to detect defects in motors and determine their impact on rocket motor performance. This project will develop required evaluation criteria for computer aided x-rays to insure 100% performance of one-shot rocket motors.

4. (U) FY 1991 Planned Program:
   - (U) Elevated temperature aluminum structures to demonstrate material capable of elevated temperatures for structures on the ATF. Replace costly titanium structure with aluminum-based alloys. Survivability to be improved due to structural improvements and weight savings.
   - (U) Large area composite inspection system. Ultrasonic testing system to inspect large areas of composite material on the ATF and B-2. Inspection capability at the base level will increase reliability, while decreasing mobility and manpower requirements.

Program Element: #0604609F
PE Title: Reliability & Maintainability Technology Insertion Program (RAMTIP)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

- (U) Electroimpulse deicing system. Remove ice without melting using an electromagnetic field on the B-1B aircraft. Decrease use of electrical power which currently degrades engine performance. Will replace existing inlet vane system.

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

D. (U) WORK PERFORMED BY: The RAMTIP Program Office (a division of the Joint Technology Insertion Program Office) 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; and Lockheed Aircraft Systems, Marietta, GA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Technology	None	None	None
Schedule	None	None	None
Cost	None	None	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 06042568F - Aircraft Engine Component Improvement Program
- (U) PE 0708026F - PRAM Program
- (U) All RAMTIP 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.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

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

J. (U) MILESTONE SCHEDULE: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXX1	Weather Systems (Engineering Development)	12,244	8,658	4,821[1]	5,358[1]	Continuing	TBD

[1]PBD 260 deleted funds for Unmanned Air Reconnaissance System(UARS) weather sensor package.

B. (U) BRIEF DESCRIPTION OF ELEMENT: This Program Element provides engineering development of weather systems that, when fielded, will eliminate critical shortfalls in weather support to Air Force and Army operations. The increasing emphasis on Air Force operations during night and adverse weather makes the rapid and accurate determination of weather conditions of increasing importance. Requirements for improved weather support have expanded much faster than the capabilities to support them. This program provides several efforts to upgrade weather support to meet such requirements. 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. It will replace 1950's technology equipment currently in use. AWDS will use a minicomputer to accelerate data handling, incorporate more efficient forecast preparation techniques, and speed dissemination of precise and up-to-date weather intelligence. The Automated Observation Subsystem (AWDS-AOS) will replace human observers and rapidly sense and input present weather data into AWDS's microcomputer. Once observations, forecasts, and weather warnings become available, the system will display them to the forecasters and local users. AWDS preplanned product improvement (P3I) will enhance graphics, interoperabilty, and communications capabilities. (b) Next Generation Weather Radar (NEXRAD): A joint Department of Defense, Department of Commerce, and Department of Transportation development and procurement effort to provide a greatly improved storm detection and warning capability. This state-of-the-art weather radar will detect severe surface wind, hail, tornadoes and turbulence using Doppler techniques; automate thunderstorm tracking; accelerate severe thunderstorm identification; and improve warning accuracy and timeliness through use of interactive warning preparation techniques. NEXRAD will dramatically increase the Nation's severe weather warning capability. It will double radar detection of severe thunderstorms, cut the severe thunderstorm warning false alarm rate from 75 to 25 percent and provide up to 20 minutes warning of a tornado touchdown. (c) Battlefield Weather Observation and Forecast System (BWOFS): In the past, weather support to combat operations has emphasized those weather parameters sensed by man. Many current and developing electro-optical weapon systems are affected by weather in totally different ways than man, i.e., visibility for a human could be unlimited, yet, an infrared sensor

would not lock onto a target unless it can detect a target temperature different than its background. Conversely, infrared sensors work well at night when people can see nothing. BWOFS will provide the capability to collect critical weather data from behind enemy lines using a weather observation sensor package, Pre-Strike Surveillance/Reconnaissance System (PRESSURS), on the UARS and develop automated weather forecast techniques, Tactical Decision Aids (TDA), specifically tailored to electro-optical weapon systems.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project XXX1, Weather Systems (Engineering Development): Develops equipment and techniques for a badly needed upgrade of Air Force Air Weather Service (AWS) support.

(U) FY 1988 Accomplishments:
- (U) AWDS: Deficiency corrections (as identified in IOT&E) integrated into the Executive Subsystem prior to awarding the production contract. Prepared specifications for a preplanned, interoperable capability between AWDS and other command and control systems and a base-wide distribution capability for graphics displays.
- (U) AWDS-AOS: Completed specifications and began limited participation in the Department of Commerce Automated Surface Observing System (ASOS).
- (U) NEXRAD: Developed and integrated deficiency corrections (as identified in IOT&E) into the system.
- (U) BWOFS: Developed and integrated TDA software for battlefield weapons into Tactical Air Force (TAF) command and control (C2) systems. Prepared specifications for the UARS weather sensor package (PRESSURS).

(U) FY 1989 Planned Program:
- (U) AWDS: Continue evaluation of the feasibility of P3I updates to include those for which specifications were begun in FY 1988.
- (U) NEXRAD: Conduct the final phase of IOT&E.
- (U) BWOFS: Conduct Development Test and Evaluation of the automated TDA on TAF C2 systems. Continue to develop specifications for the UARS weather observation sensor and coordinate with UARS planners and developers.

(U) FY 1990 Planned Program:
- (U) AWDS: Pursue development of P3I initial improvement efforts(see FY 89/90 plan above) once AWDS is deployed.
- (U) BWOFS: Continue TDA development. Begin operational testing of the automated TDA capability at TAF C2 centers.

(U) FY 1991 Planned Program:
- (U) AWDS: Continue P3I development efforts. AWS users will test initial improvements.

Program Element: 0604707F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Weather Systems (Eng Development)

- (U) BWOFS: Complete operational testing of the automated TDA capability and implement throughout TAF C2 system.

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

(U) Work Performed By: AWDS development and production are managed by Electronic Systems Division, Hanscom AFB, MA. The prime development contractor is the Canadian Commercial Corp, Ottawa, Canada. MacDonald, Dettwiler & Associates, Ltd, Richmond, British Columbia, Canada is 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cost (AWDS)	16,600	31,657	27,775	27,759	44,600	148,391
Fixed Base Quantities	5	43	33	34	52	167
Transportable Quantities	0	1	5	5	9	20
Cost (NEXRAD)	23,716	26,491	19,625	19,590	71,473	160,895
Complete Radar Quantities	6	7	5	5	21	44
User Set Quantities	15	22	17	17	32	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 is Canadian Commercial Corp, Ottawa, Canada. MacDonald, Dettwiler & Associates, Ltd, Richmond, British Columbia, Canada is the major subcontractor.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2152 Mission/Engineering Support	3,000	4,698	3,000	3,100	Continuing	N/A
2286 Tactical Air Forces Range Equipment	10,000	6,514	10,372	12,455	Continuing	N/A
3320 Strategic Air Command Range Equipment	3,700	6,214	11,197	10,240	Continuing	N/A
3321 Electronic Combat Test Resources	2,200*	2,065*	46,200	51,500	Continuing	N/A
6510 Flight Test Threat Systems Simulators	35,754	402**	47,300	24,900	Continuing	N/A
Total	54,654***	19,893***	118,069	102,195	Continuing	N/A

* 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 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: Wartime experience has shown that a disproportionate number of combat losses occur during an aircrew's first combat missions. There is a continuing requirement to reduce those potential losses by more realistic weapon system testing, aircrew training and tactics development. The increasing cost of operating modern weapon systems also mandates that we attain the most effective use of our test and training resources. 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 2152, Mission/Engineering Support: Provides basic operating support, system software acquisition, and systems engineering support such as studies, assessments, and analyses.

Program Element: #0604735F
PE Title: Range Improvement

Budget Activity: #6 - Defense Wide Mission Support

(U) FY 1988 Accomplishments:
- (U) Provided RIP basic operating support, system software acquisition, and systems engineering support.
- (U) Provided (under basic operating support) temporary duty costs, equipment and supplies.
- (U) Provided (under system software acquisition) research and development funds for project software development.
- (U) Provided (under systems engineering support) technical evaluations, documentation and development tasks to improve simulated operational threat environment, range and system safety analyses, cost estimating support, training, and instrumentation and range support equipment.

(U) FY 1989 Planned Program:
- (U) Continue RIP basic operating support, system software acquisition and systems engineering support.
- (U) Use $1.7M increase to fund studies for establishing an EC test capability at Utah Test and Training Range (UTTR).

(U) FY 1990 Planned Program:
- (U) Continue RIP basic operating support, system software acquisition, and systems engineering support.
- (U) Under the systems engineering support task (to be accomplished primarily by a systems engineering and technical assistance contractor), continue engineering support, studies, assessments and analyses.
- (U) Continue to provide range and system safety analyses, computer support, cost estimating support, travel, training, supplies and basic operating capital.

(U) FY 1991 Planned Program:
- (U) Continue RIP basic operating support, system software acquisition, and systems engineering support.
- (U) Under the systems engineering support task (to be accomplished primarily by a systems engineering and technical assistance contractor), continue engineering support, studies, assessments and analyses.
- (U) Continue to provide range and system safety analyses, computer support, cost estimating support, travel, training, supplies and basic operating capital.

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

(U) Work Performed by: VSE Corporation, Fort Walton Beach, FL.

Program Element: #0604735F Budget Activity: #6 - Defense Wide Mission Support
PE Title: Range Improvement

(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.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 2286
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title: Tactical Air Forces Range Equipment

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(N/A)	10,000	6,514	10,372	12,455	Continuing	N/A

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: Provides for the development and procurement of electronic, telecommunications, and instrumentation equipment/systems for the tactical operational test and training ranges worldwide. This equipment will enhance range capability by more realistically simulating the combat environment and providing more accurate data for training, testing and evaluation to improve aircrew training and combat readiness. The primary developmental efforts include the Homestead Air Combat Maneuverability Instrumentation (ACMI) system, the Crow Valley Measurement and Debriefing System (CVMDS) for the Pacific Air Forces, and integration of the Army's National Training Center (NTC) range with the Air Force's Red Flag ranges. In addition, aircraft interface requirements for proper data transmission from the ACMI pods must be addressed in order to fully utilize our range ACMI/MDS capabilities.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Began improvements to Unmanned Threat Emitter System; software development for Homestead AFB, FL, ACMI system; Laser Engagement System (LES) for A-10 aircraft supporting U.S. Army exercises at National Training Center, Fort Irwin, CA; software upgrades to Red Flag Measurement and Debriefing System (RFMDS) at Nellis AFB, NV.
   - (U) Continued development of Gulf Range MEGS system and ACMI enhancements.
   - (U) Started development of Crow Valley MDS for Pacific Air Forces.
   - (U) Continued design for LES and software upgrade for RFMDS.

2. (U) FY 1989 Planned Program:
   - (U) Continue development of ACMI enhancements and software upgrades to RFMDS.
   - (U) Begin development of advanced threat training emitters.

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 2286
Budget Activity: #6 - Defense-Wide Mission Support

- (U) Continue to support development of aircraft interface with ACMI pods, weapon simulations, and the integration of the NTC-RFMDS ranges.
- (U) Begin software development for a Smokewinder pod with laser receivers for the NTC range, development of a Red Forces Command and Control (RFC^2) capability for the Nellis ranges, and R&D efforts required for advanced threat simulators.

3. (U) FY 1990 Planned Program:
   - (U) Continue to support software for weapon simulations, RFC^2 R&D and advanced threat simulator development.
   - (U) Begin software development for the Pil Sung Aircrew Debriefing Station (ADS).
   - (U) Continue development efforts on the advanced threat simulators needed to allow realistic combat training against current/projected Warsaw Pact defense systems.

4. (U) FY 1991 Planned Program:
   - (U) Continue weapons simulation development, advanced threat simulator R&D and RFMDS upgrades.
   - (U) Initiate development for USAFE MDS and Mountain Home AFB, ADS.

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

D. (U) WORK PERFORMED BY: This program is managed by the Armament 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.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 2286
Budget Activity: #6 - Defense-Wide Mission Support

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):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement (PE 0207429F):						
Funds	20,813	16,883			Continuing	N/A
Quantity	N/A	N/A	N/A	N/A	N/A	N/A
Other Procurement (PE 0207429F):						
Funds	73,750	57,189			Continuing	N/A
Quantity	N/A	N/A	N/A	N/A	N/A	N/A

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE: N/A, several tasks in project.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 3320
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title: Strategic Air Command Range Equipment

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(N/A)	3,700	6,214	11,197	10,240	Continuing	N/A

B. (U) MISSION REQUIREMENT AND SYSTEM CAPABILITIES: 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. The STRC will be a system of interlocking, low-level navigation routes with scored bomb legs. The range will be equipped with simulated enemy threat air defense systems (i.e., air defense radars and ground jammers) with measurement systems to record crew/aircraft performance for no-drop bomb scoring, mission debriefing and training feedback. The range will also provide equipment performance evaluation. The STRC Route Integration Instrumentation Systems (RIIS) will collect and transmit STRC range data via microwave, landlines, and/or satellite to a central facility (the Strategic Training Center) for processing, formatting, and display.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Provided upgrades to range equipment, instrumentation and training emitter systems on SAC training ranges.
   - (U) Initiated development of a new Strategic Training Route Complex (STRC) (interlocking, low-level navigation routes with scored bomb legs) for bomber crew training.
   - (U) Initiated development of STRC emitter system equipment creating a more realistic combat environment.
   - (U) Undertook effort to equip STRC with simulated enemy threat air defense systems (air defense radars and ground jammers); measurement systems (signals analyzers) to record crew and aircraft performance for no-drop bomb scoring, mission debriefing and training feedback; and a capability to provide equipment performance evaluation.
   - (U) Included in the STRC Route Integration Instrumentation Systems (RIIS) a capability to collect and transmit STRC range data via microwave, landlines, or satellite to the

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 3320
Budget Activity: #6 - Defense-Wide Mission Support

central Strategic Training Center for processing, formatting, and display.
- (U) Continued STRC/RIIS development and began threat updates to AN/MST-T1 training emitter systems.
- (U) Initiated performance enhancements to AN/MSR-T4 threat receiver/analyzer system.

2. (U) FY 1989 Planned Program:
- (U) Begin STRC initial operational test and evaluation (OT&E) planning, development of advanced threat emitter, and ACMI bomber interface.

3. (U) FY 1990 Planned Program:
- (U) Continue STRC OT&E and advanced threat emitter development.
- (U) Begin MSR T-4 advanced techniques development, ACMI bomber integration, and initial GPS integration.

4. (U) FY 1991 Planned Program:
- (U) Continue MSR T-4 advanced techniques development, GPS integration and advanced threat emitter development.

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

D. (U) WORK PERFORMED BY: This program is managed by the Armament 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.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 3320
Budget Activity: #6 - Defense-Wide Mission Support

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):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Aircraft Procurement (PE 0101897F):						
Funds	0	4,586			Continuing	N/A
Quantity	N/A	N/A	N/A	N/A	N/A	N/A
Other Procurement (PE 0101897F):						
Funds	91,614	68,481			Continuing	N/A
Quantity	N/A	N/A	N/A	N/A	N/A	N/A

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE: N/A, several tasks in project.

FY 1990/1991 BIENNIAL 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	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(N/A)	2,200*	2,065**	46,200	51,500	Continuing	N/A

* In FY 1988 $26.6M additional project funds were provided from other PEs as follows:
$21.1M - PE 0604738 - Protective Systems
$ 3.6M - PE 0604739 - Tactical Protective Systems
$ 1.9M - PE 0604755 - Improved Capability for DT&E

** 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) 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) will be a digital simulation 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 Red Capabilities (REDCAP) simulator . These facilities provide realistic laboratory simulations of surface-to-air missile (SAM) and air-to-air missile (AAM) systems (including cockpits for AAM system evaluations) 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

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 3321
Budget Activity: #6 - Defense-Wide Mission Support

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 antennas and antenna installations on board actual aircraft to determine radiation patterns. 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 1988 Accomplishments:
   - (U) Provided upgrades to the Radar Test Facility (RTF) to support programs for airborne radar and weapon system electronic counter-countermeasures engineering design, development and test.
   - (U) Completed development of APG-70 radar (F-15) test bench.
   - (U) Began development of APG-68 radar (F-16) test bench.
   - (U) Continued work on AFEWES simulator developments/upgrades currently on contract (i.e., TWS-8, TWS-11, Ground Clutter Generator). (PE 64738F)
   - (U) Awarded follow-on contract for Phase II of an ongoing AFEWES simulator development (i.e., TWS-10). (PE 64738F)
   - (U) Awarded contract for Phase I of a comprehensive AFEWES upgrade program, consisting of nine projects. Phase I initiates work on four of those projects (i.e., Reconfigurable Airborne Interceptor (RAI) simulator development, Multiple Emitter Generator (MEG) upgrade, Test Director System (TDS) development, and Infrared Laboratory (IR Lab) expansion). (PE 64738F)
   - (U) Awarded contract for Phase I of a comprehensive REDCAP upgrade program, consisting of three projects (i.e., Battle Management/Command Control & Communications (BM/C3), Integrated Air Defense System (IADS), and Early Warning/Acquisition/Ground Controlled Intercept (EW/Acq/GCI) radars. (PE 64739F)
   - (U) Began ECCM upgrades to PRIMES, GWEF, and EMTE. (PE 64755F)
   - (U) Continued EO, MMW, and PAAS antenna range upgrades. (PE 64738F)

2. (U) FY 1989 Planned Program:
   - (U) Integrate AFEWES Ground Clutter Generator with the TWS-4 and TWS-8 simulators. (PE 64270F)
   - (U) Continue work on Phase II of the AFEWES TWS-10 development.(PE 64270F)
   - (U) Continue work on the four AFEWES upgrade projects begun under the Phase I contract. (PE 64270F)

Program Element: #0604735F Project Number: 3321
PE Title: Range Improvement Budget Activity: #6 - Defense-Wide Mission Support

- (U) Continue work on the three REDCAP upgrades begun under the Phase I contract. (PE 64270F)
- (U) Award Phase II AFEWES upgrade contract, which continues the four ongoing projects to completion and provide for six additional projects (i.e., TWS-11 Phase II, Reconfigurable Surface-to-Air (SAM) simulator, Advanced Environment Generator (AEG), EW/GCI radar integration, Airborne Clutter Generator, and Technique Evaluation Equipment). Begin work on the TWS-11 Phase II. (PE 64270F)
- (U) Complete EO, MMW, and PAAS antenna range upgrades. (PE 64270F)
- (U) Continue ECCM upgrades of PRIMES, GWEF, and EMTE. (PE 64755F)
- (U) Continue RTF upgrades, as required by users.

3. (U) FY 1990 Planned Program:
   - (U) Continue TWS-10 development.
   - (U) Achieve IOC on the AFEWES TWS-11, MEG upgrade, IR Lab expansion and Test Director System.
   - (U) Continue work on AFEWES RAI and other upgrades under the Phase II contract.
   - (U) Start work on Reconfigurable SAM Simulator and Airborne Clutter Generator.
   - (U) Continue work on REDCAP upgrade. 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) Continue RTF upgrades, as required by users.
   - (U) Initiate full-scale development of ECDES.

4. (U) FY 1991 Planned Program:
   - (U) Achieve IOC on TWS-10.
   - (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) Continue RTF upgrades, as required by users.
   - (U) Continue ECDES development.

5. (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

Program Element: #0604735F | Project Number: 3321
PE Title: Range Improvement | Budget Activity: #6 - Defense-Wide Mission Support

contractors include General Dynamics Corporation, Fort Worth, TX and Calspan Corporation, Buffalo, NY.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY: The increases in FY 1990 and FY 1991 result from transfer of components of the Electronic Combat Test Resources program from other program elements (PEs 0604738, 0604739, 0604755) into this program element solely for the purpose of program consolidation.

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

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): N/A, RDT&E only.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:
4Q88: AFEWES TWS-10 Phase II contract award.
4Q88: AFEWES Upgrade Phase I contract award.
4Q88: REDCAP Upgrade Phase I contract award.
3Q89: AFEWES Upgrade Phase II contract award.
1Q90: ECDES Full-Scale Development contract award.
2Q90: REDCAP Upgrade Phase II contract award.
2Q90: AFEWES TWS-8 IOC
2Q90: AFEWES TWS-11 IOC
2Q91: AFEWES TWS-10 IOC.
4Q91: AFEWES RAI IOC.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
(N/A)	35,754	402*	47,300	24,900	Continuing	N/A

* In FY 1989 $20.M additional funds were provided from PE 0605134D as a result of OSD consolidation.

B. (U) 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 1988 Accomplishments:
   - (U) Continued development work on the SARS-VI radar simulator and Flycatcher radar enhancements.
   - (U) Continued full scale development of [redacted] threat simulator target tracking radar, target acquisition radar, missile seeker.
   - (U) Completed contract definitization for a second [redacted] threat system.
   - (U) Continued development of the [redacted] threat radar simulator.

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 6510
Budget Activity: #6 - Defense-Wide Mission Support

- (U) Begin development work on threat simulator.
- (U) Continue simulator modifications.

2. (U) FY 1989 Planned Program:
   - (U) Continue development on the simulators.
   - (U) Continue simulator modifications.

3. (U) FY 1990 Planned Program:
   - (U) Continue development on the simulators.
   - (U) Continue simulator modifications.

4. (U) FY 1991 Planned Program:
   - (U) Continue development work on the 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 Armament 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	None	None
Cost	None	None	None

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.

Program Element: #0604735F
PE Title: Range Improvement
Project Number: 6510
Budget Activity: #6 - Defense-Wide Mission Support

- (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): N/A, RDT&E only.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:
2Q83: HAVE PEWTER contract award.
4Q88: HAVE COPPER contract award.
3Q90: HAVE PEWTER IOC.
2Q91: HAVE COPPER delivery.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1209 EMP Simulation Test Facilities	4,695	4,166	3,558	3,782	Continuing	N/A
2064 HAVE NOTE	1,174	1,041	889	946	Continuing	N/A
Total	5,869	5,207	4,447	4,728	Continuing	N/A

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(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 1988 Accomplishments:
- (U) Tested B-1B, EC-135 and Small ICBM Hard Mobile Launcher for Air Force, OH-58C Helicopter for Army, and E-6A aircraft for Navy. Tested second French Astarte aircraft under Defense Nuclear Agency sponsorship.
- (U) Completed upgrades of data acquisition and processing system. Continued support to the AFWL EMP Test Aircraft and other technology programs.

(U) FY 1989 Planned Program:
- (U) Continue tests of Small ICBM Hard Mobile Launcher, test third Astarte aircraft, and begin tests of the EC-135 for the Air Force.
- (U) Augment maintenance and spares provisioning for a new data acquisition system to maximize data acquisition rates and minimize test costs for users. Continue support to the EMP Test Aircraft (EMPTAC) and other technology programs.

Program Element: #0604747F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Electromagnetic Radiation (EMR) Test Facilities

(U) FY 1990 Planned Program:
- (U) Continue tests of the B-1B and the EC-135. Begin tests of the 4 Electronic Service Switching (ESS) System for the Defense Communications Agency (DCA) and 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.

(U) FY 1991 Planned Program:
- (U) Continue 4 ESS tests for DCA, EC-135 tests for the Air Force, and SRAM-II tests for the Air Force.
- (U) Continue EMPTAC 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.

(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.

