## **DEPARTMENT OF THE AIR FORCE**

## FISCAL YEAR 2000/2001 BIENNIAL BUDGET ESTIMATES

# **RESEARCH, DEVELOPMENT, TEST AND EVALUATION**

## **DESCRIPTIVE SUMMARIES**



**FEBRUARY 1999** 

**VOLUME I** 

#### Fiscal Year 2000/2001 Biennial Budget Estimates RDT&E Descriptive Summaries, Volume I February 1999

#### 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 elements and projects in the FY2000/2001 President's Budget Submission (PB). All formats in this document are in accordance with the revised guidelines of the DoD Financial Management Regulation, Volume 2B, Chapter 5, with the exception of the R-3 exhibit. The Air Force could not support the new format matrix because our programs do not track their programs in the manner required to complete the exhibit.

- a. Contents: Exhibits R-2, R-2a and R-3 provide narrative information for all RDT&E program elements and projects within the USAF FY1999 RDT&E program except the classified program elements. The formats and contents of this documents are in accordance with the guidelines and requirement of the Congressional committees insofar as possible.
- b. The "Other Program Funding Summary" portion of the R-2 includes, in addition to RDT&E funds, Procurement funds and quantities, Military Construction appropriation funds on specific development programs, Operations and Maintenance appropriation funds where they are essential to the development effort described, and where appropriate, Department of Energy (DOE) costs.
- c. The Justification book has been assembled in accordance with DoD Financial Management Regulation 7000.14, Vol 2B Cpt 5, Sec 050302 with the exception of the R-1, Project Funding Listing which was distributed under a separate cover due to classification.

#### 2. (U) CLASSIFICATION.

a. All R-2 and R-3 exhibits contained in Volumes I and II are UNCLASSIFIED. Classified R-2 and R-3 exhibits are not included in the submission due to the level of security classification and necessity of special security clearances.

#### **INTRODUCTION AND EXPLANATION OF CONTENTS**

## **Program Element**

Remarks

BUDGET ACTIVITY 1: BASIC RESEARCH No changes

#### BUDGET ACTIVITY 2: APPLIED RESEARCH DEVELOPMENT

0602202F, Armstrong Lab Exploratory Development	Environmental noise portion of project 7757 has been realigned to Project 7184 in FY99. Studies in support of Distributed Mission Training has been realigned from Project 7184 to Project 1123 in FY00. Toxicology hazards research program will be realigned from Project 7757 to Project 1710 beginning in FY00. PE 62102F, Project 4349 will realign to project 1900 beginning in FY00.
0602203F, Aerospace Propulsion	Project 3012 terminates in FY00
0602269F, Hypersonic Technology Program	Project 1025 terminates in FY00
0602601F, Phillips Laboratory Exploratory Development	Spectral Sensing efforts currently in Project 3326 moves into Project 8809 in FY00
0602702F, Command, Control and Communication	Project 2338 terminates in FY99 and Project 4600 terminates in FY00.
0602805F, Dual Use