Program Element: #0604747F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Electromagnetic Radiation (EMR) Test Facilities

(U) FY 1988 Accomplishments:
- (U) Completed high-power microwave (HPM) testing of Imaging Infrared (IIR) Maverick.
- (U) Conducted electromagnetic radiation (EMR) testing of AGM-130 (powered version of GBU-15 Glide Bomb).
- (U) Completed test planning for Infrared Search and Track (IRST) System and Sensor-Fuzed Weapon (SFW) and began testing.
- (U) Continued Electromagnetic Compatibility Analysis Facility (EMCAF) upgrades to attain an improved vulnerability assessment capability against new or projected threats, including HPM.
- (U) Achieved initial operational capability of Rapid-Evaluation Chamber.
- (U) Continued Rapid-Evaluation Chamber upgrades to meet special rapid-sequence test requirements.
- (U) Upgraded test methodologies and data bases for expected EMR environments.

(U) FY 1989 Planned Program:
- (U) Continue testing IRST System and SFW.
- (U) Begin initial EMR assessments for AMRAAM Producibility Enhancement Program (APREP).
- (U) Begin planning for tests of the GBU-15/AGM-130 Improved Data Link (IDL).
- (U) Continue upgrades to the EMCAF, the Rapid-Evaluation Chamber, and test methodologies and data bases.

(U) FY 1990 Planned Program:
- (U) Complete vulnerability assessments of the IDL and the APREP 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) Program to Completion: This is a continuing program.

(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.

Program Element: #0604747F Budget Activity: #6 - Defense-Wide Mission Support
PE Title: Electromagnetic Radiation (EMR) Test Facilities

(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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2880 4950th Test Wing	15,105	2,747	3,643	2,458	Continuing	N/A
3120 Armament Division	11,126	11,462	11,479	12,062	Continuing	N/A
3285 Arnold Engineering & Development Center (AEDC)	0	1,943	3,662	4,651	Continuing	N/A
3323 Cruise Missile Mission Control Aircraft (CMMCA)	11,600	18,935	12,853	9,188	0	52,576
3324 HAVE LINK	3,070	4,384	4,131	4,210	Continuing	N/A
3620 Air Force Flight Test Center (AFFTC)	12,212	10,094	16,831	23,838	Continuing	N/A
Total	53,113	49,565	52,599	56,407	Continuing	N/A

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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: ARIA Upgrade, Palletized Digital Avionics Recording Test System (PDARTS), Integrated Data Facility (IDF), and Computer Aided Engineering (CAE). ARIA Upgrade includes upgrades of EC-18B and EC-135 ARIA onboard data-processing equipment to meet the increased sensitivity and data rate requirements of the users. PDARTS will integrate and flight test software-intensive avionics systems, providing a capability to perform fully instrumented, developmental flight test of digital avionics at the component level. 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,

Program Element: 0604755F
PE Title: Improved Capability for DT&E

Budget Activity: 6 - Defense - Wide Mission Support

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.

(U) FY 1988 Accomplishments:
- (U) ARIA upgrades included test and delivery of optics kits
- (U) The fourth EC-18 began operation
- (U) PDARTS development equipment purchase, modification and flight testing integration and checkout took place.
- (U) IDF hardware acquisition commenced.
- (U) CAE major system purchase multi-year competitive contract was awarded.

(U) FY 1989 Planned Program:
- (U) Second EC-18 receives remainder of ARIA modification after completion of SMILS prototype testing; instrumentation modifications continue
- (U) PDARTS integration and checkout, 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 will include 54 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 and CAE tasks.
- (U) The IDF will provide an enhanced support capability for processing flight test data.
- (U) CAE capabilities includes use of expert systems in structural design/analysis, electronic analysis and design.

(U) FY 1991 Planned Program:
- (U) In FY 91 work will continue on the IDF project.
- (U) Three electronic data processing modules, which can operate in a stand alone mode, will be linked together for maximum power and flexibility.
- (U) These modules are the ground-based laboratories, real-time test-data monitoring and improved data computation and analysis.

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

Program Element: 0604755F
PE Title: Improved Capability for DT&E

Budget Activity: 6 - Defense - Wide Mission Support

2. (U) Project: 3285, Arnold Engineering and Development Center (AEDC): AEDC, Arnold AFS, TN, provides ground environmental test support for aeronautical, missile and space programs. The center has three facilities: 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; 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 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, the Army Ballistic Missile Division, the Navy 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 1988 Accomplishments:
- (U) FY 88 activities continued prior year efforts.
- (U) Computer Enhancement Program continued to provide real-time data processing and state-of-the-art capabilities
- (U) Refrigeration controllers in ETF installed
- (U) Dynamic data acquisition system was procured to support dual cell operations and reduce cell turnaround time
- (U) Test Area Control automation systems for the turbine cells were activated and validated

(U) FY 1989 Planned Program:
- (U) Final phase of the Facility Computer Enhancement Program
- (U) Data system improvements
- (U) Facility plant upgrades
- (U) Test article control improvements
- (U) Large Rocket Test Facility technical support begins.

(U) FY 1990 Planned Program:
- (U) The principal efforts will be the Large Rocket Test Facility (J-6) and High Pressure/High Temperature Test Cell (HP/HTTC) enhancement in FY 90.

(U) FY 1991 Planned Program:
- (U) Work begins on the Test Unit Support Systems (TUSS) and the Test Data Acquisition and Processing System (TDAP).
- (U) J-6 activation and analysis begins.
- (U) HP/HTTC will provide a capability for testing small turbine engines at high temperature/pressure conditions.

Program Element: 0604755F Budget Activity: 6 - Defense - Wide Mission Support
PE Title: Improved Capability for DT&E

- (U) TDAP replaces operationally inadequate Aeropropulsion Systems Test Facility (ASTF) data systems.
- (U) TUSS will provide greater freedom of control over test article and its environment resulting in higher test data accuracy and improved productivity of test operations.

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

3. (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 1988 Accomplishments:
- (U) Identified potential vulnerabilities at AEDC, AFFTC, AD, and 4950TW.
- (U) AD purchased secure microwave equipment and document shredders.
- (U) AEDC shielded computer cables against electromagnetic emanations.
- (U) AFFTC purchased video and telemetry encryption equipment, data transmission equipment, and secure telephones.
- (U) 4950 TW began planning for data encryption equipment.

(U) FY 1989 Planned Program:
- (U) AD will secure computer data links.
- (U) AEDC is installing data communications systems which can be encrypted.
- (U) AFFTC will continue secure communications and telemetry encryption equipment purchases and upgrades to existing facilities to meet TEMPEST requirements.
- (U) 4950 TW will begin encryption equipment purchases.

(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) Program to Completion: This is a continuing p ogram.

(U) WORK PERFORMED BY: Applied Physics Laboratory/Johns Hopkins University, Laurel, MD (4950 TW); E-Systems, Greenville, TX (4950 TW); and Calspan Field Services, Inc, Buffalo, NY (AEDC).

Prorogram Element: 0604755F Budget Activity: 6 - Defense -
PE Title: Improved Capability for DT&E Wide Mission Support

(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	66.3	0	182.3

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604755F
PE Title: Improved Capability for DT&E
Project Number: 3120
Budget Activity: 6 - Defense - Wide Mission Support

A. (U) RESOURCES ($ in thousands)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Armament Division	11,977	11,462	11,479	12,062	Continuing	N/A

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES: AD is located at Eglin AFB, FL, and is responsible for Air Force nonnuclear armament development. AD, 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 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 Airborne Radar Electronic Counter-Countermeasures (ECCM). 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.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Seeker Development included a rate table for the Guided Weapons Evaluation Facility (GWEF) which will accommodate a variety of guided seekers and point source targets.
- (U) Computer Sciences included acquisition of the necessary computer hardware to support a twelve-stream telemetry capability which performs both range systems test and evaluation and operational real-time and post-mission data processing simultaneously.
- (U) MPI Range Systems Upgrade included the buildup of the range telemetry dual-mission capability, upgrades of support systems (sled track capability, radiometers, timing/video equipment and weather instrumentation), replacements of unsupportable analog microwave (MW) systems with digital MW systems and replacement of over 300 tube-type range radios and wideband data transmission equipment, weather sensors and calibration equipment and infrared resolution test capability upgrades.
- (U) Preflight Integration of Munitions and Electronics Systems (PRIMES) facility was upgraded to test critical directional power management features of Radar Warning Receiver Systems.

00786

Program Element: 0604755F
PE Title: Improved Capability for DT&E

Budget Activity: 6 - Defense - Wide Mission Support

- (U) Armament Systems Test Environment (ASTE) Upgrade included improvements in the areas of cinetheodolites, photo-optic cameras, high-speed video cameras, explosive instrumentation, warhead and fuze test systems, and laser trackers.
- (U) Electronic Counter-Countermeasures (ECCM) included work on the AD electronic jammers and other range instrumentation such as radio frequency generators, receivers and supporting software.

(U) FY 1989 Planned Program:

- (U) Seeker Development includes 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 will be started. Work will also begin to define the realistic level of countermeasure simulators, obscurant generators, and instrumentation required for the scenario ranges.
- (U) Computer Sciences will acquire additional hardware for secure real-time and post-flight data processing/mission analysis.
- (U) MPI Range Systems Upgrade will acquire computer hardware for real-time mission analysis.
- (U) ASTE Upgrades includes cameras, high-speed video, explosive instrumentation data systems, advanced warhead and fuze test systems, and laser tracker improvements.
- (U) FY 1989 ECCM efforts continue work begun in FY 1988.

(U) FY 1990 Planned Program:

- (U) SEEK EAGLE studies will be conducted to investigate computer applications and instrumentation for quicker completion of store certification flight testing.
- (U) Acquisition of PRIMES equipment for simulation of electro-optical (EO) and infrared (IR) environments will begin, to include counter-countermeasures.
- (U) MPI hardware for enhancing security of test data against undesirable interception will be acquired.
- (U) Radio and analog microwave equipment replacement continues.
- (U) Additional Seeker Development equipment for millimeter wave measurements will be acquired.

(U) FY 1991 Planned Program:

- (U) Initial SEEK EAGLE software models for ballistics analysis will be developed.
- (U) ASTE high-speed video cameras and portable IR trackers will be added to the range optics network.
- (U) Acquisition of PRIMES EO/IR simulation equipment continues.
- (U) Initial indoor Seeker Development simulation capability for millimeter-wave systems will be completed.
- (U) Computer Sciences equipment for real-time data reduction and multiple simultaneous mission control will be acquired.

Program Element: 0604755F
PE Title: Improved Capability for DT&E

Project Number: 3323
Budget Activity: 6 - Defense-Wide Mission Support

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

D. (U) WORK PERFORMED BY: Armament Division, Eglin Air Force Base, FL; Southern Research Incorporated, Birmingham, AL (Seeker Development); and Datron Systems, Simivalley, CA (T/M Systems).

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF Change	IMPACT ON System Capabilities	IMPACT ON Schedule	Budget Year Cost
Eng	N/A	N/A	-0-
Schd	N/A	N/A	-0-
Cost	N/A	N/A	-0-

NARRATIVE DESCRIPTION OF CHANGES

1. ENGINEERING CHANGES: Not Applicable
2. SCHEDULE CHANGES: Not Applicable
3. COST CHANGES: Not Applicable

F. (U) PROGRAM DOCUMENTATION: PMD 2164(3)/64755F Improved Capability for DT&E, 3 Mar 87

G. (U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F). Most PE 0604755F projects were originally contained within PE 0605807F. PE 0604755F contains funding for high priority range support projects. In addition, the improved capabilities benefit 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.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE: Not Applicable

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604755F
PE Title: Improved Capability for DT&E
Project Number: 3323
Budget Activity: 6 - Defense-

A. (U) RESOURCES ($ in thousands)

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Cruise Missile Mission Control Aircraft (CMMCA)	11,600	18,935	12,853	9,188	0	52,576

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

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) The RFP was released and source selection made.
- (U) Design of the aircraft modification began.
- (U) Purchase of the GFE radars began.

(U) FY 1989 Planned Program:
- (U) Projected activities include completion of the aircraft modification design, Critical Design Review and fabrication.
- (U) Modification of the first EC-18 will be initiated.

(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.

00789

Program Element: 0604755F | Project Number: 3323
PE Title: Improved Capability for DT&E | Budget Activity: 6 - Defense-

(U) Program to Completion:
- (U) Modification of the second aircraft will be completed and tested.
- (U) Full Operational Capability is planned to occur by the first quarter of FY 92.

D. (U) WORK PERFORMED BY: Electro-Space Industries, Richardson, Tx and Aeronautical Systems Division, Wright-Patterson Air Force Base, OH.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF Change	IMPACT ON System Capabilities	IMPACT ON Schedule	Budget Year Cost
Eng	N/A	N/A	-0-
Schd	N/A	N/A	-0-
Cost	N/A	N/A	-0-

NARRATIVE DESCRIPTION OF CHANGES

1. ENGINEERING CHANGES: Not Applicable
2. SCHEDULE CHANGES: Not Applicable
3. COST CHANGES: Not Applicable

F. (U) PROGRAM DOCUMENTATION: PMD 6266(3)/64755F EC-18 Cruise Missile Mission Control Aircraft, 22 Oct 87

G. (U) RELATED ACTIVITIES: The Improved Capability for DT&E program supports the Test and Evaluation Support Program (PE 0605807F). Most PE 0604755F projects were originally contained within PE 0605807F. PE 0604755F contains funding for high priority range support projects.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable

J. (U) MILESTONE SCHEDULE:
- (U) Requirements Study 4th Quarter FY 1987
- (U) Contract Source Selection 4th Quarter FY 1988
- (U) Initial Operational Capability (First Aircraft) 4nd Quarter FY 1991
- (U) Full Operational Capability (Second Aircraft) 1st Quarter FY 1992

FY 1990/1991 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Air Force Flight Test Center (AFFTC)	12,212	10,094	16,831	23,838	Continuing	N/A

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. Integration Facility for Avionics Systems Testing (IFAST) provides a multi-user support facility for full-scale avionics development test and evaluation. Integrated Flight Data Processing System (IFDAPS) is a distributed processing system for Time Space Positioning Information (TSPI) and 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). Modular Airborne Instrumentation System (MAIS) will develop a high data rate, pulse code modulation, airborne instrumentation system to meet the requirements of future test programs to be conducted at the AFFTC. The Electronic Combat Integrated Test Facility (ECITF) 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 1988 Accomplishments:
- (U) IFAST integration engineering was performed to interface the current IFAST capability with the new three bay addition.
- (U) Acquired a new system to support current high data requirements, bought initial GPS based instrumentation.
- (U) Continued upgraded of airborne instrumentation and laboratory calibration equipment.
- (U) AFFTC Range Instrumentation Upgrade began upgrading the data transmission between Edwards AFB and the Utah Test and Training Range, fiber optic installation and upgrades to video systems and mobile telemetry.

Program Element: 0604755F
PE Title: Improved Capability fo[illegible]T&E
Project Number: 3620
Budget Activity: 6 - Defense

- (U) PMF included upgrades to the Horizontal Engine Trust Stand and the Weight and Balance Facility; work continued on specifications for the Multidimensional Thrust Stand.

(U) FY 1989 Planned Program:
- (U) Continued ARDs processor software development and hardware integration for first GPS Range System.
- (U) AFFTC Range Instrumentation Upgrade includes acquisition of voice communication switch hardware, data transmission upgrades to UTTR and WSMC, upgrades for fiber optic data transmission, telemetry vans and sites, and completion of a video theodolite.
- (U) Airborne Instrumentation Enhancements 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 and spares.
- (U) ECITF acquisition planning and system definition begins.

(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, completion of a telemetry site and vans and acquisition of autotracking video theodolites.
- (U) Airborne Instrumentation Enhancement continues FY 1989 efforts and acquires a third telemetry antenna for the Test Pilot School.
- (U) Procurement of the ECITF equipment will begin.
- (U) MAIS planning and specification preparation for modular miniature instrumentation units development will begin.
- (U) Begin upgrade of IFDAPS display work stations and improvements of the processor.
- (U) PMF will include initial acquisition of a Multi-dimensional Thrust Stand, definition of upgrades for IR Flow Field visualization and Free Space Electro-Optical Measurements.

(U) FY 1991 Planned Program:
- (U) Purchase and integration of Advanced Range Data System equipment will continue.
- (U) Procurement of the Modular Airborne Instrumentation System will begin.
- (U) AFFTC Range Instrumentation Upgrade purchases control room voice communication hardware, begins digital data transmission hardware procurement for Edwards AFB and UTTR link, begins telemetry antenna upgrades and video autotracking upgrades.
- (U) PMF begins integration of Multi-dimensional Thrust Stand and initial acquisition planning for development of advanced take-off and landing facility.
- (U) ECITF planning, system design of primary equipment procurement and integration of ECITF with existing facilities continues.

Program Element: 0604755F | Project Number: 3620
PE Title: Improved Capability for DT&E | Budget Activity: 6 - Defense

- (U) Initial procurement for MAIS and support equipment will begin.
- (U) Installation and checkout of IFDAPS upgrades will continue 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 (Integrated Facility for Avionics Systems Test); VERAC Incorporated, San Diego, CA (Advanced Range Data System); and AFFTC inhouse efforts.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF Change	IMPACT ON System Capabilities	IMPACT ON Schedule	Budget Year Cost
Eng	N/A	N/A	-0-
Schd	N/A	N/A	-0-
Cost	N/A	N/A	-0-

NARRATIVE DESCRIPTION OF CHANGES

1. ENGINEERING CHANGES: Not Applicable
2. SCHEDULE CHANGES: Not Applicable
3. COST CHANGES: Not Applicable

F. (U) PROGRAM DOCUMENTATION: PMD 2164(3)/64755F Improved Capability for DT&E, 3 Mar 87

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 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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605101F Budget Activity: #6 - Defense-Wide Mission Support
Title: Project AIR FORCE

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

Project Number	Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
0605101F	Project AIR FORCE	22,020	21,881	23,320	24,658	Cont.	TBD
TOTAL		22,020	21,881	23,320	24,658	Cont.	TBD

B. (U) BRIEF DESCRIPTION OF ELEMENT: Program funds Project AIR FORCE (PAF), AF Studies and Analyses 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project PE #0605101F, Project AIR FORCE

(U) FY 1988 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 1987, particularly in the areas of deterrence, TACAIR in NATO, and combat support, research focused on three integrative studies which prepared for the issues likely to be raised during the transition to a new administration. These studies addressed major policy, employment, cost, and force modernzation issues related to strategic forces, theater forces,and SDI.

(U) FY 1989 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 areas will include close air support issues and options, policy issues surrounding AF space operations, the role of China in U.S. regional strategy, alternative methods for determining requirements for spare parts and depot level

repair, improved wartime readiness and sustainability of electronic warfare equipment and means of enhancing the Allied contribution to NATO airpower.

(U) FY 1990 Planned Program:

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(U) FY 1991 Planned Program:

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

(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 Analyses.

- (U) There is no unnecessary duplication of effort within AF or DOD.

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

(U) INTERNATIONAL COOPERATIVE AGREEMENTS: Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2767 Ranch Hand II Epidemiology Study	5,754	1,740	1,419	1,476	Continuing	TBD
Total	5,754	1,740	1,419	1,476	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 dissemination 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(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 at the 3, 5, 10, 15, and 20 year time periods. A recent development is enabling an 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 Hands 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.

Program Element: #0605306F Budget Activity: 6-Defense-Wide Mission Support
PE Title: Ranch Hand II Epidemiology Study

(U) FY 1988 Accomplishments:
- (U) Baseline and Year-3 reports were published showing:
  -- (U) No statistical difference in mortality between Ranch Hand and comparison groups.
  -- (U) Insufficient evidence to establish cause and effect between herbicide exposure and adverse health in Ranch Hand group.
- (U) Completed Year-5 examinations and questionnaires.
- (U) Obtained blood samples from all Ranch Hands for later serum dioxin analysis.

(U) FY 1989 Planned Program:
- (U) Complete serum dioxin assays.
- (U) Start serum dioxin analysis.
- (U) Complete fertility analysis report and continue annual mortality analysis.

(U) FY 1990 Planned Program:
- (U) Complete serum dioxin analysis.
- (U) Continue annual mortality analysis.
- (U) Release five year morbidity report.
- (U) Continue data base management.

(U) FY 1991 Planned Program:
- (U) Review contract proposals for Year-10 study.
- (U) Continue mortality analysis.
- (U) Continue data base management.
- (U) Publish Year-5 morbidity report with dioxin exposure index.

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

(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 Deputy for Development and Acquisition, 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 of 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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605708F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: NAV/RADAR/SLED-TRACK Test Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06TG 6585th Test Group Support	20,122	17,294	22,568	22,433	Continuing	N/A
2900 RATSCAT Upgrade	2,000	1,600	2,000	2,000	Continuing	N/A
688G Aircraft Navigation System Verification	2,000	1,500	2,000	2,000	Continuing	N/A
Total	24,122	20,394	26,568	26,433	Continuing	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 is a tenant organization at Holloman AFB, NM, adjacent to the White Sands Missile Range (WSMR). This project provides institutional 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 conducts many other types of tests requiring realistic simulations of high acceleration or high velocity environments. The sled track was used to perform measurements of the Peacekeeper guidance system under environmental stress conditions and has attained a world speed record of over Mach 8 while testing rain erosion degradation of reentry vehicles. The sled track is also vital for developmental testing of guidance subsystems. For the foreseeable future, the track is heavily 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 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

Program Element: #0605708F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: NAV/RADAR/SLED-TRACK Test Support

performing test and 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 1988 Accomplishments:
- (U) Sled tests of Short Range Attack Missile (SRAM) II, F-111 Crew Escape System, and High Endo-Defense Interceptor (HEDI)
- (U) Flight test of AMRAAM
- (U) RCS tests for Air Launched Cruise Missile (ALCM), B-1, and numerous USAF-directed efforts
- (U) Inertial Navigation System (INS) verification efforts under Project 688G
- (U) Guidance tests for Ground Launched Cruise Missile (GLCM) and B-1B avionics
- (U) Guidance tests for helicopter INS for the Canadian National Defence Headquarters

(U) FY 1989 Planned Program:
- (U) Support of 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) Consolidation of sled track fabrication shops

(U) FY 1990 Planned Program:
- (U) Continue support for ACES II, ATF, SRAM II, B-1, B-52, SDI
- (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 GLCM guidance, GPS-Aided Inertial System, and High-Accuracy Ring Laser Gyroscope

(U) FY 1991 Planned Program:
- (U) Support for test mission, maintenance and upgrades continues
- (U) Continuing support for ACES II, SRAM II and SDI
- (U) Additional equipment will be acquired to secure data for various classified test missions
- (U) Acquisition of Advanced Reference System will provide up-to-date capability for testing of airborne INS

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

(U) Work Performed By: The primary contractor, Dynalectron of Washington, D.C., operates and maintains the Radar Target Scatter (RATSCAT) facility.

Program Element: #0605708F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: NAV/RADAR/SLED-TRACK Test Support

(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.

(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 1988 Accomplishments:
- (U) Continue procurement of automated multiple frequency radar, control and data acquisition system called the Integrated Radar Measurement System (IRMS), expanding capability from manually conducted single frequency RCS measurement to simultaneous, computer-controlled multiple frequency testing

(U) FY 1989 Planned Program:
- (U) Complete IRMS procurement
- (U) Complete Military Construction Project of new, corrosive-resistant facilities

(U) FY 1990 Planned Program:
- (U) RATSCAT Advanced Measurement Systems (RAMS) radar equipment and measurement 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 RATSCAT main site upgrade

Program Element: #0605708F Budget Activity: 6 - Defense-Wide Mission Support
PE Title: NAV/RADAR/SLED-TRACK Test Support

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

(U) Work Performed By: Not Applicable

(U) Related Activities: Not Applicable

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

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 Verification Testing, Aided INS Verification Testing, Velocity Sensor Verification Testing, Standard INS Qualification Testing, Form/Fit/Function Testing, management and maintenance of CIRIS, and minor improvement and modernization of systems supporting both project efforts and users with valid support requirements.

(U) FY 1988 Accomplishments:
- (U) Verification and development testing of navigation systems with emphasis on radar and stellar-aided INS
- (U) Added CIRIS multiple frequency capability to simultaneously support multiple tests without frequency interference

(U) FY 1989 Planned Program:
- (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) Miniaturization of system into five inch diameter AIM-9 Sidewinder pod for compatibility with additional aircraft
- (U) Begin support of SRAM II

(U) FY 1991 Planned Program:
- (U) Acquisition of the Advanced Reference System (ARS) upgrade to the CIRIS will begin

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

(U) Work Performed By: Not Applicable

(U) Related Activities: Not Applicable

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

FY 1990/FY 1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
06RB Arnold Engineering & Development Center (AEDC)	143,850	141,944	147,964	156,162	Continuing	N/A
06ZA Armament Division (AD)	54,255	52,750	50,876	53,654	Continuing	N/A
06YA Air Force Flight Test Center (AFFTC)	60,000	60,101	61,864	65,497	Continuing	N/A
06UC 4950th Test Wing (4950 TW)	41,000	42,311	43,648	46,006	Continuing	N/A
Total	299,105	297,106	304,352	321,319	Continuing	N/A

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 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 1988 Accomplishments:
- (U) Major test efforts supported Peacekeeper, SICBM, Inertial Upper Stage (IUS), Boost Surveillance Tracking System , Space Surveillance Tracking System (SSTS), Intelsat VI, NASP, STOL Fighter Technology, F-16. F-15, B-1B, Minuteman, Joint Cruise Missile, SDI, and the ATF.
- (U) Turbine engine programs included F100 Improved Performance Engine (IPE)/Component Improvement Program (CIP), F100 CIP, and Expendable Turbine Engine Concept (ETEC).
- (U) Continued support to flight dynamics, aeropropulsion, space systems, store separations and munition programs.
- (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.

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

(U) FY 1989 Planned Program:
- (U) AEDC will continue the development of DOD weapons systems and technologies including Peacekeeper, ATF, SSTS, STOLMTD, Minuteman, SDI, NASP, High Endoatmospheric Defense Interceptor (HEDI), and classified programs.
- (U) Emphasis on turbine engine testing will involve the F100 IPE/CIP, ATF prototype engines and the AFWAL ETEC.
- (U) Continued support in the areas of flight dynamics, aerospace propulsion, ordnance technology, and space.

(U) FY 1990 Planned Program:
- (U) Program support includes Peacekeeper, Minuteman, F-15E, NASP, ATF, F100, F110, numerous classified programs and other DOD service/Government Agencies.
- (U) Technology efforts include IR signature, flight dynamics 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) FY 1991 Planned Program:
- (U) FY 91 workload will be essentially the same as FY 90 except a marked increase in ATF and classified programs.

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

2. (U) Project: 06ZA, Armament Division (AD): AD is located at Eglin AFB, FL, and is responsible for Air Force nonnuclear armament development. AD accomplishes technology research, engineering development, test, evaluation, and initial acquisition of USAF nonnuclear munitions. AD, 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 1988 Accomplishments:
- (U) AD supported over 600 programs in FY 1988.
- (U) Supported development testing of conventional munitions and electronic combat systems for the using commands.
- (U) Continued F-15 and F-16 munitions certification projects (Seek Eagle), AMRAAM, AN/ALR-56C and AIM-9P-4 tests.
- (U) Tested the F-15E, Tactical Electronic Warefare System (TEWS), the QF-106 full scale aerial target drone, the Advanced Radar Warning Receiver (ARWR), and supported the Hypervelocity Missile and the Inertial Guidance Technology Demonstrations.

(U) FY 1989 Planned Program:
- (U) The workload for testing of electronic combat systems will continue growing.

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

- (U) Seek Eagle store certification testing on F-15 and F-16 aircraft will continue to support the tactical forces, as will testing of AMRAAM and the QF-106.
- (U) Additional test programs which will be supported will include the Hardened Target Weapon, the Low-Cost Seeker, the Joint Strategic Target Attack Radar System (JSTARS), the Direct Airfield Attack Cluster Munition (DAACM) and MC-130.

(U) FY 1990 Planned Program:
- (U) Testing of major systems including AMRAAM, INEWS and store certification on the F-15 and F-16 will continue.
- (U) Additional test programs supported include the Autonomous Guided Weapon and Miniature Laser Warning System.

(U) FY 1991 Planned Program:
- (U) Requested funds for AD in FY 1991 will sustain essential test and evaluation support.
- (U) Support for, AMRAAM, DAACM and major electronic combat systems will continue.
- (U) Support of the ALQ-131 Block II, GBU-15/12K Integration and Peacekeeper Rail Garrison climatic evaluation will begin.

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

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. Support 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 1988 Accomplishments:
- (U) Testing included continuation of the B-1B, F-16 and F-15 Multi-Stage Improvement Program, B-52 strategic system upgrades, cruise missile evaluations, classified programs and technology efforts on the X-29 and AFTI-16.
- (U) Testing of the MC-130H and F-15E increased significantly.
- (U) Preparation for the C-17 and ATF Dem/Val accelerated.
- (U) Space shuttle landings and planning for the National Aerospace Plane continued.
- (U) The Center was tasked to support some 200 to 250 aircraft fleet mix, modernization and technology programs.
- (U) Support of operational cruise missiles testing continued.

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

(U) FY 1989 Planned Program:
- (U) Testing of B-1B, F-16, F-15, F-15E, cruise missile evaluation, MC-130H, X-29, and AFTI-16 will continue.
- (U) Classified program testing increases significantly.
- (U) The F-111 Avionics Modernization Program (AMP) starts up.
- (U) Shuttle landings build to six per year.
- (U) Operational testing of cruise missiles continues.
- (U) Preparation for the B-2 first flight, C-17, Peace Pearl, YA-7 and ATF continues.

- (U) The emergence of avionics intensive weapon systems which are entering the development testing cycle presents new challenges to both ground and flight test capabilities.

(U) FY 1990 Planned Program:
- (U) Testing of B-1B, B-2, F-16, F-15, F-15E, cruise missiles, MC-130H, X-29, AFTI-16, and F-15 STOL will continue.
- (U) Classified program testing will increase significantly.
- (U) Preparation for the C-17, NASP, Peace Pearl and ATF Dem/Val continues.
- (U) B-1B Electronic Warfare testing begins in the production anechoic chamber and space shuttle support continues.

(U) FY 1991 Planned Program:
- (U) Testing of B-1B, B-2, MC-130H, F-15, F-15E, A-7F, F-111, F-16, AFTI/F-16, X-29A, AFTI, F-15 STOL, ATF, Peace Pearl and cruise missile evaluation will continue.
- (U) C-17 testing will begin.
- (U) NASP preparation will continue.
- (U) Classified program testing will continue at a high level.

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

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 the 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 1988 Accomplishments:
- (U) EC-18B ARIA conversion tasks were completed.
- (U) The in-house integrated Computer Aided Design and Manufacturing (CAD/CAM) system was used to conduct engineering design and fabrication for flight test aircraft modifications.

Program Element: 0605807F Budget Activity: 6 - Defense-wide Mission Support
PE Title: Test and Evaluation Support

(U) FY 1989 Planned Program:
- (U) Continue ARIA and other flight test support for DOD & NASA programs.
- (U) Continue support in fabrication/modification and flight test to the Air Force Wright Aeronautical Laboratories and other DOD and government organizations.
- (U) ARIA fleet will support 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 will be improved, replacing older, obsolete equipment in an orderly manner that will result 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 System (SMILS) aircraft are scheduled for initial operational capability.

(U) FY 1991 Planned Program:
- The FY91 workload will increase as additional support will be provided by the ECCM/ARTB, CMMCA and SMILS.

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

(U) WORK PERFORMED BY: Primary contractors performing test support (test center shown in parentheses) include: SVERDRUP Technologies, Inc., Schneider Services, Inc. and Calspan Field Services, Inc. (AEDC); RCA Service (AD); Computer Science Corporation (CSC) (AFFTC); and E-Systems (4950 TW).

(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 Industrial 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 Station (AFS), 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 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3360 Technical Support	3,144	3,270	3,236	3,429	Continuing	TBD
3361 Mission and System Planning	13,813	9,934	10,800	11,485	Continuing	TBD
Total	16,957	13,204	14,036	14,914	Continuing	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 Forces' acquisition development programs. Implementing FY 86 Congressional direction to use appropriated funds, this type of force planning focuses technology on the Air Forces' most urgent warfighting requirements. Technologies which significantly enhance warfare capabilities, which exploit adversary weaknesses, or which reduce weapon system ownership costs are evaluated for incorporation into system concepts. Studies evaluate system approaches and configurations to determine limitations and development challenges. Technical support to augment in-house analytical capabilities is also provided.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS: Activities funded by Project 3360 Technical Support and Project 3361 Mission and System Planning are integrated into discrete projects. Total accomplishments and plans are listed below:

(U) FY 1988 Accomplishments:

- (U) Determined requirements for ICBMs to successfully penetrate future Soviet defenses and strike deeply buried targets
- (U) Analyzed alternative non nuclear, high velocity missile concepts for development
- (U) Assessed current aerial refueling forces in future roles and planned cost effective force modifications
- (U) Evaluated improvements to current air defense engagement systems and high velocity missiles to attack projected threats to North America
- (U) Defined survivable surveillance system concepts and technology requirements against low altitude threats to North America
- (U) Developed satellite terminal technology requirements for MILSATCOM
- (U) Assessed advanced spacecraft concepts to select those which would reduce total costs while being compatible with both expendible boosters and shuttle

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Program Element: 0605808F Budget Activity: 6-
PE Title: Advanced Systems Engineering/Planning Defense Wide Mission Support

- (U) Evaluated alternative precision weapons concepts to reduce procurement costs

FY 1989 Planned Program

- (U) Identifying critical technologies and development schedule for long-range, stand-off airfield attack weapons
- (U) Evaluating alternative concepts to enhance accuracy of conventional cruise missiles for strategic missions
- (U) Analyzing utility of advanced air superiority missile concepts in future battlefield and limited warfare environments
- (U) Applying artificial intelligence approaches to reduce the number of operators of weapon systems
- (U) Developing advanced transport concepts to replace aging C-130s while significantly increasing productivity and survivability
- (U) Assessing technology programs and concepts for next generation special operations aircraft to select best acquisition strategy for reduced cost
- (U) Defining concepts to assure space based system availability and extend on-orbit life at lower cost

(U) FY 1990 Planned Program:

- (U) The planning process begins each fiscal year with a thorough review of approved Air Force requirements, threat projections, technological potentials, and other likely future challenges for the Air Force. Studies are then recommended for funding that focus on the most serious near-, mid-, and far-term deficiencies. Because planning is a continuous and iterative process and the environment is dynamic, a candidate test of projects is continuously reviewed and updated to meet national security objectives with final selections made at the start of each fiscal year.

(U) FY 1991 Planned Program:

- (U) See FY 1990 Planned Program above.

(U) Program to Completion:

- (U) This is a continuing program.

(U) Work Performed By: Technical Support (Project 3360) is primarily provided by the Aerospace Corporation, El Segundo CA, and the MITRE Corporation, Bedford MA. Mission and System Planning (Project 3361) is performed by numerous system contractors and analytical service companies which are selected at the beginning of each year for one year periods or less.

(U) Related Activities:

- (U) Projects funded by this program element evaluate integrating emerging technology of the S&T base into candidate systems for concept exploration.

Program Element: 0605808F
PE Title: Advanced Systems Engineering/Planning

Budget Activity: 6-
Defense Wide Mission Support

- (U) Conceptual studies and mission area analyses are the basis for beginning engineering development programs.

- (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.

FY1990/1991 BIENNIAL 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	FY1988 Actual	FY1989 Estimate	FY1990 Estimate	FY1991 Estimate	To Complete	Total Program
4514 DYCOMS	7,471	9,146	4,968	3,177	5,926	30,688
Total	7,471	9,146	4,968	3,177	5,926	30,688

B. (U) BRIEF DESCRIPTION OF ELEMENT: This test facility is required to test operational low observable (LO) airborne platforms. Additionally, this facility is required for acceptance testing of new LO systems and maintenance of the LO capability of critical operational assets after modifications.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) 4514 DYNAMIC COHERENT MEASUREMENT SYSTEM: (same as section B.)

(U) FY 1988 Accomplishments:
- (U) White Sands Missile Range North Oscura Peak selected
- (U) Concept definition contract awarded

(U) FY 1989 Planned Program:
- (U) Purchase of long lead items
- (U) Award contract for facility modification, system design and development, and site installation.

(U) FY 1990 Planned Program:
- (U) Start site construction and facility modifications.
- (U) Start subsystem level testing.

(U) FY 1991 Planned Program:
- (U) Site installation, system checkout and characterization
- (U) Initial operational capability.

(U) Program to Completion:
- (U) System refinement and adjustments.

(U) Work Performed By: AFSC, Electronic Systems Division, Hanscom AFB, MA. Prime contractor is EG&G Special Projects, Las Vegas, Nevada.

(U) Related Activities: All systems having signature modifications. There is no unnecessary duplication within Air Force or DOD.

(U) Other Appropriation Funds: Not Applicable

(U) International Cooperative Agreements: Not Applicable

00810

FY 1990/FY 1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2111	Armament Division	8,016	8,508	9,303	8,863	Continuing	N/A
2112	Air Force Flight Test Center	27,483	27,355	30,144	31,490	Continuing	N/A
2114	4950th Test Wing	12,500	16,501	21,001	21,800	Continuing	N/A
Total		51,999	52,364	60,448	62,153	Continuing	N/A

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 DMIF reimbursement. This program currently supports 202 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, Armament Division (AD): The Armament Division (AD), Eglin AFB, FL, is the prime USAF organization responsible for nonnuclear munitions armament development. AD 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. AD currently has the following types and quantities of test/test support aircraft assigned: A-10A(2); C-130A(1); F-4D(5); F-4E(2); F-15A(1); F-15B(1); F-15C(1); F-15D(1); F-15E(2); F-16A(6); F-16B(1); F-16C(3); F-16D(1); F-111E(2); UH-1N(2); and T-38A(5). Total aircraft assigned: 37.

(U) FY 1988 Accomplishments:
- (U) Programmed Depot Maintenance (PDM) accomplished on one F-4D.
- (U) TCTOs on 3 A-10s, 1 C-130A, 4 F-4s, 3 F-111s, and 1 T-38.
- (U) An inspection was accomplished on two UH-1Ns.
- (U) AD had 5,820 flying hours which generated corresponding engine overhaul and exchangeable requirements.

(U) FY 1989 Planned Program:
- (U) PDM on one F-4D, one F-15A and one F-111.
- (U) One F-15 is scheduled for Speedline.
- (U) Two UH-1Ns will have a condition inspection.

00811

Program Element: 0605863F
PE Title: RDT&E Aircraft Support

Budget Activity: 6-Defense-wide Mission Support

- (U) TCTOs will be done on six T-38s.
- (U) AD has projected 6,903 flying hours which will generate corresponding engine overhaul and exchangeable requirements.

(U) FY 1990 Planned Program:
- (U) PDM will be done on one F-4D, one F-111E and two F-15s.
- (U) TCTOs on 3 F-16As, 1 F-16C, 6 T-38As, 2 A-10s 2 F-111Es and 1 UH-1N.
- (U) AD is projecting to fly 7,305 hours, which will generate corresponding exchangeable/engine overhaul requirements.

(U) FY 1991 Planned Program:
- (U) PDM will be done on one C-130A and one F-4E.
- (U) TCTOs on 5 F-16s, 5 T-38s, 1 C-130A, 1 UH-1N and 2 A-10s.
- (U) AD is projecting 7,299 flying hours, which will generate corresponding exchangeable and engine overhaul requirements.

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

(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; Hayes International, 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
PE Title: RDT&E Aircraft Support

Budget Activity: 6-Defense-wide Mission Support

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(3), B-52G(1), B-52H(1), FB-111A(1), C-130B(2), C-130H(5), C-130U(1), F-4C(4), RF-4C(5), F-4D(2), F-4E(10), F-15A(4), F-15B(2), F-15D(2), F-15E(3), F-16A(7), F-16B(9), F-16C(7), F-16D(2), F-111A(1); F-111D(3); F-111E(1), EF-111A(1), H-1H(7), H-3E(3), H-53Q(2), T-38A(22), UV-18B(1), and U-6(1). Total aircraft assigned: 129.

(U) FY 1988 Accomplishments:
- (U) PDMs were accomplished on three F-4s, and two F-111s.
- (U) Two F-15s received Speedline and TCTOs.
- (U) One A-37 had Analytical Condition Inspections done, and two H-1s had a condition inspection accomplished.
- (U) TCTOs/modifications on 2 C-130s, 2 F-15s, and 4 T-38s.
- (U) AFFTC had 23,945 flying hours which generated corresponding engine overhaul and exchangeable requirements.

(U) FY 1989 Planned Program:
- (U) PDM will be done on two C-130s, four F-4s and one F-111D.
- (U) TCTOs/MODs on nine A-7s, one A-37 and two T-38s.
- (U) Analytical Condition Evaluation (ACE) on two HH-1Hs.
- (U) AFFTC projects 28,660 flying hours which will generate corresponding engine overhaul and exchangeable requirements.

(U) FY 1990 Planned Program:
- (U) PDM on 1 C-130B, 1 HC-130H, 1 NC-130H, 1 NF-4C, 2 NRF-4Cs, 2 F-4Es and 1 HH-1H scheduled for On-Condition Maintenance.
- (U) Nine H-1s are scheduled for ACE.
- (U) TCTOs will be done on four A-7s, one C-130H, two RF-4Cs, two F-15s, two F-16s, one F-111D and one HH-1H.
- (U) PDM on one F-4C will be accomplished.
- (U) AFFTC is projecting 28,413 flying hours which will generate corresponding exchangeable and engine overall requirements.

(U) FY 1991 Planned Program:
- (U) PDM on 1 C-130B, 2 NF-4Cs, 1 F-4D, 1 RF-4C, 3 F-4Es, 2 F-15s, and 1 F-111D.
- (U) Nine H-1s will have ACEs.
- (U) TCTOs on 5 A-7s, 14 F-15s, 4 F-16s, 3 C-130s, 1 HH-1H.
- (U) AFFTC is projecting 27,458 flying hours which will generate corresponding exchangeable/engine.

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

Program Element: 0605863F
PE Title: RDT&E Aircraft Support

Budget Activity: 6-Defense-wide Mission Support

(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; Hayes International, 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.

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); EC-18B(5); 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 1988 Accomplishments:
- (U) PDMs on one C-18, three C-135s, and one NF-111A.
- (U) ACE, corrosion control and life extension mods on 1 T-39.
- (U) TCTOs/mods were done on four C-135s and six T-39Bs.
- (U) The 4950th Test Wing had 8,041 flying hours which generated corresponding engine overhaul and exchangeable requirements.

(U) FY 1989 Planned Program:
- (U) Two C-18s, four C-135s, and two C-141 will receive PDM.
- (U) ACE/corrosion/Life Extension Mod is scheduled on two T-39s.
- (U) The 4950th Test Wing is projecting 9,020 flying hours which will generate corresponding engine overhaul and exchangeable requirements.

Program Element: 0605863F
PE Title: RDT&E Aircraft Support

Budget Activity: 6-Defense-wide Mission Support

(U) FY 1990 Planned Program:
- (U) PDM will be done on one C-18, three C-135s, one C-141.
- (U) Corrosion & Life Extension Mod will be done on one T-39.
- (U) TCTOs will be done on five C-135s and two C-141s.
- (U) 4950th is projecting 8,810 flying hours, which generate corresponding engine and exchangeable overhaul requirements.

(U) FY 1991 Planned Program:
- (U) PDM will be done on two C-18s, and four C-135s.
- (U) TCTOs will be done on five C-135s, and two C-141s.
- (U) 4950th is projecting 8,892 flying hours which will generate corresponding exchangeable and engine overhaul requirements.

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

(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; Hayes International, 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.

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0605894 F
Title: Real Property Maintenance Activity (RPMA)

Budget Activity: 6-Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY1991 Estimate	To Complete	Total Program
8941 Operation of Utilities	14,658	16,487	17,306	17,784	Continue	TBD
8942 Maintenance and Repair of Real Property	44,663	43,030	51,280	49,507	Continue	TBD
8943 Minor Construction	6,255	3,455	5,320	4,917	Continue	TBD
8944 Other Support	12,888	15,738	23,846	24,244	Continue	TBD
Total	78,464	78,710	97,752	96,452		

B. (U) BRIEF DESCRIPTION OF ELEMENT: The Real Property Maintenance Activity (RPMA) account provides resources for Air Force Systems Command (AFSC) owned bases for support of utility operations; maintenance, repair, and minor construction of facilities; and other civil engineering services. The bases funded by this program element are Edwards AFB, CA; Eglin AFB, FL; and Arnold AFB, TN.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) Project 8941, Operation of Utilities: This project supports both purchased and base produced utilities. 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 1988 Accomplishments:
- (U) FY88 was the first effective year of this program element. Previously this effort was supported in PEs 0605806 F and 0605807 F.
- (U) This project funds both the purchased and base-produced utilities for Eglin AFB, FL and Edwards AFB, CA.

(U) FY 1989 Planned Program:
- (U) Continuing level of effort.

(U) FY 1990 Planned Program:
- (U) Continuing level of effort.

(U) FY 1991 Planned Program:
- (U) Continuing level of effort.

Program Element: #0605894 I Budget Activity: 6-Defense-Wide Mission Support
Title: Real Property Maintenance Activity (RPMA)

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

(U) Work Performed By:
- (U) In-house work force and various utility companies such as Southern California Edison.

(U) Related Activities:
- (U) Program Element #0605807 F, 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.

2. (U) Project 8942, Maintenance and Repair of Real Property: This project funds the recurring maintenance and repair of extremely complex test facilities to prevent deterioration, damage, and to ensure preservation of Air Force facility investments. This project also provides for repair of damaged facilities/facility components and extends the effective life of the facilities.

(U) FY 1988 Accomplishments:
- (U) Minimal dollars were available in this project to ensure adequate maintenance and repair of our facilities.
- (U) Due to this low level of support the Backlog of Repair and Maintenance grew to $62 million by the end of the year.

(U) FY 1989 Planned Program:
- (U) Continue prior year level of effort.
- (U) Backlog is estimated to increase to $72 million.

(U) FY 1990 Planned Program:
- (U) The backlog continues to increase but at a slower rate of growth due to an increased level of funding.

(U) FY 1991 Planned Program:
- (U) Continue decreasing the rate of growth in the Backlog of Repair and Maintenance projects.

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

(U) Work Performed By:
- (U) In-house work force and various contractors.

(U) Related Activities:
- (U) PE 0605807 F, Test and Evaluation, provides the mission funds for civilian personnel at Arnold AFB, TN due since mission support consumes almost all personnel efforts.

Program Element: #0605894F
Title: Real Property Maintenance Activity (RPMA)

Budget Activity: 6-Defense-Wide Mission Support

3. (U) Project 8943, Minor Construction: 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 1988 Accomplishments:
- (U) Provides funding for minor construction of facilities via in-house or contractor resources.

(U) FY 1989 Planned Program:
- (U) Level of effort to satisfy minimum mission requirements.

(U) FY 1990 Planned Program:
- (U) Continued level of effort.

(U) FY 1991 Planned Program:
- (U) Continued level of effort.

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

(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 due since mission support consumes almost all personnel efforts.

4. (U) Project 8944, Other Support: The final project provides resources for such Civil Engineering services as snow removal, custodial, fire protection, refuse collection, entomology, leases, and environmental compliance.

(U) FY 1988 Accomplishments
- (U) This is a "must pay" account to provide health and safety services for base personnel.

(U) FY 1989 Planned Program:
- (U) Continued level of effort.

(U) FY 1990 Planned Program:
- (U) Continued level of effort.

(U) FY 1991 Planned Program:
- (U) further continuation of the level of effort.

Program Element: #0605894 I
Budget Activity: 6-Defense-Wide Mission Support
Title: Real Property Maintenance Activity (RPMA)

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

(U) Work Performed By:
- (U) In-house work force and various contractors. The major contractors in the Real Property Maintenance Activity account are Powell Sanitation Services, Niceville, FL; Management Technical Services, Camarillo, CA; and Schneider Services, Inc., Pittsburgh, PA.

(U) Related Activities:
- (U) None.

(U) Other Appropriation Funds:
- (U) Not Applicable.

(U) International Cooperative Agreements:
- (U) Not Applicable.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
XXXl Base Operating Support						
Total	60,808	59,881	67,780	65,364	Continuing	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT: This program element provides 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 finances pay of people, 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. This support enhances mission readiness, increases productivity, and improves retention of the career member.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Accomplishments:
   - (U) Continued to maintain on-going level of efforts in base operations support (BOS) for three AFSC bases.
   - (U) An additional family support center was activated at Eglin AFB FL.

2. (U) FY 1989 Planned Program:
   - (U) This is a continuing level-of-effort program to provide BOS for Eglin AFB FL, Edwards AFB CA, and Arnold AFB TN.
   - (U) Resources are required to sustain base operating activities in support of AFSC's test mission.
   - (U) Family support center will continue to provide critical quality-of-life services for the enhancement of mission readiness.

3. (U) FY 1990 Planned Program:
   - (U) Continues level-of-effort program to provide BOS for Eglin AFB FL, Edwards AFB CA, and Arnold AFB TN.
   - (U) Includes funds for purchase of a base level computer system for Arnold AFB TN.
   - (U) Family support center continues to provide quality-of-life service.

Program Element: #0605896F
PE Title: Base Operation RDT&E

Budget Activity: #6- Defense-Wide Mission Support

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

5. (U) Work Performed by: Primary contractors performing support in this program include 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, provides 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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: 0305110F Project Number: XXX1
PE Title: Satellite Control Facility (SCF) Budget Activity: 6-Defense Wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Title / Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
SCF	91884	88255	68579	117717	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 instrumentation systems, antennas, communications and computer systems required to support a growing inventory of increasingly complex space vehicles which support operational forces in peace and wartime.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1988 Accomplishments:
- (U) Continued to provide sustaining engineering and development of network hardware/software modifications to meet evolving satellite program requirements.
- (U) Continued transition of satellite programs from the old data systems configuration to a new computer configuration.
- (U) Installation and checkout of equipment in the Automated Remote Tracking Station (ARTS) Thule and Colorado stations completed and developmental testing successfully accomplished.
- (U) ARTS Colorado and Thule tracking stations accomplished initial operational test and evaluation.
- (U) ARTS Acquisition II contract awarded August 88. Initiated acquisition of new Diego Garcia station and the upgrade of two existing stations.

(U) FY 1989 Planned Program:
- (U) Provide sustaining engineering and development of network hardware/software modifications to meet evolving satellite needs.
- (U) Continue transition of satellite programs from the old data systems configuration to a new computer configuration.
- (U) Install and checkout equipment in the Northern Europe Station and achieve station IOC. Completes ARTS Acquisition I stations.
- (U) Initiated upgrade of second increment of three tracking stations under ARTS Acquisition II.
- (U) Plan for the Advanced Satellite Control System (ASCS) with focus on operational capabilites necessary for interoperable, enduring satellite control in peace and war.

Program Element: 0305110F Project Number: XXX1
PE Title: Satellite Control Facility (SCF) Budget Activity: 6-Defense Wide Mission Support

(U) FY 1990 Planned Program
- (U) Provide sustaining 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) ASCS planning discontinued due to OSD reduction.

(U) FY 1991 Planned Program
- (U) Provide sustaining 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 fourth increment of two stations under ARTS Acquisition II.
- (U) ARTS Diego Garcia tracking station IOC.
- ASCS 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 Division, Los Angeles, CA. Principal contractors are: Ford Aerospace Corporation (FAC), Sunnyvale, CA, provides study and development analysis for the range facilities and communications; UNISYS Corporation, Camarillo, CA, provides computer software/hardware integration; Space Applications Corporation, San Jose, CA, provides system engineering integration and test analysis; International Business Machines Corporation, Gaithersburg, MD, provides command and control sustaining engineering; Ford Aerospace Corporation, Sunnyvale, CA, provides development and acquisition of the ARTS program.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	-18,700
Schd	None	+2 years	-81,560
Cost	None	None	0

Program Element: 0305110F Project Number: XXX1
PE Title: Satellite Control Facility (SCF) Budget Activity: 6-Defense Wide Mission Support

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: RDT&E Sustaining engineering funds for new AFSCN computer system transferred to O&M by OSD based on Congressional direction.
2. (U) SCHEDULE CHANGES: (a) ARTS station IOCs delayed one year consistent with OSD budget reductions. (b) ASCS planning and development slipped to FY 92 consistent with Air Force and OSD TOA reductions. (c) Transition of satellite programs to new computer system delayed minimum of two years consistent with Air Force, OSD, and Congressional reductions.
3. (U) COST CHANGES: Not Applicable

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.
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Other Procurement, BA 83 Funds	81285	53513	74173	45781	TBD
Military Construction	7,500	8,800	20200	4000	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- (U) Automated Remote Tracking Station (ARTS) Contract Award	June 1984
- (U) Command and Control Sustaining Engineering Contract Award	January 1986
- (U) ARTS-Thule Tracking Station Initial Operational Capability	March 1988
- (U) ARTS Acquisition II Contract Award	August 1988
- (U) ARTS-Diego Garcia Station IOC	December 1990
- (U) ARTS Modification of Existing Stations	1990 - 1994
- (U) ARTS-Full Operational Capability	September 1994

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305119 Project: # N/A
PE Title: SPACE BOOSTERS Budget Activity: #6 - Defense Wide Mission Support
Project Title: Space Boosters

POPULAR NAME: EXPENDABLE LAUNCH VEHICLES (ELVs)

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones		Final Titan 34D Launch			
Engineering Milestones	Titan II First Launch Sep 88 - - - - - - Titan 34D Flights Resume (Oct & Nov 87)	Delta II ILC - Jan 89 - - - - - - Titan IV/IUS ILC - Cape Canaveral, Jan 89	Titan IV/NUS ILC Vandenberg - Mar 90	Atlas II ILC - Jan 91 - - - - - - Titan IV Centaur ILC Cape Canaveral- Dec 90	Titan IV 2d pad(SLC-40) Cape Canaveral 1 Qtr FY 92 - - - - - - Titan IV 2d pad (SLC-7) Vandenberg 1 Qtr Fy 95
T&E Milestones	N/A	N/A	N/A	N/A	N/A

Program Element: #0305119F
PE Title: Space Boosters

Budget Activity: #6 Defense Wide Mission Support

	FY 1988	FY 1989	FY 1990	FY 1991	ToComplete
Contract Milestones	Award Atlas II Jun 88 - - - - - - - - Titan II option Oct 87 - - - - - - - Titan IV Restructure Dec 87 - - - - - - - - Delta II option Jan 88	Delta II option Jan 89 - - - - - - - - Atlas II option Oct 88 - - - - - - - - Titan IV follow-on buy Jun 89 - - - - - - - -	Atlas II option Oct 89 - - - - - - - -	Atlas II option Oct 90	Atlas II option (annual)
BUDGET ($000)	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contracts	Delta II 63200 Titan II 5200 Atlas II 35300 Titan IV 327497	Delta II 4700 Titan II 5500 Atlas II 31200 Titan IV 396925	Delta II 7400 Titan II 2800 Atlas II 1100 Titan IV 348281	Delta II 300 Titan II 7400 Titan IV 162253	
Support Contract	3300	9500	8900	4000	
In-House Support	9800	7100	8600	10500	
GFE/ Other	Titan IV 6800 Atlas II 500 Delta II 100	Atlas II 8300	TIV QPQ 4867 Atlas II 2400 Delta II 2600 DII QPQ 19000	Titan IV 22900 TIV QPQ 46097 Delta II 6200 DII QPQ 13000	
Total	451697	473225	405948	272650	

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, Titan 34D, Delta II, and the Atlas II at Cape Canaveral AFS (CCAFS), Florida and Titan IV, Titan 34D, Titan II Space Launch Vehicle (SLV) and Atlas E at Vandenberg AFB, California. Major development efforts include the following: 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 (SRMU); 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,

Program Element: #0305119F
PE Title: Space Boosters

Budget Activity: #6 Defense Wide Mission Support

development and modification of 17 Titan II SLVs, development and procurement of up to 24 Delta IIs and planning for up to 11 Atlas II launches are ongoing. The Delta II and Titan IV programs also are providing ELVs for NASA through the Quid-Pro-Quo (QPQ) agreement between DoD and NASA. This program also provides for engineering support of active launch programs and post-flight 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	10,200
Titan IV/Inertial Upper Stage	Geosynchronous	5,290
Titan IV/No Upper Stage (NUS)	Low Easterly	39,100
Titan IV/NUS	Low Polar	31,100
Titan 34D/Transtage	Geosynchronous	4,100
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 1988 Accomplishments:

- (U) Delivered the first Titan IV and Titan II SLV to their launch sites for assembly and test.
- (U) Continued Titan IV, Titan II SLV and Delta II development.
- (U) Awarded Atlas II contract (MLV II) and initiated development.
- (U) Successfully launched first Titan II SLV from Vandenberg AFB.
- (U) Completed pathfinder operations for first Titan IV launch.
- (U) Began development of the Titan IV solid rocket motor upgrade program.

2. (U) FY 1989 Planned Program:

- (U) Continue Development of Delta II, Atlas II, and Titan IV
- (U) Launch First Delta II and Titan IV launch vehicles
- (U) Continue Centaur upper stage and Titan IV SRMU development
- (U) Complete Design studies for Space Launch Complex (SLC) - 7 launch pad for Vandenberg AFB

3. (U) FY 1990 Planned Program:

- (U) Begin modification of SLC-40 at CCAFS
- (U) Begin construction of SLC-7 at Vandenberg AFB
- (U) Deliver first Titan IV Centaur Upper Stage
- (U) Begin Construction of Solid Motor Assembly Building (SMAB) at CCAFS
- (U) Launch first Titan IV from Vandenberg AFB

Program Element: #0305119F
PE Title: Space Boosters

Budget Activity: #6 Defense Wide Mission Support

4. (U) FY 1991 Planned Program:

- (U) Complete Modification of SLC-40 and SMAB
- (U) Launch first Atlas II launch vehicle
- (U) Launch first Titan IV Centaur vehicle from CCAFS

5. (U) Program Plan to Completion

- (U) This is a continuing program
- (U) Continue to support Titan II, Titan IV, Delta II,and Atlas II flight assessment, reliability maintenance and obsolete component replacement until all vehicles have been launched
- (U) Complete development efforts on Delta II, Atlas II and Titan IV

D. (U) WORK PERFORMED BY: Air Force Systems Command's Space 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 Astronautics Group, 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 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.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	None	None	None
Schd	None	Titan IV/ILC moved to Jan 89; Titan IV/Centaur ILC moved to Dec 90; Delta II ILC moved to Jan 89	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: All changes due to first vehicle launch processing delays
3. COST CHANGES: None

00828

Program Element: #0305119F
PE Title: Space Boosters

Budget Activity: #6 Defense Wide Mission Support

F. (U) PROGRAM DOCUMENTATION:

- (U) National Space Policy, January 1988

G. (U) RELATED ACTIVITIES: * Note: Asterisks indicate related activities which reimburse the Space Boosters Program for expendable launch vehicle services

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

H. (U) OTHER APPROPRIATION FUNDS

	FY 1988 Actual	FY 1989 Actual	FY 1990 Estimate	FY 1991 Estimate	FY 1992 Estimate	Total Program
Missile Procurement, BA 5	713,012	597,677	446,867	456,231	933,473	continuing
Other Procurement BA 83	0	0	3,000	10,000	10,000	26,000
Military Construction	0	0	106,000	48,000	44,000	218,000
Operation and Maintenance	160,538	250,880	271,969	277,238	335,571	continuing

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) TEST AND EVALUATION DATA: None

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305130F
Title: Consolidated Space Operations Center
Project Number: XXX1
Budget Activity: #6-Defense Wide Mission Support

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

Project Title: Popular Name	CSOC FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
CSOC	38,836	34,913	24,533	24,762	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 spaceground 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 intrastations 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 1988 Accomplishments:
- (U) Continued installation, and test of command and control software and communications for the first Mission Control Center (MCC-1A).
- (U) MCC-1A routinely performed successful on-orbit support to Global Positioning System (GPS) satellites.
- (U) Began installation, and test of command and control software and communications for the second MCC (MCC-2).
- (U) Continued training of operations personnel. First cadre of satellite mission controllers completed initial training.

(U) FY 1989 Planned Program:
- (U) MCC-1A developmental testing will continue. GPS on-orbit operations will continue along with GPS launch support from CSOC.
- (U) Primary control authority for the GPS constellation will transition 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 (DSP) support capability will be performed in MCC-1B.
- (U) AFSCN range control/scheduling software development will be complete; and operational testing will begin.
- (U) Initial SOC Training complete; comm training will start.

Program Element: #0305130F
Title: Consolidated Space Operations Center

Project Number: XXXI
Budget Activity: #6-Defense Wide Mission Support

(U) FY 1990 Planned Program:
- (U) Testing of MCC-1(A&B), MCC-2 and a fully activated communications system will occur. System tests will demonstrate tracking, monitoring and commanding of GPS, DSP and DMSP in MCC-1 and military communications satellites (COMSAT) in MCC-2. Operational testing will culminate in turnover of MCC-1A (GPS) and MCC-2 to AF Space Command.
- (U) The NCS/range/scheduling/control will become fully operational.
- (U) Sustaining SOC training continues.

(U) FY 1991 Planned Program:
- (U) The communications segment will be completed by adding direct duplex high data rate communications between CSOC and AFSCN elements.
- (U) Communications nets for the Operations Command Center, installation and checkout of the NCS and Timing Subsystem, and communications for the Weather Support Unit will be completed.
- (U) Basic program development will be completed. Operational testing of MCC-1B (DSP and DMSP) and the communications segment will be complete with the final turnover to AF Space Command.
- (U) Steady state satellite operations will begin for all systems assigned to CSOC. Mods/upgrades will be performed in support of operations.

(U) Program Plan To Completion:
- (U) This is a continuing program .
- (U) RDT&E portion of this program element will extend through FY 1994 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 Division, Los Angeles, CA. Major contractors are TRW, Redondo Beach, CA; IBM, Gaithersburg, MD; Space Communications Co., a CONTEL division, Gaithersburg, MD; Lockheed Space and Missile Co., Sunnyvale, CA and INFOTEC Corp, Costa Mesa, CA.

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	Impact on System Capabilities	Impact On Schedule	Impact FY 1990 Cost
Tech	None	None	None
Schd	None	+6 months	None
Cost	None	None	+19,919

NARRATIVE DESCRIPTION OF CHANGES

1. (U) TECHNICAL CHANGES: None
2. (U) SCHEDULE CHANGES: Operational testing slipped six months due to rephase dictated by prior year budget reductions and technical problems in the command/control software and in the comm. system.

Program Element: #0305130F
Title: Consolidated Space Operations Center

Project Number: XXXI
Budget Activity: #6-Defense Wide Mission Support

3. (U) COST CHANGES: Funding for sustaining engineering/follow-on development.

F. (U) PROGRAM DOCUMENTATION:
- (U) Mission Element Need Statement (MENS) Sep 1979
- (U) Test and Evaluation Master Plan (TEMP)- Annual Update Aug 1988

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 0804731F, General Skill Training; 0804772F, Training Development; and 0805796F, Base Operations (Training).
- (U) Base operations support funded by PE 0102496F, Base Operations-AFSPACECOM.
- (U) Logistics support funded by PE 0701112F, Inventory Control Pt. Operations.
- (U) Utilities/facilities maintenance in PE 0102894F, Real Property Maintenance.
- (U) PE 0305165F 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 ($ in Thousands)

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
1. Other Procurement, BA 83 Funds	6,422	5,995	2,125	4,594	Cont.	TBD.
2. Military Construction:	None					

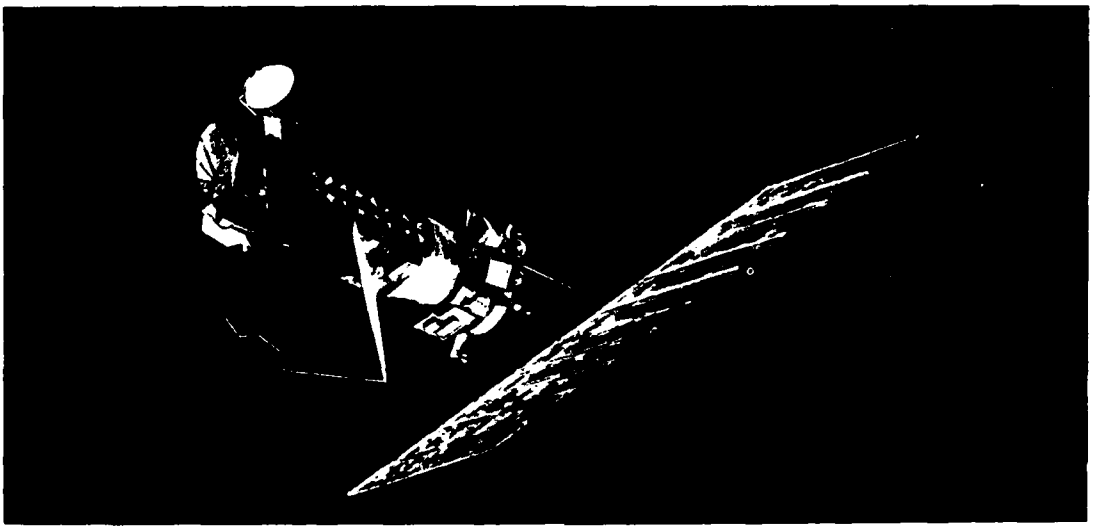
I. (U) INTERNATIONAL AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

- (U) Construction Start May 1983
- (U) Facility Occupancy Oct 1985
- (U) GPS Master Control Station Operational Jan 1986
- (U) 1st Cadre of Mission Controllers Complete Training Jun 1987
- (U) First Mission Control Center (MCC-1A) Supports GPS Launch 2Q FY 1989
- (U) Mission Control Centers (MCC-1A & -2) Fully Operational 3Q FY 1990
- (U) Mission Control Center(MCC-1B) Fully Operational 2Q FY 1991
- (U) CSOC Full Operational Capability (FOC) 4Q FY 1991

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305160F Project: #XXX1
PE Title: Defense Meteorological Satellite Program (DMSP) Budget Activity: 6-Defense Wide Mission Support
Project Title: DMSP



POPULAR NAME: DMSP

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

SCHEDULE	FY 1988	FY 1989	FY 1990	FY 1991	To Complete
Program Milestones	F-9 Launch Feb 1988	Complete 1st Block 6 Studies Jun	F-10 Launch On Demand	F-11 Launch On Demand	Milestone V 4th Qtr FY 1993
Enginerng Milestones	Block 5D-3 Production Dec 1987		Deliver First Block 5D-3 S-15	Begin Blk 6 Development Dec 1990	Begin Block 6 FSD 1st Qtr FY 1994
T&E Milestones	Microwave Imager Calb Continues	Begin FSOC OT&E Mar 89	Begin Mark IVB OT&E Sep 90	Complete Mark IVB OT&E Jan 91	
Contract Milestones	Award Block 6 Studies	Award 5D-3 Multiyear Mar 1989		Begin Mark IVB Prodctn Feb 1991	Final Mark IVB Delivery 4th Qtr FY 1995
BUDGET	FY 1988	FY 1989	FY 1990	FY 1991	Program Total (To Complete)
Major Contract	27,387	28,437	30,204	32,980	Continuing
Support Contract	4,888	13,517	14,170	14,580	Continuing
In-House Support	1,403	1,458	1,515	1,520	Continuing
GFE/ Other	8,092	8,808	6,454	567	Continuing
Total	41,770	52,220	52,641	49,647	Continuing

Program Element: #0305160F Project: #XXX1
PE Title: Defense Meteorological Satellite Program (DMSP) Budget Activity: 6- Defense Wide Mission Support

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, each providing coverage of the whole earth at least every 12 hours. (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 production, launch and on-orbit operations. 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 1988 Accomplishments:

- (U) Successfully launched the F-9 satellite in Feb 88 and completed checkout and turnover to Air Force Space Command in Mar 88.
- (U) Titan II refurbishment and integration continued.
- (U) The first Block 5D-3 satellite completed Critical Design Review/ Manufacturing Readiness Review in Dec 87 and began production.
- (U) Integration continued of the C^3 hardware for the hardened satellite operations center (SOC) near Fairchild AFB WA.
- (U) Shared Thule AB Greenland antenna completed and Operational Test and Evaluation (OT&E) successfully completed in Apr 88.
- (U) Strategic data processing and handling upgrades at Air Force Global Weather Central (AFGWC) continued.
- (U) Four Block 6 competitive concept study contracts awarded in Jan 88. Objectives include lowering system life cycle cost, upgrading obsolete late 1960s designs and parts, and exploring options for satisfying requirements for increased survivability, interoperability, and remote sensing.

2. (U) FY 1989 Planned Program:

- (U) Titan II refurbishment and integration will continue.
- (U) The first Block 5D-3 satellite will complete subsystem level testing and start system integration and test with all sensors.

Program Element: #0305160F Project: #XXX1
PE Title: Defense Meteorological Satellite Program (DMSP) Budget Activity: 6-Defense Wide Mission Support

- (U) The new microwave water vapor sounder will be integrated on to a Block 5D-2 satellite and mission sensor calibration/validation (Cal/Val) work will continue.
- (U) Complete Fairchild SOC acceptance and conduct OT&E.
- (U) Award Mark IVB tactical terminal upgrade contract.
- (U) Competitive contract award for Block 5D-3 microwave imager/sounders.
- (U) Complete first phase of Block 6 competitive concept studies.

3. (U) FY 1990 Planned Program:

- (U) Complete Titan II integration.
- (U) Deliver the first Block 5D-3 satellite (S-15).
- (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.

4. (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) Award two parallel competitive Block 6 advance development contracts for the demonstration and validation of alternatives.

5. (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 advance development through FY 1993, down select to one prime contractor and begin Full Scale Development (FSD) in FY 1994 after the completion of Milestone V. The first Block 6 satellite must be delivered in 2002 to meet continuing on-orbit operational requirements.

D. (U) WORK PERFORMED BY: Development and procurement are managed by Space 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); Aerojet Electro-systems, Azuza CA (microwave sounders); Harris Corporation, Melbourne FL (ground systems); Ford Aerospace, Palo Alto CA (Block 6 studies); and Lockheed Missiles & Space Company, Sunnyvale CA (Block 6 studies and Mark IVB).

Program Element: #0305160F Project: #XXX1
PE Title: Defense Meteorological Satellite Program (DMSP) Budget Activity: 6-Defense Wide Mission Support

E. (U) COMPARISON WITH AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
TECH	None	None	None
SCHED	None	None	None
COST	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

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) JCS Requirements Memorandum 154-86, 1 Aug 86
- (U) MAC SON 508-78, 28 Dec 78
- (U) MAC SON 505-79, 8 Sep 88
- (U) MAC SON 02-80, 14 Feb 86
- (U) MAC SON 01-83, 17 Mar 83
- (U) AFSPACECOM SON 07-84, 3 Jun 85
- (U) Navy OR-W0527-OS, 10 Feb 77
- (U) SOC, 21 Sep 87
- (U) TEMP, 22 Jan 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 to better meet meteorology/oceanography requirements in DMSP, PE #0305160N.
- (U) The Marine Corps procured 10 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.

Program Element: #0305160F Project: #XXX1
PE Title: Defense Meteorological Satellite Program (DMSP) Budget Activity: 6- Defense Wide Mission Support

- (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) AFGWC upgrades jointly funded with Air Weather Service, PE #0305111F.
- (U) Navy and Army jointly funding Block 6 studies. OMB has directed DOC to include their civil requirements in the Block 6 studies for cost comparison with other civil options. Operational and survivability requirements will drive major differences with DOC.
- (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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	Total Program
Missile Procurement, BA 23					
Funds	68,722	157,773	137,380	150,138	Cont
Quantity	0	1	1	1	
Other Procurement, BA 83					
Funds	9,049	16,110	2,006	17,836	Cont

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

J. (U) TEST AND EVALUATION DATA:

T&E ACTIVITY (PAST 36 MONTHS)

Event	Date	Results
F-8 On-orbit Checkout and Turnover to AFSPACECOM	Jun-Jul 87	Fully Operational
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/ Algorithms Being Corrected
Thule Antenna/DMSP OT&E	Apr 88	89.9% Mission Success, 147 Contacts

T&E ACTIVITY (TO COMPLETION)

Event	Planned Date	Remarks
Fairchild SOC OT&E	Mar 89	AFSPACECOM
Mark IVB OT&E	Sep 90-Jan 91	MAC and AFCC

FY 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0305171F Project Number: xxx1
PE Title: Space Shuttle Operations Budget Activity: 6 -Defense Wide Mission Support

A. (U) RESOURCES ($ In Thousands)
Project Title: Space Shuttle Operations

Popular Name	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
	48,737	39,630	64,692	47,227	Continuing	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. 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 Stage (IUS), and Payload Assist Module-Delta Class II (PAM-D II) 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 1988 ACCOMPLISHMENTS:
- (U) The Space Shuttle resumed operations in FY1988
  -- No DOD dedicated flights or secondary payloads
  -- IUS used in first mission (NASA Satellite
- (U) No Orbiter flight charge payment to NASA (use 3 of 9 flight credits due to DOD --6 remain)
- (U) Modified 4 IUS from DSCS Shuttle to DSP Titan IV
- (U) Terminated 10,000 pound class upper stage development on Shuttle due to the lack of a need
- (U) The Manned Spaceflight Engineer program transferred from research and development funding to AFSPACECOM
- (U) VLS attained "minimum facility" caretaker status and directed to reduce the level to "mothball"

(U) FY 1989 Planned Program:
- (U) DOD to fly three dedicated missions on Shuttle
  -- One of these missions will require an IUS
  -- Provide secure operations at all NASA centers
- (U) DOD to resume flying secondary payloads on Shuttle (includes research and development experiments, small payloads - space available basis)
  -- Resume payment of secondary payload flight charges to NASA (as required)
  -- Develop, maintain and use airborne support equipment (ASE)

00838

Program Element: #0305171F Project Number: xxx1
PE Title: Space Shuttle Operations Budget Activity: 6 -Defense Wide Mission Support

- (U) NASA to fly two IUS missions on Shuttle
- (U) No Orbiter flight charge payment to NASA (Use 4 of 6 flight credits due to DOD -- 2 remain)
- (U) VLS will attain and be sustained in "mothball" status
  -- Alternate users financial responsibility for any operations and maintenance expenses

(U) FY 1990 Planned Program:
- (U) DOD to fly four dedicated Shuttle missions
  -- Includes a research and development mission
  -- Provide secure operations at all NASA centers
- (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 (Use last 2 of the flight credits due to DOD)
- (U) Provide PAM D-II upper stage integration and engineering support for DOD Shuttle missions
  -- Two Global Positioning System satellites planned for FY 1991
- (U) VLS will be sustained in "mothball" status
  -- Alternate users financial responsibility for any operations and maintenance expenses
- (U) Plan for phase out of secure operations at NASA centers after last secure DOD mission

(U) FY 1991 Planned Program:
- (U) DOD to fly 1 dedicated and 1 equivalent flight in partial STS missions
  -- Provide integration support for flight
  -- Includes one IUS mission (Last secure mission)
  -- Includes two GPS missions on PAM D-II
- (U) DOD to fly secondary payloads on Shuttle
- (U) NASA to fly two IUS missions on Shuttle
- (U) Flight charge payment for two missions in FY 1992
- (U) Provide Pam D-II upper stage integration and engineering support for DOD Shuttle missions
- (U) VLS will be sustained in "mothball" status
- (U) Phase out of secure operations after last secure mission

(U) Program to Completion:
- (U) This is a continuing program
- (U) Average .33/year research and development flights
- (U) VLS maintained in "mothball" status
- (U) Upper stage procurement/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

Program Element: #0305171F
PE Title: Space Shuttle Operations
Project Number: xxx1
Budget Activity: 6 -Defense Wide Mission Support

McDonnell-Douglas Company, Huntington 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 AMENDED FY 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact of System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Tech	Delete FY 1988 enhanced Inertial Upper Stage processing capability	None	None
Schd	None	None	None
Cost	None	None	None

NARRATIVE DESCRIPTION OF CHANGES

1. TECHNICAL CHANGES: Projected usage of Interial Upper Stage no longer justified FY 1988 enhancement to processing capability. Congress marked FY 1989 budget to delete this effort.
2. SCHEDULE CHANGES: None
3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION: NASA Mar 1988 Manifest
NASA Aug 1988 Manifest

G. (U) RELATED ACTIVITIES: The research and development satellite program supported is the Space Test Program (PE 0603402F). The Air Force operational satellite programs supported are the Defense Support Program (PE 0102431F), and Navstar Global Positioning System (PE0305165F). The resources for the Orbiter Flight Charges and support for other DOD programs are included in their elements. There is no duplication.

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

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MISSILE PROCUREMENT:	93,451	6,595	46,087	38,423	Continuing	TBD

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

	DATE
VLS "Caretaker" status	OCT 1987
* Shuttle Flight Resumption/IUS Flights	AUG 1988
* DOD resumption of Shuttle Flights	NOV 1988
* NASA planetary mission (MAGELLAN)/IUS	APR 1989
* Resumption of DOD secondary payloads	Jul 1989
VLS "Mothball" status	OCT 1989
* NASA planetary mission (Galileo)/IUS	OCT 1989
* NASA planetary mission (Ulysses)/IUS	OCT 1990
* Last Secure Shuttle Mission	MAR 1991

*NASA Milestone

00840

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
3090 Embedded Computer Resources Support Improvement Program (ESIP) & PE Total	4,326	4,455	4,621	4,752	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 extendable integration support facility (AEISF), 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) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) Project 3090, ESIP: See B above for description.

(U) FY 1986 Accomplishments:

- (U) Transitioned technologies to integration support facilities.
- (U) Surveyed reprogrammability of communication, navigation, and identification (CNI) systems and planned electronic warfare measurements task.
- (U) Completed AEISF system critical design.
- (U) Continued rapid turnaround methodologies study for radars.
- (U) Continued roadmap for advanced reconfiguration technology.
- (U) Started CNI measurements program.
- (U) Initiated embedded computer software development study.
- (U) Started development of test bench for Ada distributed system.
- (U) Distributed Ada compiler results.

(U) FY 1989 Planned Program:

- (U) Start design for modular distributed Ada software.
- (U) Prepare CNI study final report and update the CNI data base.
- (U) Apply advanced reconfiguration technology effort.
- (U) Initiate efforts to extend advanced performance monitor and control (APMAC) to distributed systems.
- (U) Investigate support issues with distributed systems.
- (U) Demonstrate test bench for APMAC in distributed Ada systems.
- (U) Start efforts on fault tolerant Ada software.
- (U) Continue transition of technologies to integration support facilities.
- (U) Start avionics distributed systems instrumentation.

Program Element: #0701112F Budget Activity: #6-Defense-Wide
PE Title: Inventory Control Point Operations Mission Support

(U) FY 1990 Planned Program:
- (U) Complete radar and CNI rapid turnaround development for the rapid turnaround data base.
- (U) Incorporate preliminary APMAC, radar, and CNI results into AEISF.
- (U) Assess modular embedded software development practices for incorporation into AEISF and identity deficiencies.
- (U) Initiate techniques for parallel processing and artificial intelligence support.
- (U) Complete definition of fault tolerant Ada software.
- (U) Continue fault tolerant and distributed systems studies.
- (U) Continue avionics distributed systems instrumentation.
- (U) Start automated software test generation capability.
- (U) Start radar readiness technology development.

(U) FY 1991 Planned Program:
- (U) Continue work begun in prior years.
- (U) Define fault tolerant and distributed/parallel processing software issues and applications available for Ada distributed systems.
- (U) Develop fault tolerant software techniques.
- (U) Integrate results from modular embedded computer systems software study into AEISF.
- (U) Complete avionics distributed systems instrumentation.
- (U) Continue automated software test generation capability.
- (U) Start technology development in high payoff areas from modular embedded software practices study.
- (U) Continue radar readiness technology development.

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

(U) Work Performed By: In-house work is done by Aeronautical Systems Division, Wright-Patterson AFB, OH. The contractors are ITT, Fort Wayne, IN; TRW, Dayton, OH; Hughes, Los Angeles, CA area; ITT, Nutley, NJ; and The Analytical Sciences Corporation, Reading, MA.

(U) Related Activities: None. There is no unnecessary duplication of effort within the Air Force or the Department of Defense.

(U) Other Appropriation Funds:

Other Procurement (BA 0, PE #0207133, F-16 Squadrons):

	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Program
Cost	1,000	-	-	-	Cont.	TBD

(For procurement of equipment to demonstrate AEISF on F-16; equipment will be provided to Hill AFB to support F-16 aircraft)

(U) International Cooperative Agreements: Not applicable.

Maj Cardinal/AF/LEYM/73523/27 Dec 88

FY 1990/FY 1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

Program Element: #0702207F Budget Activity: #6 Defense-Wide
PE Title: Depot Maintenance (Mission Support)

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY88 Actual	FY 89 Estimate	FY 90 Estimate	FY91 Estimate	To Complete	Total Program
3326 Precision Measurement & Calibration Equipment Development (PMCED)	0	969	2428	2628	Cont	N/A
TOTAl	0	969	2428	2668	Cont	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT: Program develops, tests, & evaluates measurement standards & associated equipment for 167 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.

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 1988 Planned Program: New start not supported by Congress.

(U) FY 1989 Planned Program:
- (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: Continue and expand 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.

Program Element: #0702207F Budget Activity: #6 Defense-Wide
PE Title: Depot Maintenance (Mission Support)

(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%.

(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 1990/1991 BIENNIAL RDT&E DESCRIPTIVE SUMMARY

Program Element: #0708011F
PE Title: Industrial Preparedness
Project Number: 2865
Budget Activity: #6 - Defense-Wide Mission Support

A. (U) RESOURCES ($ in Thousands)
Project Title: Manufacturing Technology

Popular Name:	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
MANTECH	82,770	96,430	70,751	71,513	Cont.	Cont.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:
MANTECH is the RDT&E part of a larger Air Force industrial program that includes many activities impacting industrial preparedness and productivity; key elements in force modernization and sustainability. MANTECH is the only concentrated manufacturing R&D sponsored by the AF. It develops manufacturing processes that determine what products can be produced and at what cost. MANTECH transitions advanced product designs into producible, high quality, cost-efficient weapon systems and components. MANTECH is critical in maintaining a strong domestic industrial base and in solving manufacturing challenges that influence competitiveness.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

1. (U) FY 1988 Planned Program:
   - (U) Evaluating best manufacturing processes for overall composite production.
   - (U) Exploring new techniques to lay up radar absorbing materials.
   - (U) Using carbon-carbon and titanium aluminide materials to improve performance of critical engine nozzles and vanes.
   - (U) Demonstrating improved melting techniques to produce defect-free titanium ingots.
   - (U) Improving fabrication and inspection of integrated circuits.
   - (U) Exploring robotic repair applications.
   - (U) Developing digital data standards to reduce the number and complexity of engineering drawings.
   - (U) Evaluating machining technologies for subtier applications.
   - (U) Developing automated ways to make chaff.
   - (U) Exploring artificial intelligence application to machining.
   - (U) Developing technical agenda with the National Center for Manufacturing Sciences and monitoring Congressional grant to the machine tool industry that was part of the President's Machine Tool Action Plan.

2. (U) FY 1989 Planned Program:
   - (U) Continued pursuit of most economical composite manufacturing methods.
   - (U) Continued exploration of better ways to make advanced materials to produce critical engine parts using advanced materials and design concepts.

Program Element: #0708011F Project Number: 2865
PE Title: Industrial Preparedness Budget Activity: #6 - Defense-Wide

- (U) Complete work on improved fabrication and inspection of very high speed integrated circuit printed wiring board fabrication.
- (U) Continue work on producibility of electronic subsystems, flexible microelectronics manufacturing systems, and advanced radar modules.
- (U) Continue work on a flexible repair center concept that will reduce engine case repair time.
- (U) Initiate work to provide computerized reprocurement data.
- (U) Explore advantages 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.
- (U) Tailor latest metal cutting, cutting tools, machining data and systems technology to meet manufacturing subcontractors needs.
- (U) Expand efforts to revitalize machine tool industry.
- (U) Increase yield of electronic systems using focal plane arrays, radiation hardened chips, peripheral circuits for memories, and solar cells.
- (U) Continued development cost-effective manufacturing of complex shaped thermoplastics and rugate filters.
- (U) Continued support of the National Center for Manufacturing Sciences (NCMS).

3. (U) FY 1990 Planned Program:
   - (U) No new start activities.
   - (U) Complete financial support of NCMS.
   - (U) Continue work on producibility of electronic subsystems, flexible microelectronics manufacturing systems, and advanced radar modules.
   - (U) Scope efforts to implement advanced technologies in repair depots while continuing efforts on flexible repair center and CALS support.
   - (U) Continue activities to provide economical manufacturing methods for composite airframe components.
   - (U) Complete development of computer integrated composites manufacturing center.

4. (U) FY 1991 Planned Program:
   - (U) Continue machine tool revitalization.
   - (U) Continue efforts to provide more economical manufacturing methods for composite airframe components.
   - (U) Continue work on producibility of electronic components and subsystems, flexible microelectronics manufacturing systems, and solid state radar modules.
   - (U) Complete advanced manufacturing methods for high performance, affordable turbine engine components.
   - (U) Increase efforts to implement advanced technologies in repair depots, and to support CALS initiatives in repair and provisioning.

Program Element: #0708011F Project Number: 2865
PE Title: Industrial Preparedness Budget Activity: #6 - Defense-Wide

- (U) Start initiative to advance electronics packaging technologies for greater quality and reliability at decreased cost.
- (U) Complete efforts to establish higher quality, lower cost manufacturing methods of mercury cadmium telluride focal plane array detectors.
- (U) Complete work on manufacturing methods for gallium arsenide germanium solar cells.
- (U) Establish techniques for producing a range of high performance materials needed by the next generation of turbine engines.
- (U) Create manufacturing procedures for materials and components required for hypersonic vehicles and to create an industrial base capable of supporting anticipated production requirements.
- (U) Establish high volume, economical production techniques for ceramic fibers with low observable properties.

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

D. (U) WORK PERFORMED BY: MANTECH is managed by the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. Work is competitively contracted for with private industry or universities. The top five contractors are General Electric, Evendale, OH; United Technologies, West Palm Beach, Fl; Northrop, Hawthorne, CA; National Center for Manufacturing Science, Ann Arbor, MI; and Dravo Automation Sciences, Pittsburgh, PA.

E. (U) COMPARISON WITH FY 1988/89 DESCRIPTIVE SUMMARY:

Type of Change	System Capabilities	Schedule	FY 1990
Tech	None	Yes	- 0 -
Schd	Yes	Yes	+24months
Cost	Yes	Yes	- 30,154

NARRATIVE DESCRIPTION OF CHANGES

1. ENGINEERING CHANGES: Level of effort program, but reduced funds resulted in descoping 9 tasks.
2. SCHEDULE CHANGES: Deferred 15 manufacturing research tasks.
3. COST CHANGES: Reflects overall DOD budget reductions.

F. (U) PROGRAM DOCUMENTATION:
- (U) DOD Instruction 4200.15, Manufacturing Technology, 5/85.
- (U) Defense Guidance, 03/88.

G. (U) RELATED ACTIVITIES:
- (U) The Army, Navy and Defense Logistics Agency have PE 0708011 MANTECH programs that are coordinated with this program.
- (U) Other government agencies like NASA, the Defense Advanced Research Projects Agency and the Strategic Defense Initiative Offices pursue manufacturing technology development.

Program Element: #0708011F Project Number: 2865
PE Title. Industrial Preparedness Budget Activity: #6 - Defense-Wide

- (U) Individual weapon system program managers do manufacturing research specifically related to their weapon system.
- (U) Manufacturing technology efforts are coordinated through the DOD MANTECH Advisory Group that includes industry representatives.
- (U) The Material Lab at Wright-Patterson AFB is the Air Force's single focal point for all manufacturing technology activity.
- (U) The Air Force carries out other industrial preparedness and productivity activity like Industrial Base Planning, the Industrial Modernization Incentives Program (IMIP), and managing 13 industrial plants that are funded with procurement appropriations.
- (U) There is no duplication of effort within 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 generic manufacturing process, methods and equipment research and development.

FY 1990/1990 MANUFACTURING TECHNOLOGY PROGRAM
TITLE. INDUSTRIAL PREPARI DNESS

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	FY1988 Actual	FY1989 Estimate	FY1990 Estimate	FY1991 Estimate	Additional to Complete	Total Est Cost
AIRCRAFT PROCUREMENT, AIR FORCE						
A 0005 Manufacturing Methods for Thermoplastics ATF, F-16, F-15, Future Systems - 1	2450	3700	4000	3712	0	13962
A 0268 MT for Advanced Tooling Concepts ATF, F-16, Advanced Aircraft - 1	0	1000	2500	4000	1500	9000
AIRCRAFT PROCUREMENT, AIR FORCE						
A 0269 Advanced Oxidation Resistant Alloy Powder Classified Applications -	1000	900	1037	0	0	2937
A 0008 MT for Advanced Propulsion Materials Advanced Fighter Engine, Future Systems - 3	10260	13385	6969	1280	0	54703
A 0273 Premium Quality Ti Alloy Disk Material Advanced Engines - 3	0	1200	1500	1400	0	4100
A 0300 Automated Fabrication of Small Engine Composite Compressor Rotors Missile Engine - 3	360	1085	710	680	0	2835
A 0011 MT for Solid State Microwave Circuits ATF Radar, Satellites - 4	4683	3240	429	0	0	16604

00849

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	FY1988 Actual	FY1989 Estimate	FY1990 Estimate	FY1991 Estimate	Additional to Complete	Total Est Cost
A 0022 Integrated Composites Center F-15, F-18, AV-8B, ATF - 6	1885	1000	472	0	0	8007
A 0372 MT for Radar Transmit/Receive Moudules ATF, ATA, ECM, Communications Links - 4	0	1500	2800	6000	9700	20000
A 0181 Automated Airframe Assembly ATF, Future Systems - 6	2050	5000	4100	1712	0	13450
A 0301 On Line Information System All Systems - 6	0	500	1300	2500	3450	7750
Total Aircraft Procurement, Air Force, Related			25817	21284		
MISSILE PROCUREMENT, AIR FORCE						
A 0229 Chaff Coil Manufacturing Peacekeeper, SICBM - 7	1806	1117	766	0	0	3789
A 0032 MT for HgCdTe Focal Plane Arrays BSTS, Space Systems - 8	3485	2530	2400	1280	0	10795
A 0200 MT for Bubble Memory Peripheral Electronics DSCS, GPS, Advanced Satellites - 8	662	760	406	0	0	1878
A 0221 MT for Radiation Hardened SOI Wafers DSCS, MILSTAR, Advanced Satellites - 8	0	1000	2200	3300	3100	8600
A 0275 MT for Rugged, Thin GaAs Solar Cells Advanced Satellites - 8	0	1000	1500	500	0	3000

00850

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	FY1988 Actual	FY1989 Estimate	FY1990 Estimate	FY1991 Estimate	Additional to Complete	Total Est Cost
A 0319 Electronics Subsystems Producibility (IR sensors) SFW, Future Systems - 9	100	1200	1200	1000	0	3550
Total Missile Procurement, Air Force, Related			8472	6080		
O&M, AIR FORCE						
A 0187 Static and Accessory Repair Engine Repair - 5	1675	2500	2025	0	0	6800
A 0226 Oklahoma City ALC Flexible Repair Center Engine Case Repair - 5	3271	2423	1262	381	0	10375
A 0255 Robotic Applications/Shot Peening Engine Repair - 5	0	750	1250	1000	0	3000
A 0276 CALS Initiative Spares Acquisition - 5	0	700	2500	2500	1400	7100
A 0318 Robotic Desealing Airframe Repairs - 5	300	1500	700	0	0	2500
Total O&M, Air Force, Related			7737	3881		

00851

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	FY1988 Actual	FY1989 Estimate	FY1990 Estimate	FY1991 Estimate	Additional to Complete	Total Est Cost
GENERIC PROCUREMENT						
A 0245 MT for Holographic Wafer Inspection All Systems - 4	50	700	218	0	968	1100
A 0320 Electronics Subsystems Producibility Initiative (Power Supplies) All Systems - 4	0	500	1300	1300	1800	4900
A 0295 Microelectronics Manufacturing Science and Technology All Systems - 4	50	6000	6000	6500	13950	32500
A 0026 Manufacturing Technology Special Studies All Systems - 6	0	1200	1200	2700	0	5100
A 0028 MT Program Assessment All Systems - 6	1446	1900	1:39	0	0	5235
A 0308 Machine Tool Initiative All Systems - 6	0	3000	.000	9000	23000	40000
Total Generic Procurement, Air Force, Related			15557	19500		
R&D AIR FORCE						
A 0182 Intelligent Machining Workstation Generic Applicability - 10	1500	1500	1184	0	0	4884

00852

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	FY1988 Actual	FY1989 Estimate	FY1990 Estimate	FY1991 Estimate	Additional to Complete	Total Est Cost
A 0191 Rugate Filters Generic Applicability - 10	585	422	420	70	0	2352
A 0304 Knowledge Integrated Design System Generic Applicability - 10	0	750	1000	1600	1550	4900
A 0306 Advanced Composite Processing Generic Applicability - 10	0	800	1000	400	0	2200
A 02063 Automated Airframe Assembly Generic Applicability - 10	800	1571	1550	729	0	4905
A 0236 Feature Recognition Generic Applicability - 10	0	60	120	120	60	360
Total R&D, Air Force, Related			5274	2919		
DIRECTED PROGRAM, AIR FORCE						
A 0274 National Center for Manufacturing Science Grant Generic Application - 10	5000	5000	5000	0	0	15000
New Starts	0	0	0	14872	N/A	N/A
Program Support	3160	3200	3059	3122	N/A	N/A
Total			8059	17994		
Total Program			70916	71685		

00853

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
PRAM	14,506	15,167	20,158	20,652	Contin.	N/A

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 over 132 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 1988 Accomplishments:
   - (U) Qualified a new high-reliability, long-life, maintenance-free battery for aircraft and support equipment.
   - (U) Qualified a heat-to-shrink tube coupling that will dramatically reduce line leak problems and make them much easier to repair.
   - (U) Qualified techniques and materials to enhance aircraft battle damage repair of metallic and composite structures.
   - (U) Prototyped and installed a stationary neutron radiography nondestructive inspection system for large aircraft sections subject to corrosion failures.
   - (U) Prototyped an improved technical order distribution system that will revolutionize the efficiency and speed with which updated technical information can be furnished to organizational and intermediate maintenance levels.
   - (U) Flight tested composite electrical connectors that will double the reliability and life while halving the weight as compared to current metallic connectors.
   - (U) Developed a leadless microchip carrier for the F-15 radar that will provide a four-fold reliability increase and will be applicable to all circuit boards in the future.

Program Element: #0708026F
PE Title: Productivity, Reliability, Availability, Maintainability (PRAM)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

2. (U) FY 1989 Planned Program:
   - (U) Prototype thermoplastic avionics enclosures in the APG-68 radar to save weight, improve durability, and reduce costs. Will be applicable to all aircraft subsequently.
   - (U) Redesign the C-141 tailcone attachment to improve its maintainability.
   - (U) Construct the E-3A Klystron Power Amplifer (KPA) Hot Mock-Up to improve reliability and maintainability on the fielded version of the KPA. Will address 67% of the E-3A's most telling electrical problems with attendant operational cost avoidances.
   - (U) Apply televideo capabilities to engine borescopic inspections to improve inspection effectiveness. Will allow more "on-wing" engine repairs and thus eliminate unnecessary engine removals.
   - (U) Initiate the Qualitative Process Automation for Autoclave Processing. Will utilize computerized tracking of temperatures and pressures in the autoclave process to reduce variability, and enhance yield rates. Will be used on existing autoclave units.

3. (U) FY 1990 Planned Program:
   - (U) Evaluate and qualify for A-10 (and others) improved corrosion protection techniques to increase parts life and reduce base-level maintenance requirements.
   - (U) Evaluate new robotic aircraft painting and stripping processes to improve corrosion protection and reduce labor.
   - (U) Evaluate modern materials for long shelf-life war reserve and rapid deployment fuel storage containers. Current systems suffer a 50% fail rate upon initial use.
   - (U) Apply environmental stress screening and combined environment reliability test/evaluation criteria to larger numbers of newly designed/redesigned parts.
   - (U) Emphasize generation of new projects which not only meet PRAM and Air Force R&M 2000 objectives, but also lend themselves to technology transition (eg; bead blasting method of paint removal).

4. (U) FY 1991 Planned Program:
   - (U) Prototype common (eg; F-15, F-16) non-corrosive fuel tanks thereby eliminating the need for "nesting environmental storage".
   - (U) Prototype new material for aircraft wheels and brakes to solve fatigue-induced cracking and failure.
   - (U) Flight test and qualify the variable speed/constant frequency electrical generator for the C-141 and other aircraft. Will reduce the excessive maintenance man-hours required today.
   - (U) Continue to generate new projects which directly benefit the combat commander and combat support personnel. (eg; development of a standard family of reliable, inexpensive, long-life, maintenance-free electrical batteries).
5. (U) Program to Completion:
   - (U) This is a continuing program.

Program Element: #0708026F
PE Title: Productivity, Reliability, Availability, Maintainability (PRAM)
Project Number: N/A
Budget Activity: #6-Defense Wide Mission Support

D. (U) WORK PERFORMED BY: The PRAM Program Office (a division of the Joint Technology Insertion Program Office) is located at Wright-Patterson AFB, OH. Satellite PRAM offices are located at each of the five AF Logistics Centers, and at the Aerospace Guidance and Metrology Center, Newark OH. PRAM liaison personnel are also located at each of the major air commands. The AF Wright Aeronautical Laboratories and AF Systems Command product divisions also participate in the PRAM Program. The largest participating contractors are General Dynamics, Dallas-Ft. Worth, TX; Westinghouse Corp., Baltimore, MD; McDonnell-Douglas, St. Louis, MO; Lockheed Aircraft Systems, Marietta, GA; and Northrop Aircraft, Hawhtorne, CA.

E. (U) COMPARISON WITH AMENDED 1988/89 DESCRIPTIVE SUMMARY:

TYPE OF CHANGE	Impact on System Capabilities	Impact on Schedule	Impact on FY 1990 Cost
Technology	None	None	None
Schedule	None	None	None
Cost	None	None	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) 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.

H. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

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

J. (U) MILESTONE SCHEDULE: Not Applicable.

FY 1990/1991 BIENNIAL BUDGET RDT&E DESCRIPTIVE SUMMARY

PE: #0901218F
PE Title: Civilian Compensation Program

Budget Activity: #6 - Defense-wide Mission Support

A. (U) RESOURCES ($ in Thousands)

Project Number & Title	FY 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
Total	0	0	4,148	4,360	Continuing	N/A

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 1988 Accomplishments:
- (U) Prior to FY 1990 this program was funded by O&M 3400 to pay disability compensation for all Air Force employees in PE 91218F regardless of which appropriation funded the civilian pay of personnel generating these costs.

(U) FY 1989 Planned Program:
- (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. The amounts cited above will fund only disability compensation of personnel assigned to RDT&E activities. This is not a new start but a realignment of charges to the proper appropriation rather than having O&M 3400 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 FYDR.

(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 bills the Department of 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.

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

(U) Other Appropriation Funds: Appropriation 3400 will provide disability compensation only for employees assigned to O&M activities.

(U) International Cooperative Agreements: None.

FY 1990/1991 BIENNIAL 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 1988 Actual	FY 1989 Estimate	FY 1990 Estimate	FY 1991 Estimate	To Complete	Total Program
2446 von Karman Institute	384	390	400	400	Continuing	Continuing
2447 SHAPE Technical Centre/AGARD/Cooperative R&D	2,682	2,724	2,777	3,350	Continuing	Continuing
Total	3,066	3,114	3,177	3,750	Continuing	Continuing

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) PROGRAM ACCOMPLISHMENTS AND PLANS:

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 1988 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 1989 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 1990 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) FY 1991 Planned Program:
- (U) Continue funding U.S. Share of VKI's international budget
- (U) Continue funding five fellowships per year

(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 1988 Accomplishments:
- (U) 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 international cooperative R&D (ICR&D) to include conferences, working groups and the Scientist/Engineer Exchange Program.

(U) FY 1989 Planned Program:
- (U) Continue AGARD support
- (U) Continue funding U.S. STC positions
- (U) Continue funding ICR&D efforts

(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.

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MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES

FUNDED BY RDT&E

Department/Agency: Air Force

PART 1. UTILIZATION OF SECTION 2353, TITLE 10 AUTHORITY

Specialized R&D facilities 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 $5,000,000. 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 planned in FY 89, FY 90, and FY 91.

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
SECTION I							
Projects Accomplished or Underway							
Refurbish Complex 40 2/	35119F	TBD	Cape Canaveral AFS, FL		$45,000.0	45,000.0	45,000.0
PLF Processing Annex, ITL Expansion 2/	35119F	Martin Marietta	Cape Canaveral AFS, FL		10,000.0		
Payload Processing 2/ Room Mods	35119F	TBD	Vandenberg AFB, CA	6,000.0	14,000.0		
Alter Integrate-Transfer Launch (ITL) Facilities 1/	35119F	Martin Marietta	Cape Canaveral AFS, FL	11,000.0	7,100.0		
MDT Upgrades, ITL 1/	35119F	TBD	Cape Canaveral AFS, FL		12,000.0	13,000.0	
Medium Launch Vehicle Program 1/	35119F	General Dynamics	Cape Canaveral AFS, FL	1,500.0	9,000.0	4,500.0	

PART 1. UTILIZATION OF SECTION 2353, TITLE 10 AUTHORITY (CONT)

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
			SECTION I				
			Projects Accomplished or Underway				
AFSTC/OL-AA, Malabar FL Malabar Advanced Telesco System 1/*	64710F	ITEK Corp	Malabar Test Annex Malabar, FL	$1,200.0			
Solid Rocket Motor Upgrade 1/*	35119F	Martin Marietta	Cape Canaveral AFS, FL	10,000.0	4,000.0	4,000.0	
Solid Rocket Motor Upgrade 1/	35119F	Martin Marietta	Edwards AFB, CA	13,000.0			
Addition to Electronic Research Laboratory 1/3/*	63250F	MIT Lincoln Lab	Hanscom AFB, MA Bldg 1312L	50.0	2,874.0		
Addition to Electronic Research Laboratory 1/*	63250F	MIT Lincoln Lab	Hanscom AFB, MA Bldg 1302E	50.0	1,850.0		
Compact Antenna Range 1/*	63311F	MIT Lincoln Lab	Hanscom AFB, MA	820.0			

PART 1. UTILIZATION OF SECTION 2353, TITLE 10 AUTHORITY (CONT)

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
			SECTION II				
			Projects Planned or Projected				
Contractor Provided Facilities for Solid Rocket Motor Upgrade 2/	35119F	Martin Marietta	Vandenberg AFB, CA			$4,000.0	
Computer Test Lab 1/*	12424F	MIT Lincoln Lab	Millstone Hill Westford, MA			910.0	
Addition to Chemical Stock Facility 1/*	63250F	MIT Lincoln Lab	Hanscom AFB, MA Bldg 1302M			294.0	
Extension to L-Band Transmitter High-Bay Area 1/*	12424F	MIT Lincoln Lab	Millstone Hill Westford, MA			607.0	
Near Field Anechoic Chamber 1/ 4/	63424F	MIT Lincoln Lab	Hanscom AFB, MA			1,319.0	
Dynamic Coherent Measurement Complex (DYCOMS) 2/	65809F		White Sand Missile Range		4,300		

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MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES

FUNDED BY RDT&E

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 installation of equipment, where the cost of installation is more than $200,000, accomplished in FY 88 and planned in FY 89, FY 90, and FY 91.

Facility/Equipment	RDT&E PROGRAM ELEMENT	CONTRACTOR	LOCATION	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
SECTION I							
Projects Accomplished or Underway							
Modernize Component Research Air Facility 1/*	62203F		Wright Patterson AFB, OH Bldgs 18D, 18C and 18E		$600.0		
Install Equipment for Low Observables R&D 1/	63003F		Wright Patterson AFB, OH, Bldg 254	1,180.0			
Upgrade ARC Heater 1/*	64755F		Arnold AFB, TN	1,600.0	470.0		
TAC Implementation 1/*	65807F		Arnold AFB, TN	450.0			
Facility Computer & Network Improvement 1/*	65807F		Arnold AFB, TN	1,565.0	112.0		
Test Facility Plant Automation 1/*	65807F		Arnold AFB, TN	284.0	197.0	144.0	

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PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED GOVERNMENT-OPERATED INSTALLATIONS

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
			SECTION I				
			Projects Accomplished or Underway				
Flexible Nozzle Tunnel 4T 1/*	65807F		Arnold AFB, TN	$1,151.0	959.0		
Sensitive Compartmented Information Facility (SCIF) Equipment Installation 1/	20006F	Roy Jurgensen & Associates	Hanscom AFB, MA Bldg 1614	125.9			
Small ICBM Program 1/*	Various		Various	9,000.0	1,800.0		
Peacekeeper Rail Garrison Basing 1/*	Various		Various	3,400.0	37,000.0	16,300.0	2,200.0
Reentry System Launch Program 1/*	Various		Various		1,700.0	1,500.0	

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PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED GOVERNMENT-OPERATED INSTALLATIONS

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
			SECTION II				
			Projects Planned or Projected				
Install Chemical Analysis Equipment 2/	62102F		Wright Patterson AFB, OH Bldg 20450		$400.0		
Install Foundry Processing Equipment 2/	62102F	Westinghouse	Wright Patterson AFB, OH Bldg 20655				2,500.0
Install Equipment for Anechoic Chamber 2/	21002F		Wright Patterson AFB, OH Bldg 4A/4E		900.0		
Install Electronic Warfare Hot Bench Development System 1/*	62204F		Wright Patterson AFB, OH Bldg 620		500.0		
Install Equipment for Applied Sensor Technology Facility 2/	63003F		Wright Patterson AFB, OH Bldg 22		450.0		
Install Equipment for Clean Room Support Area 1/*	62204F		Wright Patterson AFB, OH Bldg 620		500.0		
Install Environmental Control System for Clean Rooms 1/*	62204F		Wright Patterson AFB, OH Bldg 1620		800.0		
Install Metal Organic Molecular Beam Epitaxial System 1/*	62204F		Wright Patterson AFB, OH Bldg 620		400.0		
Modify Sensor/System Dynamic Analyzer 1/*	62204F		Wright Patterson AFB, OH Bldg 23		100.0	200.0	200.0
Install Equipment for RASPL Relocation 1/*	62204F		Wright Patterson AFB, OH Bldg 620			300.0	
Equipment Installation Tempest Shielded Room 2/	Classified		Edwards AFB, CA	206.0			

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PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED GOVERNMENT-OPERATED INSTALLATIONS

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
			SECTION II				
			Projects Planned or Projected				
Equipment Installation F-15 Avionics Test (IFAST) 1/*	27130F		Edwards AFB, CA		500.0		
Equipment Installation F-16 Radar and ECCM Testing 1/*	27133F		Edwards AFB, CA		250.0		
Temporary Contruction SRAM II Integration 2/	63364F/ 64226F		Edwards AFB, CA		1,848.0		
Equipment Installation Install Air Conditioning System 2/	65896F		Edwards AFB, CA		599.0		
Temporary Construction C-17 Air Drop Complex 1/*	64231F		Edwards AFB, CA		4,300.0		
NASP Complex 2/	63211F		Edwards AFB, CA				156,100
Contractor R&D ATF Complex (Dem/Val) 1/*	63230F		Edwards AFB, CA	9,800.0			
Freejet Test Cell C-2 2/	65807F		Arnold AFB, TN		800.0	800.0	
T-3 Eq Modification 2/	65807F		Arnold AFB, TN		295.0	425.0	413.0
Unclassified Data Communication Equip 2/	65807F		Arnold AFB, TN		1,774.0	1,797.0	1,396.0

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PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED GOVERNMENT-OPERATED INSTALLATIONS

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
			SECTION II				
			Projects Planned or Projected				
Equipment Installation: Range Instrumentation Sites Interface 2/	78019F		Edwards AFB, CA			300.0	100.0
Equipment Installation: Stand-Off Range Extension 2/	78019F		Edwards AFB, CA			340.0	1,050.0
Equipment Installation: Visual Simulat Display Sys 2/	64755F		Edwards AFB, CA			680.0	420.0
Equipment Installation: Mission Simulator for Unman Vehicles 2/	64755F		Edwards AFB, CA			50.0	100.0
High Temperature Lab Eq 2/	65807F		Arnold AFB, TN		$900.0		
R-Cells Instr & Cntrl Eq 2/	65807F		Arnold AFB, TN			214.0	214.0
Signal Cond Eq 2/	65807F		Arnold AFB, TN			69.0	60.0
Freejet Test Cell C-1 2/	65807F		Arnold AFB, TN			2,000.0	3,000.0
Turbine Research Laboratory 1/*	62203F		Wright Patterson AFB, OH Bldg 71B, J-Bay		413.0		
Equipment Installation, Computer-Aided Engineering (CAE) Support, Facilities 20005, 30206, and 30207 2/	65807F		Wright Patterson AFB, OH Bldg 30207, 20005, 30206		300.0		

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PART 2. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED GOVERNMENT-OPERATED INSTALLATIONS

Facility/Equipment	RDT&E Program Element	Contractor	Location	Total Obligational Authority (Thousands of Dollars) 1988	1989	1990	1991
			SECTION II				
			Projects Planned or Projected				
Equipment Installation of CRAY X-MP/4XX Computer System 1/*	62201F, 62202F 62203F, 62204F		Wright Patterson AFB, OH Bldg 20676	293.0	300.0		
Atmospheric Compensation Fac 2/	63605F		Kirtland AFB, NM	100.0	2,000.0	1,300.0	700.0
WIS Development & Evaluation Facility (DEF) Equipment Installation (Ph IIB) 1/*	33152F		Hanscom AFB, MA Bldg 1302 F Annex			690.0	
Temporary Facility for Airborne Imagery Transmitter (ABIT) 1/*	63727F		Wright Patterson AFB, OH Bldg 620			300.0	

MAJOR IMPROVEMENTS TO AND CONSTRUCTION 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 Appropriation 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 FY88, and the estimated amounts planned for FY89, FY90, and FY91. All minor construction projects must result in a complete and usable facility. In no event are two or more minor construction projects or minor and major construction projects to be contrived to form a usable facility.

SUMMARY OF MINOR CONSTRUCTION FUNDED BY RDT&E, AIR FORCE

	FY 88	FY 89	FY 90	FY 91
TOTAL PART 3				
SUBTOTAL PART 1	43,620.0	110,124.0	73,630.0	45,000.0
SUBTOTAL PART 2	29,154.9	61,167.0	27,409.0	168,453.0
SUBTOTAL PART 3	8,920.9	10,463.8	9,414.2	6,600.1
GRAND TOTAL	81,695.8	181,754.8	110,453.2	220,053.1

1/ Listed in previous submittal
2/ Initial submittal
3/ SDIO companion funding support no longer applicable
4/ In FY 88 report, inadvertently omitted from FY 88 report
* Cost, Scope and/or FY change

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1 COMPONENT	FY 19_90 RDT & E FACILITIES	2 DATE
(AFSC) AIR FORCE		5 Feb 88

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
VANDENBERG AIR FORCE BASE, CALIFORNIA	CONTRACTOR PROVIDED FACILITIES FOR SOLID ROCKET MOTOR UPGRADE

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
35119 F			4,000

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
SOLID ROCKET MOTOR UPGRADE	LS			4,000
INSTALLED R & D EQUIPMENT (NON-ADD)				TBD

10 DESCRIPTION OF PROPOSED CONSTRUCTION Provides necessary modifications to the existing Space Shuttle solid rocket motor processing facility to accommodate the three segment T IV motors. Work includes foundation work to support the much longer segments on vertical stands, various platform mods to match 126 inch vs 144 inch diameter solid motors. Work also includes supports for ultrasonic test fixture, mods to a paint spray booth to support insulation application, access road and utility modifications and miscellaneous launch pad (SLC-4E) mods to support the on pad integration and launch of the larger three segment solid motor configuration vehicle.

REQUIREMENT: The Martin contract for T IV has been modified to provide for Solid Rocket Motor Upgrade (SRMU). This program provides for a three segment motor which is six inches larger in diameter than the previous seven segment T IV motor and requires full qualification testing prior to actual launch. Both the testing and subsequent launch require facility modifications/construction to accommodate the larger and significantly heavier segments. The Martin Company is responsible for motor development, testing and all modifications necessary to support 13 launches through 1993.

CURRENT SITUATION: The existing facility was built for larger diameter but shorter solid motor segments and must be modified to process the solid motors in preparation for launch.

IMPACT IF NOT PROVIDED: Three existing facility payloads supporting the highest national priority programs can not be placed into proper orbit with any existing space booster. Each of these payloads require multiple launches and simply must wait for launch until the SRMU or some comparable upgrade occurs to allow launch of payloads in this size range.

1 COMPONENT	FY 1989 ~~RTD&E FACILITIES~~	2 DATE
AIR FORCE		DEC 14, 1988

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WHITE SANDS MISSILE RANGE, NEW MEXICO	DYNAMIC COHERENT MEASUREMENT COMPLEX (DYCOMS)

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65809F	141-000	ESDS-89-0030	4,300

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
DYNAMIC COHERENT MEASUREMENT COMPLEX (DYCOMS)	LS			4,280
MEASUREMENT ENGINEERING BUILDING	SF	3,000	165.00	495
RADAR BAND 2/3 BUILDING RENOVATION	LS			180
DATA COLLECTION FACILITY CONVERSION	SF	8,000	210.00	1,680
MISSION CONTROL BUILDING CONVERSION	SF	2,800	140.00	390
GENERATOR BUILDING RENOVATION	LS			190
SITE PREPARATION,UTILITIES(WATER,SANITARY)	LS			390
MINE CALIBRATION FACILITY	LS			130
RADAR ANTENNA FOUNDATIONS	EA	5	165,000	825
TOTAL REQUEST				4,280
TOTAL ROUNDED				4,300
INSTALLED EQUIPMENT FROM OTHER APPROPRIATIONS	(NON-ADD)			(26,000)

10 DESCRIPTION OF PROPOSED CONSTRUCTION Radar antenna foundations, building renovations/conversions, new facilities, all necessary support and utilities. Air conditioning: 80 tons

II. REQUIREMENT: **16,000 SF; ADEQUATE 0 SF; SUBSTANDARD: 8,700 SF**

PROJECT: Provide contractor operated facility for the collection, analysis and study of radar measurement data from in-flight weapon systems.

REQUIREMENT: Acquisition of an Air Force capital plant capability to be known as Dynamic Coherent Measurement System (DYCOMS). This system will provide dynamic radar cross section measurements of in-flight weapon systems during study and analysis, research, and conceptual thru development phases. DYCOMS will support testing requirements of major systems including the B-2 Bomber, Advanced Tactical Fighter, and other Advanced Tactical Aircraft. DYCOMS will be the only capability, either contractor or government owned, available to support day to day aircraft requirements.

CURRENT SITUATION: DYCOMS is to be located at the existing North Oscura Peak Range Center within the White Sands Missile Range, New Mexico. Existing government-owned facilities at North Oscura Peak are to be converted and/or altered for DYCOMS use.

IMPACT IF NOT PROVIDED: Testing of major, advanced aircraft will not be available unless all facilities are in place.

1 COMPONENT	FY 1989 RDT&E FACILITIES PROJECT DATA	2 DATE
AF (AFSC)		1 SEP 1988

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WRIGHT-PATTERSON AFB, OHIO	INSTALL CHEMICAL ANALYSIS EQUIPMENT, BLDG 450

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
62102F	310-933	EQ 89-2204	400.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
INSTALL CHEMICAL ANALYSIS EQUIPMENT, BLDG 450				(400.0)
EQUIPMENT REMOVALS	LS			(50.0)
AIR CONDITIONING	LS			(150.0)
SECONDARY UTILITIES	LS			(200.0)
COST OF PURCHASED EQUIPMENT (NON-ADD)				(500.0)
TOTAL EQUIPMENT AND INSTALLATION COST (NON-ADD)				(900.0)
OTHER NON-ADD COSTS (DESIGN)				(50.0)
MINOR CONSTRUCTION (NON-ADD)				(150.0)

10 DESCRIPTION OF PROPOSED CONSTRUCTION

INSTALLATION: Provide equipment removals, air conditioning and secondary utilities.

SPECIFIC PURPOSE: To support USAF directed R&D programs.

PROJECT: Install chemical analysis equipment.

REQUIREMENT: Equipment installation is required to provide continued upgraded chemical analysis capability in support of the materials laboratory mission.

CURRENT SITUATION: Current chemical analysis laboratories are inadequate to support new in-house research and development activities. Available laboratory space must be modified for chemical analysis activities to expeditiously minimize the impact to critical in-house R&D projects.

IMPACT IF NOT PROVIDED: Failure to provide this project will delay or cancel in-house efforts involving chemical analysis which will have a critical impact on the transfer of materials technology to modern operational weapon systems.

1 COMPONENT	FY 1991 RDT&E FACILITIES PROJECT DATA	2 DATE
AF (AFSC)		1 SEP 1988

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WRIGHT-PATTERSON AFB, OHIO	INSTALL FOUNDRY PROCESSING EQUIPMENT, BLDG 655

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
62102F	310-933	EQ 91-2200	2,500.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
INSTALL MATERIALS PROCESSING EQUIPMENT, BLDG 655				2,500.0
EQUIPMENT RELOCATION	LS			(1,000.0
SPECIAL EQUIPMENT FOUNDATIONS	LS			(500.0
VENTILATION SYSTEMS	LS			(200.0
SECONDARY UTILITIES	LS			(800.0
COST OF PURCHASED EQUIPMENT (NON-ADD)				(1,000.0
TOTAL EQUIPMENT AND INSTALLATION COST (NON-ADD)				(3,500.0
OTHER NON-ADD COSTS (DESIGNS)				(100.0
MINOR CONSTRUCTION (NON-ADD)				(200.0

10 DESCRIPTION OF PROPOSED INSTALLATION: Relocate existing R&D equipment and provide special foundations, ventilation systems and secondary utilities.
SPECIFIC PURPOSE: To support USAF directed R&D programs.
PROJECT: Install materials processing equipment.
REQUIREMENT: Provide adequate facilities for the powder alloy development and process modeling mission efforts of the Materials Laboratory.
CURRENT SITUATION: Materials Laboratory R&D involving powder alloy development and process modeling (foundry operations) are housed in a substandard facility constructed in 1931. This facility is scheduled for demolition during the early 1990's.
During this period the R&D equipment supporting the foundry operations will be replaced with new-state-of-the art equipment and relocated into newer laboratory facilities constructed in 1985.
IMPACT IF NOT PROVIDED: Failure to provide this project will critically impact progress in this vital R&D area and affect transfer of materials technology to modern operational weapon systems.

1 COMPONENT (AFSC) AIR Force	FY 1989 RDT&E FACILITIES PROJECT DATA	2 DATE 1 SEP 1988

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WRIGHT-PATTERSON AIR FORCE BASE, OHIO	EQUIPMENT INSTALLATION, ANECHOIC CHAMBER, BLDG 4A/4F

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
21002F	310-932	EQ 89-2203	900.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION, ANECHOIC CHAMBER, BLDG 4A/4F				900.0
SECONDARY UTILITIES	LS			(200.0)
AIR CONDITIONING	LS			(300.0)
ELECTROMAGNETIC SHIELDING	LS			(300.0)
SPECIAL FOUNDATION PADS	LS			(100.0)
COST OF PURCHASED EQUIPMENT (NON-ADD)				(800.0)
TOTAL EQUIP AND INSTALLATION COST (NON-ADD)				1,700.0)
OTHER NON-ADD COST (DESIGN)				(45.0)
MINOR CONSTRUCTION (P-341 NON-ADD)				(918.0)

10 DESCRIPTION OF PROPOSED INSTALLATION: Provide secondary utilities, air conditioning, electromagnetic shielding and special foundation pads.

SPECIFIC PURPOSE: To support USAF quick reaction capability (QRC) programs involving COMPASS SPRUCE.

PROJECT: Equipment installation for an anechoic chamber.

REQUIREMENT: An adequate anechoic chamber is required to support quick reaction capability (QRC) programs with a precedence of 1-3. This new facility will handle classified programs as directed by Air Staff.

CURRENT SITUATION: The present anechoic chamber is operating already with two QRC programs. As a result, no additional QRC programs can be started without a work stoppage in another program.

IMPACT IF NOT PROVIDED: These Air Staff directed programs are essential to the survival of Air Force platforms in hostile situations. Without equal consideration to all programs, the Air Force will lose valuable information needed for its survival. This new facility will enhance the current capabilities to provide the Air Force with this vital information.

1 COMPONENT	FY 1989 RDT&E FACILITIES PROJECT DATA	2 DATE
(AFSC) AIR FORCE		1 SEP 1988

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WRIGHT-PATTERSON AIR FORCE BASE, OHIO	EQUIPMENT INSTALLATION, APPLIED SENSOR TECHNOLOGY FAC, BLDG 22

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
53003F	310-937	ED 89-2202	450.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION, APPLIED SENSOR TECHNOLOGY (ASENT) FAC, BLDG 22				450.0
RAISED FLOORING	LS			(50.0)
AIR CONDITIONING	LS			(100.0)
SECONDARY UTILITIES	LS			(100.0)
MODULAR PANELS	LS			(200.0)
COST OF PURCHASED EQUIPMENT (NON-ADD)				(250.0)
TOTAL EQUIP & INSTALLATION COST (NON-ADD)				(700.0)
OTHER NON-ADD COSTS (DESIGN)				(35.0)
MINOR CONSTRUCTION (NON-ADD)				(200.0)

10 DESCRIPTION OF PROPOSED INSTALLATION: Provide raised flooring, air conditioning, secondary utilities and modular panels.
SPECIFIC PURPOSE: To support Special Access Required (SAR) programs.
PROJECT: Install equipment in support of the Applied Sensor Technology (ASENT) facility.
REQUIREMENT: An adequate and properly configured secure work and conference facility is required for work on "Limited Access" programs at the SECRET level. The Avionics Lab conducts exploratory and advanced development programs to demonstrate improved aerospaceborne reconnaissance and weapon delivery capabilities for present and future Air Force tactical and strategic weapon systems including the Advanced Tactical Fighter (ATF).
CURRENT SITUATION: An adequate and secure area is not presently available at the Avionics Laboratory to support the type of work required for completion of high priority "Limited Access" programs at the SECRET level.
IMPACT IF NOT PROVIDED: Failure to provide the secure work area will compromise the timely transition of near term Air Force weapon systems to future tactical and strategic aircraft.

1 COMPONENT	FY 19 88	RDT & E FACILITIES PROJECT DATA	2 DATE
AIR FORCE (AFSC)			12 APR 88

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	EQUIPMENT INSTALLATION TEMPEST RF SHIELDED ROOM

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
	317-311	(80-22) FSPM882550	206

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION:				
TEMPEST RF SHIELDED ROOM				206
INSTALLATION: INCLUDING INLET & EXHAUST OUTLETS, ELECTRICAL & COMMUNICATION PENETRATIONS WITH FILTERS.				(41)
COST OF PURCHASED EQUIPMENT (NON-ADD)	SFSA	1032	160	(165)
TOTAL EQUIPMENT & INSTALLATION COST (NON-ADD)				206
TEMPEST CERTIFICATION (NON-ADD)				10
DESIGN COSTS 12% (NON-ADD) (41K)				5
MINOR CONSTRUCTION (PROJ #882551) NON-ADD				(168)

10 DESCRIPTION OF PROPOSED RDT & E WORK: Install a standard 12'x18' or 20'x10' (self-contained) TEMPEST RF shielded room with two 3' doors, cypher locks, mechanical, electrical and communication penetrations with filters within the Sensitive Compartmented Information Facility (SCIF) area.

PROJECT: Provide TEMPEST RF shielded room in accordance with National Security Agency Specification NSA No. 65-6.

REQUIREMENT: Establish TEMPEST RF shielded room within SCIF area, with the capabilities to provide open avionics laboratory to conduct required tests, development and verification of test items. Required BOD is 15 Jan 89.

CURRENT SITUATION: No existing facilities are available for required capabilities under SCIF conditions.

IMPACT IF NOT PROVIDED: Failure to accomplish installation would eliminate AFFTC's ability to test and develop a system of national urgency with a priority of Brickbat 1-3.

1. COMPONENT	FY 1989 RDT & E FACILITIES	2. DATE
AIR FORCE (AFSC)		14 DEC 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	TEMPORARY CONSTRUCTION: SRAM II INTEGRATION

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
63364F 64226F	311-173	FSPM 882578	1,848

9. COST ESTIMATES

ITEM	UNIT	QUANTITY	UNIT COST	COST ($000)
TEMPORARY CONSTRUCTION				
SRAM II INTEGRATION	LS			1,680
EQUIPMENT INSTALLATION	LS			1,000
ACFT POWER ISLANDS	LS			(680)
ACFT AIR-CONDITIONING	LS			(330)
MODULAR INSTALLATION	LS			330
SITE PREP	LS			(120)
UTILITIES	LS			(210)
SUPPORT FACILITIES	LS			350
SUBTOTAL				1,680
CONTINGENCIES (10%)				168
TOTAL FUNDED				1,848
DESIGN COST (A-E 10%, NON-ADD)				222
EQUIPMENT (NON-ADD)				5,179
TOTAL PROJECT				7,249

10. DESCRIPTION OF PROPOSED CONSTRUCTION: Provide temporary/relocatable office/technical working area for approximately 464 SRAM II and B-1 test personnel, aircraft power on the ramp and in the hangar, and aircraft air-conditioning in the hangar. The temporary/relocatable office facility should consist of open bay office areas, computer rooms, common area with conference rooms, restrooms and entry control. Provide site preparation and all utility extensions (power, water and sewer service) for the temporary/relocatable office facility, paved parking, trenching for aircraft power, and any other structural, electrical, mechanical or site work required to provide a complete and useable facility.

SPECIFIC PURPOSE: Provide site preparation for the installation of a temporary/relocatable office facility and installation of aircraft power and air-conditioning.

REQUIREMENT: By January 1990, technical/office space for approximately 464 test personnel, aircraft power and air-conditioning to support the relocation and beddown of the SRAM II integration and B-1 test forces will be required. Provide a centralized area in which the SRAM II weapons system can be efficiently tested and integrated with the B-1 aircraft. This is required to proceed the start up of the C-17 test program in January 1990.

CURRENT SITUATION: The B-1 test program is currently located in the Hangar 1623 complex at Edwards AFB. These facilities have been designated to support the C-17 flight test program beginning in January of 1990. The B-1 and SRAM II integration test program were scheduled to relocate to Hangar 1207 and share the facility with the Strategic System Combined

DD FORM 1391 — PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED — PAGE NO 00879

1 COMPONENT	FY 1989 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
AIR FORCE (AFSC)		14 DEC 88

3. INSTALLATION AND LOCATION

EDWARDS AIR FORCE BASE, CALIFORNIA

4. PROJECT TITLE	5. PROJECT NUMBER
TEMPORARY CONSTRUCTION: SRAM II INTEGRATION	FSPM 882578

Test Force. Due to the extension of various programs and the resulting conflicts in program security, this facility can no longer be shared with other programs.

IMPACT IF NOT PROVIDED: If this project is not provided, the Air Force Flight Test Center will be unable to support either the C-17 or the SRAM II integration test programs. Delays beyond the January 1990 time frame to allow the B-1 program to relocate will impact the commencement up of the C-17 program. If the C-17 cannot move into its facilities, renegotiation of contracts between the System Project Office, AFOTEC, MAC, United States Army and the contractor will have to occur. This delay will force the delaying of permanent change of station for 200 plus AFOTEC, MAC, Army and other related personnel. The acceptance of the C-17 aircraft will also be impacted, forcing renegotiation of the contract with the contractor. These delays will equate roughly to $4M per month for the C-17. If the SRAM II program is forced to relocate during its scheduled test period, delays/cancellations of flights occur costing approximately $.5-1M per flight. Delays beyond May 90, will cost the SRAM II program $2.5M per month of delay.

EQUIPMENT LIST

Item				Cost ($000)
MODULAR UNITS	EA	73	46,800	(3419)
MODULAR FURNITURE	EA	464	3,800	(1763)
TOTAL				5179

DD FORM 1391c PREVIOUS EDITION IS OBSOLETE IN THE USAF. PAGE NO

1 COMPONENT	2 FY 1989 RDT & E FACILITIES PROJECT DATA	3 DATE
AIR FORCE (AFSC)		25 Aug 88

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	EQUIPMENT INSTALLATION: INSTALL AIR CONDITIONING SYSTEM

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65896	311-174	882554	599

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
INSTALL AIR CONDITIONING SYSTEM				570
CHILLER, 500 TON	EA	1	339,333	(339)
FLUID COOLER, 700 TON	EA	1	100,000	(100)
PIPING	LS			(131)
SUBTOTAL				570
CONTINGENCIES (5%)				29
TOTAL FUNDED COST				599
UNFUNDED COST (DESIGN, 10%)				30
TOTAL PROJECT COST				629
(COMPANION PROJECT: "PROVIDE MECHANICAL BUILDING," PROJECT NO. 882554C)				

10 DESCRIPTION OF PROPOSED RDT & E WORK: Work includes provision of a 500 ton chiller, a 700 ton cooling tower, piping and all other necessary incidental or appurtenant work.

11. REQUIREMENT:

PROJECT: Provision of additional cooling capability in Building 145.

REQUIREMENT: Additional cooling capability for this facility is required to provide adequate cooling for the new computer equipment to be installed. Also, air conditioning is required to provide year round, 24 hour, continuous operation for the support of computer equipment.

CURRENT SITUATION: Presently, Building 145 utilizes two chillers to adequately cool the computer equipment. During peak performance periods both chillers have to be on line at 85% to 90% of their total cooling capacity. This facility has already experienced several chiller failures, and additional back-up cooling was unavailable to adequately support the installed computer equipment.

IMPACT IF NOT PROVIDED: Without this project, Building 145 will be unable to provide support test and evaluation programs for the B-2 Combined Test. This will prevent the accomplishment of significant test support objectives, adversely affecting the critical mission work they accomplish.

1 COMPONENT: AIR FORCE (AFSC)	FY 1991 RDT & E FACILITIES PROJECT DATA	2 DATE: 16 SEP 87

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	NASP COMPLEX

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
63211F	31X-XXX	PSPM913014	156,100

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
NASP FACILITIES COMPLEX				138,300
(P) LH_2/LOX STOR & HANDLING FAC	LS			(29,400)
(T) HYDROGEN SERVICING/VEHICLE PROC FAC	LS			(44,900)
(P) ENGINE TEST FAC	LS			(20,300)
(T) INTEGRATED TEST SUPPORT FAC	LS			(41,500)
OTHER SUPPORT ITEMS	LS			(2,200)
SUBTOTAL				138,300
CONTINGENCIES (5%)				6,915
TOTAL CONTRACT				145,215
SIOH (7.5%)				10,891
TOTAL REQUEST				156,106
TOTAL REQUEST ROUNDED				156,100
P = PROTOTYPE				
T = TEMPORARY				

10 DESCRIPTION OF PROPOSED RDT & E WORK: Construct a prototype facility complex to support the flight test of the National Aerospace Plane (NASP) program's X-30 flight research vehicle. The currently proposed prototype facilities will most likely consist of the following; a liquid hydrogen/oxygen storage and handling facility, a hydrogen servicing/vehicle processing facility, an engine test pad and stand, and an Integrated Test Support building. The work should also include the upgrade of any existing structures located at the site, construction of taxiways and ramp areas, the upgrade and extension of existing utilities, and any other work required to make this a complete and usable complex.

SPECIFIC PURPOSE: To support the research flight testing of this country's first hydrogen fueled hypersonic research vehicle, the X-30.

PROJECT: Construct a prototype facility complex to support the development and flight test of two X-30 flight research vehicles.

REQUIREMENT: Since the needs of liquid hydrogen/oxygen fueled vehicles are unique, specially designed facilities are required. This project will provide a central complex from which flight test operations of these vehicles can be conducted and an understanding of their operational requirements developed and understood. As such, this complex will serve as the prototype for all future liquid hydrogen/oxygen operational vehicles, both military and civilian. It will also continue to serve as the basis for follow on testing of these vehicles. It has been initially determined that facilities wihtin this complex are required for propellant storage and servicing, and for processing of the vehicle. Other facilities, including mission control, laboratories, engineering/technical areas, and warehousing

00882

1. COMPONENT	FY 19__ RDT & E FACILITIES PROJECT DATA	2. DATE
AIR FORCE (AFSC)		16 SEP 87

3. INSTALLATION AND LOCATION

EDWARDS AIR FORCE BASE, CALIFORNIA

4. PROJECT TITLE	5. PROJECT NUMBER
PROTOTYPE: NASP COMPLEX	FS2913014

space to meet the unique flight test requirements of the X-30 will also be required. Existing facilities, if available, will be used to the maximum extent practicable. Many requirements and problems involved with operating a liquid hydrogen/oxygen fueled vehicle are yet unknown.

CURRENT SITUATION: Presently, there are no DoD or NASA facilities suitable for storing and servicing liquid hydrogen for a horizontal take-off vehicle. Existing facilities for vertical launched space vehicles at other locations are not suitable for the unique X-30 requirements. For safety of flight reasons, the flight test operations must be flown from Edwards AFB with its unique dry lakebed emergency runway capabilities. This vehicle will be even more complex than the Space Shuttle which will preclude the use of existing shuttle flight test/processing facilities at Edwards. Presently, space for technical areas, laboratories, warehousing, hangars and offices is not available in the 1990's to handle a test program as large and complex as currently projected for the X-30.

IMPACT IF NOT PROVIDED: If these prototype facilities are not provided, AFFTC will be unable to support the NASP program. Without the required hydrogen storage and vehicle servicing/processing facilities, the X-30 vehicles cannnot be serviced with the required propellants or undergo ground checks and the research flight test program will not be possible. Attempting to accomplish the related flight test program operations, such as mission control, simulation, data reduction, planning, and etc., without the Integrated Test Support building will result in a fragmented and inefficient test activity. The fragmentation of the test team could also result in test schedule delays and increased program cost.

UNCLASSIFIED

1. COMPONENT	FY 1989 - 92 RDT&E FACILITIES PROJECT DATA	2. DATE
AIR FORCE		30 AUG 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE EQUIPMENT INSTALLATION
ARNOLD AFB, COFFEE COUNTY,TN 37389	FREEJET TEST CELL C-2

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
65807F	390-614	ANZY880478	2200

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION FREEJET TEST CELL C-2	LS			2200
POSITIONING MECHANISM HYDRAULICS	LS			(1600)
NOZZLES/DIFFUSER	LS			(400)
MISC. FREEJET SYSTEMS	LS			(200)
COST OF PURCHASED EQUIPMENT (NON-ADD)	LS			(13400)
TOTAL INSTALLATION & EQUIPMENT COST	LS			(15600)
OTHER NON-ADD COSTS				
DESIGN	LS			(1600)
CHECK OUT	LS			(4300)

10. DESCRIPTION OF PROPOSED INSTALLATION:

PROJECT: Procure and install freejet testing equipment to provide airframe/propulsion testing capabilities in Test Cell C-2 to accomplish propulsion system integration testing on future fighter aircraft and missile systems.

REQUIREMENT: Freejet testing capability is required in AEDC Test Cell C-2 for airframe/propulsion system integration testing for current and new technology aircraft and turbine engines. AEDC Test Cell C-2 will be used to conduct freejet testing on future aircraft fighters and missile system integration efforts. These aircraft and comparable missile systems incorporate new technologies such as blended inlets and exhausts, integrated avionics, propulsion and armament systems, vectoring and reversing nozzles and low infrared and radar observables. The effective integration of these capabilities determines how successfully a weapon system accomplishes its mission.

CURRENT SITUATION: The ability to verify operational inlet/engine compatibility over a large portion of the aircraft/missile flight envelope prior to flight test does not currently exist. To accomplish this testing, positioning mechanism hydraulics, subsonic and supersonic nozzles, diffusers, engine mounting pedestal, forebody simulator and other freejet instruments are required to conduct fighter/missile system tests.

IMPACT: Improper integration between the airframe and its propulsion system will severely limit the capability of the aircraft or missile by impacting range, payload maneuverability and by increasing operating costs. Without the ground testing capability to ensure proper integration between these systems, future fighter/missile systems can only rely on flight testing for compatibility verification. This could result in increased weapon system delivery costs, weapon system deployment delays and expensive retrofits.

1. COMPONENT	FY 1989-92 RDT&E FACILITIES	UNCLASSIFIED	30 Aug 88
AIR FORCE			

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
ARNOLD AFB, COFFEE COUNTY, TN 37389-5000	EQUIPMENT INSTALLATION T-3 Equipment Modification

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
65807F	318-614	ANZY890248	2,644

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation T-3 Equipment Modification	LS			2,644
Piping and Valves	LS			(908)
Heater Systems	LS			(225)
Electrical Systems	LS			(590)
Test Article Controller	LS			(282)
Test Environment Controller	LS			(425)
Data Aquisition	LS			(214)
				2,644
Cost of Purchased Equipment (Non-Add)	LS			(4,961)
Total Equip. Installation & Equip. Cost	LS			(7,605)
Other Non-Add Costs:				
Design	LS			(708)
Checkout	LS			(316)
Minor Construction	LS			(95)

10. DESCRIPTION OF PROPOSED INSTALLATION:

PROJECT: Modification of the T-3 test cell equipment to provide high pressure and high temperature testing capabilities.

REQUIREMENT: This project is required to provide test capabilities for a new class of expendable turbine developmental engines and the next generation of tactical weapons which are presently under planning and design.

CURRENT SITUATION: The present T-3 configuration will not meet high pressure/temperature requirements for the flight envelopes. The control and data systems are not capable of meeting on-line transients.

IMPACT IF NOT PROVIDED: The AEDC test facility capability to meet future developmental engine testing will be compromised. The technical objectives of these concept engines cannot be fully developed without providing a dedicated test capability. Without providing the necessary modifications to T-3 test cell, the ability to provide required development testing, and flight qualification cannot be realized.

Air Force	FY 1989-93 RDT&E FACILITIES	UNCLASSIFIED	30 Aug 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
ARNOLD AFB TN 37389-5000 COFFEE COUNTY	EQUIPMENT INSTALLATION Equip Install Unclass Data Comm Ntwrk

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
65807F		ANZY880470	8647

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION UNCLASSIFIED DATA				
Communications Network	LS			8647
Secondary Electrical/Electronic Distribution	LS			(3672)
Communications Duct Expansion & Cable	LS			(2727)
Multi Building (63) HVAC Modification	LS			(2248)
Cost of Purchased Equipment (Non-Add)	LS			(1980)
Total Equipment & Installation Cost (Non-Add)	LS			(10627)
Other Non-Add Cost:				
Design	LS			(600)

10. DESCRIPTION OF PROPOSED INSTALLATION:

Install a base wide unclassified Automated Data Processing (ADP) network to provide an integrated communications and management information system. The network will consist of fiber optic cables installed in the existing communications duct and routed to 119 separate facilities. Interbuilding wiring will consist of multi-twisted pair cable.

PROJECT: Provide an integrated and systematic ADP network for all engineering and administrative offices for communications at AEDC and other Air Force installations

REQUIREMENT: This project will ensure a common network architecture will be available for Air Force and contractor needs. The commonality of a managed network system will provide secondary benefits in maintainability.

CURRENT SITUATION: Networks for unclassified data communications have been installed in an ad hoc manner over several years based on specific needs. As those needs arose, new systems were installed with terminals connected in the most direct manner. This has led to a proliferation of twisted pair, coaxial and fiber optic cable within and between buildings, both above and below ground. Logistics of maintainability for this mixed network system and future expansion in not cost effective.

IMPACT IF NOT PROVIDED: Effective use of ADP for communications and MIS will not be readily achieved nor will the full potential of those programs be realized in the immediate future.

1 COMPONENT	FY 1990 RDT & E FACILITIES	2 DATE
AIR FORCE (AFSC)		14 DEC 88

3 INSTALLATION AND LOCATION	4. PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	EQUIP INSTALLATION: RANGE INSTRUMENTATION SITES INTERFACE

5 PROGRAM ELEMENT	6 CATEGORY CODE	7. PROJECT NUMBER	8 PROJECT COST ($000)
78019F	31X-XXX	FSPM 902510	600

9. COST ESTIMATES

ITEM	UNIT	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION				
RANGE INSTRUMENTATION SITES				
INTERFACE (RISI)	LS			600
COST OF EQUIPMENT AND SOFTWARE (NON-ADD)	LS			(5,400)
TOTAL EQUIPMENT & INSTALLATION				(6,000)

10 DESCRIPTION OF PROPOSED CONSTRUCTION

RDT & E WORK: Provide interfaces to tie into the Utah Test and Training Range (UTTR) microwave network to provide command/control information, transfer data and other unique functions of the UTTR timing source. Include any electrical, structural, mechanical, and site work to make this a complete and useable system.

PROJECT: Install equipment for Range Instrumentation Site Interface (RISI).

REQUIREMENT: Interface, data transmission, and communication equipment to bring required information from various instrumentation systems into the Mission Control Center at Hill AFB. Provide the capability to improve the utilization of UTTR for the expanding workloads.

CURRENT SITUATION: Due to the vast size and remoteness of UTTR, many of the sensors and measuring instruments are located at unmanned and primitive sites. This requires command/control and data acquisition channels between the various sites and the Mission Control Center.

IMPACT IF NOT PROVIDED: Future test productivity and efficiency will be greatly impaired. There will be an inability to exploit large volumes of airspace not reachable through present instrumentation sites. This will impact the ability of UTTR to handle the increasing test program growth.

ADDITIONAL: This project is to be phased over three fiscal years.

FY90	300	(2,700)
FY91	100	(900)
FY92	200	(1,800)
SUM	600	(5,400)

DD FORM 1391

1. APPROPRIATION	FY 19 90 RDT & E FACILITIES	2. DATE
AIR FORCE (AFSC)		14 DEC 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	EQUIPMENT INSTALLATION: STAND-OFF RANGE EXTENSION

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
78019F	31X-XXX	FSPM 902511	2,490

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION				
INSTALLATION	LS			2,490
EQUIPMENT & SOFTWARE (NON-ADD)	LS			(47,310)
TOTAL EQUIPMENT & INSTALLATION				49,800

10. DESCRIPTION OF PROPOSED CONSTRUCTION

RDT & E WORK: Develop an airborne command/control/termination system to relay test data from a stand-off weapons system. Include electrical, mechanical, structural, and site work as required to make this a complete and useable system.

PROJECT: Develop an airborne command/control/termination system for stand-off weapon systems.

REQUIREMENT: High speed, stand-off weapon systems require long range instrumented flight paths that far exceed boundaries of existing overland test ranges. Test data, time-space-position information, and command and control data must be transmitted rapidly with high reliability.

CURRENT SITUATION: Presently such unmanned high speed air vehicle testing overland is not authorized without such a monitoring system.

IMPACT IF NOT PROVIDED: FAA and USAF will not authorize unmanned air vehicle testing overland without a command/control/termination system. Over water testing will not support recovery of test vehicles. The developmental, test and evaluation and the operational, test and evaluation of critical weapons will be seriously jeopardized and delayed.

ADDITIONAL: This project is to be phased over three fiscal years.

FY90	340	(6,460)
FY91	1,050	(19,950)
FY92	1.100	(20,900)
SUM	2,490	(47,310)

DD FORM 1391

PREVIOUS EDITIONS MAY BE USED UNTIL EXHAUSTED

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1 COMPONENT	FY 1990 RDT & E FACILITIES	2 DATE
AIR FORCE (AFSC)		14 DEC 88

3 INSTALLATION AND LOCATION	4. PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	EQUIP INSTALLATION: VISUAL SIMULATION DISPLAY SYSTEM

5 PROGRAM ELEMENT	6 CATEGORY CODE	7. PROJECT NUMBER	8 PROJECT COST ($000)
64755F	319-932	FSPM 902508	1,100

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION				
INSTALLATION	LS			1,100
VISUAL SIMULATOR EQUIPMENT & SOFTWARE (NON-ADD)	LS			(9,900)
TOTAL EQUIPMENT & INSTALLATION COST				11,000

10. DESCRIPTION OF PROPOSED CONSTRUCTION

RDT & E WORK: Install a high fidelity full field of view system in the Integrated Facility for Avionic System Testing (IFAST), Bldg 1020. The system will consist of a hemispherical dome for fixed based fighter cockpit and computer image system. Include any electrical, structural, and mechanical work required to make this a complete and useable system.

PROJECT: Install a visual simulation display system in the IFAST facility.

REQUIREMENT: Provide the capability at IFAST to conduct full avionics evaluations to include man-in-the-loop simulation.

CURRENT SITUATION: The Air Force Flight Test Center (AFFTC) does not presently have this capability. With completion of the FY87 MILCON Project, ADAL Avionics Laboratory, the additional space required for this system will become available.

IMPACT IF NOT PROVIDED: AFFTC will not be able to provide the visual cues needed to provide a true simulation environment. Without this system flight test hours cannot be saved, impacting the safety of flight of operations and increasing test costs.

ADDITIONAL: This project is to be phased over two fiscal years.

FY90	680	(5,120)
FY91	420	(3,780)
SUM	1,100	(9,900)

DD FORM 1391

PREVIOUS EDITIONS MAY BE USED UNTIL EXHAUSTED

PAGE NO

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1. COMPONENT	FY 19 90 RDT & E FACILITIES	2. DATE
AIR FORCE (AFSC)		14 DEC 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
EDWARDS AIR FORCE BASE, CALIFORNIA	EQUIP INSTALLATION: MISSION SIMULATOR FOR UNMAN VEHICLES

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
64755F	31X-XXX	FSPM 902509	350

9. COST ESTIMATES

ITEM	UNIT	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION:				
MISSION SIMULATOR FOR UNMANNED VEHICLES				
INSTALLATION	LS			350
EQUIPMENT & SOFTWARE (NON-ADD)	LS			(3,150)
TOTAL EQUIPMENT & INSTALLATION				3,500

10. DESCRIPTION OF PROPOSED CONSTRUCTION

RDT & E WORK: Provide six-degree of freedom simulation for flight control and navigation system analysis required for unmanned air vehicle test and evaluation. Include electrical, mechanical, structural and site work as required to make this a complete and useable system.

PROJECT: Provide an on-site capability to test and analyze mission planning systems supplied as part of an unmanned vehicle project.

REQUIREMENT: Evaluation of the mission planning system is necessary for the Ground Launched Cruise Missle (GLCM) program. An on-site capability would save critical time and money while providing an organizational capability to test this critical portion of the weapon system.

CURRENT SITUATION: Presently, the mission planning is accomplished in off-site contractor facilities. These are more costly than those which would be on-site in close promimity to the test teams.

IMPACT IF NOT PROVIDED: Continuing to have the system contractor perform mission planning at their facilities will increase the time and cost of the test program.

ADDITIONAL: This project is to be phased over three fiscal years.

FY90	50	(450)
FY91	100	(900)
FY92	200	(1800)
SUM	350	(3150)

1 COMPONENT	FY 19 89 RDT&E FACILITIES PROJECT DATA	2 DATE
AF (AFSC)		01 SEP 1988

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WRIGHT-PATTERSON AFB, OHIO (AFLC)	EQUIP INSTALLATION, COMP-AIDED ENGRNG (CAE) SUPPORT, MULTI-FAC

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65807F	610-711	EQ 88-9121	300.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION, COMPUTER-AIDED ENGINEERING SUPPORT FOR CAE SUPPORT FACILITIES 20005, 30206 AND 30207.				300.0
FAC 20005 EQUIP SUPPORT				(75.0)
FAC 30206 EQUIP SUPPORT				(200.0)
FAC 30207 EQUIP SUPPORT				(25.0)
COST OF PURCHASED EQUIPMENT (NON-ADD)				(4,600.0)
TOTAL EQUIP AND INSTALLATION COST (NON-ADD)				(4,900.0)
OTHER NON-ADD COST (DESIGN)				(50.0)
MINOR CONSTRUCTION, MULTI-FACILITY (NON-ADD)				(300.0)

10 DESCRIPTION OF PROPOSED Installation: Provide raised flooring and secondary utilities.

SPECIFIC PURPOSE: To support in the design, analysis and fabrication of aircraft parts used to modify test aircraft for R&D.

PROJECT: Equipment installation for computer-aided engineering (CAE) support.

REQUIREMENT: Provide necessary equipment support and facility modifications for the installation of 54 stand-alone computer CAD/CAM work stations and peripheral equipment at various facilities.

CURRENT SITUATION: The 4950 TESTW has a requirement for increasing computer CAD/CAM engineering capabilities in support of their aircraft modification operation.

IMPACT IF NOT PROVIDED: Failure to provide the requested work will impact 4950 TESTW capability to their own in-house design work, thereby not being able to reduce their contracting out work which is estimated at $4.2M per year.

1 COMPONENT	FY 19_83 MILITARY CONSTRUCTION PROJECT DATA RDT&E FACILITIES PROJECT DATA	2 DATE
AIR FORCE		1 SEP 88

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
KIRTLAND AIR FORCE BASE, N.M.	PROTOTYPE FACILITY: ATMOSPHERIC COMPENSATION PROTOTYPE FACILITY

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
63605F		MHMV 890600	5,630

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
ATMOSPHERIC COMPENSATION PROTOTYPE FAC.				5,622
UTILITIES/ROADS	L/S	-	-	(1,524)
TELESCOPES ENCLOSURES/FOUNDATION	L/S	-	-	(908)
HUAC BLDG/SERVICE TUNNEL	S.F.	11,200	230	(2,576)
SUPPORT BLDG	S.F.	2,300	192	(442)
	S.F.	1,800	100	(180)
DESIGN COST (Non Add)				338
R&D EQUIPMENT				
NEW				22,000
EXISTING				15,000

10 DESCRIPTION OF PROPOSED CONSTRUCTION

PROJECT: Construct a prototype experimental facility to support a 3.5 and .08 meter telescopes and associated optics and lasers for a Ground Base Laser System (GBL).

REQUIREMENT: AFWL is conducting research in Atmospheric Turbulence. At present, most of the experiments are being conducted on a 1.5 meter telescope located here at Kirtland AFB. Due to technical requirements and other program consideration, a 3.5 meter telescope is required to complete the research before moving to a full scale GBL Demonstration Facility.

CURRENT SITUATION: The existing 1.5 meter telescope and laser systems has collected data which indicates that atmospheric turbulence on larger apertures may not be as strong as theories predicted. Thus, there would be no additional penalty for using the larger apertures planned for future GBL systems.

IMPACT IF NOT PROVIDED: Congress has requested that GBL feasibility be answered in the early 1990's. Study of the national capability has shown no availability of a research tool in the 3.5 meter class. This capability is urgently required to respond to the Congressional requirements and to continue research and development in the Atmospheric Compensation Field.

ADDITIONAL: This plan project will procure a $16 million 3.5 meter telescope, and construct a $5.7 million in prototype facilities to accommodate this large telescope and associated laser systems and support the required experimentation. The new facility will be built in a remote mountain area of Kirtland A.F.B to provide the best possible optical conditions.

1. COMPONENT	FY 1990-95 RDT&E FACILITIES	UNCLASSIFIED	2. DATE
AIR FORCE			30 Aug 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE EQUIPMENT INSTALLATION
ARNOLD AFB, COFFEE COUNTY, TN 37389-5000	Signal Conditioning, ETF Test Area

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
65807F	318-614 & 390-514	ANZY818012	366

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation Signal Conditioning, ETF Test Area	LS			366
Signal Wiring System	LS			(315)
Misc Eq. Installation	LS			(51)
Cost Of Purchased Equipment (Non-Add)	LS			(6128)
Total Equip. Inst. and Equip. Cost	LS			(6494)
Other Non-Add Costs				
Design (Non-Add)	LS			(94)
Checkout (Non-Add)	LS			(230)

10. DESCRIPTION OF PROPOSED INSTALLATION:

PROJECT: Procure and install replacement signal conditioning equipment and inter connect cabling to replace obsolete and unreliable equipment in all Engine Test Facility (ETF) major test units (C1, C2, T1, T2, T3, T4, T5, T6, T7, J1, J2, J3, J4, and J5).

REQUIREMENT: Replacement equipment is required to improve reliability and operational efficiency and reduce test preparation time and cost.

CURRENT SITUATION: Existing signal conditioning equipment, and interconnect cabling is obsolete and unreliable requiring excessive manpower for setup, checkout, and maintenance. As the equipment continues to age, reliability will decrease further as replacement parts become unavailable.

IMPACT IF NOT PROVIDED: Data Systems reliability will decrease, data quality will be reduced, and manpower intensive operations will continue resulting in excessive maintenance costs and test unit operational delays. The current capability to support development testing of rocket and jet engine propulsion systems will be significantly reduced.

COMPONENT	FY 1990- 92 RDT&E FACILITIES	UNCLASSIFIED	DATE
AIR FORCE			30 AUG 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE EQUIPMENT INSTALLATION
ARNOLD AFB, COFFEE COUNTY, TN 37389	FREEJET TEST CELL C-1

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
65807F	390-614	ANZY900141	7000

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION FREEJET TEST CELL C-1	LS			7000
VARIABLE MACH NO NOZZLE TESTING	LS			(2400)
PROPELLANT STORAGE SYSTEM	LS			(1900)
FREEJET BULKHEAD SYSTEM	LS			(2700)
COST OF PURCHASED EQUIPMENT (NON-ADD)	LS			(10000)
TOTAL INSTALLATION AND EQ COST (NON-ADD)	LS			(17000)
OTHER NON-ADD COSTS:				
DESIGN	LS			(3000)
CHECK OUT	LS			(5000)

10. DESCRIPTION OF PROPOSED INSTALLATION

PROJECT: Procure and install freejet testing equipment to include variable Mach Number nozzles, propellant storage system and freejet bulkhead system.

REQUIREMENT: AEDC Test Cell C-1 will be used to conduct freejet testing on the NASP and comparable missile systems.This aircraft will incorporate new technologies such as blended inlets and exhausts, integrated avionics, and integral airframe/propulsion heat rejection/cooling systems. The effective integration of these capabilities determines how successfully the NASP will accomplish its mission.

CURRENT SITUATION: AEDC Test Cell C-1 currently does not have a freejet test capability. To accomplish NASP propulsion system testing, special equipment, such as variable supersonic Mach No.nozzle and propellant storage system are required to conduct NASP freejet tests

IMPACT: The ability to verify propulsion system operation over a critical portion of the NASP flight envelope prior to flight test does not currently exist. Improper integration between the airframe and propulsion system will severely limit the capability of the NASP by impacting range, payload, maneuverability and by increasing operating costs. Without this ground test capability, the NASP and future missile systems can only rely on flight testing for compatability verification. This could result in increased costs for the NASP, weapon system deployment delays and expensive retrofits.

1 COMPONENT	FY 19_89 RDT&E FACILITIES PROJECT DATA	2 DATE
AF (AFSC)		01 SEP 1988

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
WRIGHT-PATTERSON AFB, OHIO (AFLC)	EQUIP INSTALLATION, COMP-AIDED ENGRNG (CAE) SUPPORT, MULTI-FAC

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
65807F	610-711	EQ 88-9121	300.0

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION, COMPUTER-AIDED ENGINEERING SUPPORT FOR CAE SUPPORT FACILITIES 20005, 30206 AND 30207.				300.0
FAC 20005 EQUIP SUPPORT				(75.0)
FAC 30206 EQUIP SUPPORT				(200.0)
FAC 30207 EQUIP SUPPORT				(25.0)
COST OF PURCHASED EQUIPMENT (NON-ADD)				(4,600.0)
TOTAL EQUIP AND INSTALLATION COST (NON-ADD)				(4,900.0)
OTHER NON-ADD COST (DESIGN)				(50.0)
MINOR CONSTRUCTION, MULTI-FACILITY (NON-ADD)				(300.0)

10 DESCRIPTION OF PROPOSED Installation: Provide raised flooring and secondary utilities.

SPECIFIC PURPOSE: To support in the design, analysis and fabrication of aircraft parts used to modify test aircraft for R&D.

PROJECT: Equipment installation for computer-aided engineering (CAE) support.

REQUIREMENT: Provide necessary equipment support and facility modifications for the installation of 54 stand-alone computer CAD/CAM work stations and peripheral equipment at various facilities.

CURRENT SITUATION: The 4950 TESTW has a requirement for increasing computer CAD/CAM engineering capabilities in support of their aircraft modification operation.

IMPACT IF NOT PROVIDED: Failure to provide the requested work will impact 4950 TESTW capability to their own in-house design work, thereby not being able to reduce their contracting out work which is estimated at $4.2M per year.

1 COMPONENT	FY 19_83 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
AIR FORCE	RDT&E FACILITIES PROJECT DATA	1 SEP 88

3 INSTALLATION AND LOCATION	4 PROJECT TITLE
KIRTLAND AIR FORCE BASE, N.M.	PROTOTYPE FACILITY: ATMOSPHERIC COMPENSATION PROTOTYPE FACILITY

5 PROGRAM ELEMENT	6 CATEGORY CODE	7 PROJECT NUMBER	8 PROJECT COST ($000)
63605F		MHMV 890600	5,630

9 COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
ATMOSPHERIC COMPENSATION PROTOTYPE FAC.				5,622
UTILITIES/ROADS	L/S	-	-	(1,524)
TELESCOPES ENCLOSURES/FOUNDATION	L/S	-	-	(908)
HUAC BLDG/SERVICE TUNNEL	S.F.	11,200	230	(2,576)
SUPPORT BLDG	S.F.	2,300	192	(442)
	S.F.	1,800	100	(180)
DESIGN COST (Non Add)				338
R&D EQUIPMENT				
NEW				22,000
EXISTING				15,000

10 DESCRIPTION OF PROPOSED CONSTRUCTION

PROJECT: Construct a prototype experimental facility to support a 3.5 and .08 meter telescopes and associated optics and lasers for a Ground Base Laser System (GBL).

REQUIREMENT: AFWL is conducting research in Atmospheric Turbulence. At present, most of the experiments are being conducted on a 1.5 meter telescope located here at Kirtland AFB. Due to technical requirements and other program consideration, a 3.5 meter telescope is required to complete the research before moving to a full scale GBL Demonstration Facility.

CURRENT SITUATION: The existing 1.5 meter telescope and laser systems has collected data which indicates that atmospheric turbulence on larger apertures may not be as strong as theories predicted. Thus, there would be no additional penalty for using the larger apertures planned for future GBL systems.

IMPACT IF NOT PROVIDED: Congress has requested that GBL feasibility be answered in the early 1990's. Study of the national capability has shown no availability of a research tool in the 3.5 meter class. This capability is urgently required to respond to the Congressional requirements and to continue research and development in the Atmospheric Compensation Field.

ADDITIONAL: This plan project will procure a $16 million 3.5 meter telescope, and construct a $5.7 million in prototype facilities to accommodate this large telescope and associated laser systems and support the required experimentation. The new facility will be built in a remote mountain area of Kirtland A.F.B to provide the best possible optical conditions.

1. COMPONENT	FY 1989 RDT&E FACILITIES	UNCLASSIFIED	2. DATE
AIR FORCE			30 AUG 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
ARNOLD AFB, COFFEE COUNTY, TN 37389	EQUIPMENT INSTALLATION HIGH TEMPERATURE LAB (HTL)

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
65807F	311-115	ANZY890307	900

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
EQUIPMENT INSTALLATION				
HIGH TEMPERATURE LAB (HTL)	LS			900
TEST EQUIPMENT	LS			(600)
DATA AND CONTROL SYSTEM	LS			(300)
				(900)
COST OF PURCHASED EQUIPMENT (NON-ADD)	LS			(1,800)
TOTAL EQUIP. INSTALLATION AND EQUIP COST.	LS			(2,700)
OTHER NON-ADD COSTS:	LS			
DESIGN COSTS	LS			(400)
MINOR CONSTRUCTION	LS			(170)
CHECKOUT	LS			(300)

10. DESCRIPTION OF PROPOSED INSTALLATION

PROJECT: Procure and install High Temperature Lab equipment to include test stands, exhaust ducting, special power & cooling systems, and controls and data systems.

REQUIREMENT: Hypersonic vehicle research requires development of air breathing propulsion systems, thermal structures and new materials operating above Mach 8. Arc-heaters are needed to produce the simulated flight conditions in a large test facility for long run times. Heater development is required to increase the size, performance, run times, flow conditioning and understanding of test environments of arc heaters. No other air heating method exists to provide the extreme temperatures and run times required. Project provides equipment and services needed to conduct the enabling technology studies & development of large electric arc heaters supplying hot air flow for planned hypersonic test facilities.

CURRENT SITUATION: Existing arc heaters are inadequate to power a large hypersonic test facility. Technology development must proceed to understand the scaling potential, pressure and air mixing limitations, instrumentations and diagnostics, flow chemistry, safety and reliability of an arc heater capable of driving proposed hypersonic facilities.

IMPACT IF NOT PROVIDED: Arc heater technology will not mature sufficiently to power a large hypersonic test facility. Adequate development and qualification testing of hypersonic propulsion and airframe hardware will not be available for flight simulated conditions above Mach 8.

1. COMPONENT	FY 1990-91 RDT&E FACILITIES	UNCLASSIFIED	2. DATE
AIR FORCE			30 Aug 88

3. INSTALLATION AND LOCATION	4. PROJECT TITLE EQUIPMENT INSTALLATION
ARNOLD AFB, COFFEE COUNTY, TN 37389-5000	R Cells Inst. & Control (I&C)Systems

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
65807F	318-614	ANZY880422	428

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Equipment Installation R-Cells I&C Systems	LS			428
Signal Wiring System	LS			(110)
Electronic Eq. Installation	LS			(318)
Cost of Purchased Equipment (Non-Add)	LS			(645)
Total Equipment Installation and Equipment Cost	LS			(1073)
Minor Construction (Non-Add)	LS			(120)
Design (Non-Add)	LS			(55)

10. DESCRIPTION OF PROPOSED INSTALLATION:

PROJECT: Procure and install equipment for data conditioning, calibration, controls, and control room displays to support testing in Research Test Units R1A, R2H, R1E, and R2A. This equipment includes excitation sources, calibration networks, and amplification as well as interconnect cabling and interfaces.

REQUIREMENT: Research testing capability is required in the Engine Test Facility for studies involving models and profiles of engine inlets and engine ingestion of air containing rain and ice. System and equipment are required to permit automated setup/checkout and verification of operations to ensure quality test results and to expedite test preparations and minimize manpower expenditures.

CURRENT SITUATION: The existing equipment is obsolete and reliability is deteriorating requiring increased setup, checkout and maintenance efforts. As this equipment continues to age, reliability will decrease and measurement uncertainties will increase. Replacement parts are becoming unavailable for some equipment.

IMPACT IF NOT PROVIDED: Without this equipment, data quality will be reduced, reliability will decrease, and manpower usage for test unit preparation/ maintenance will increase. Excessive maintenance costs and test unit operational delays can be avoided with implementation of this project. Experimental studies for the ATFE Program may be impeded or delayed extensively.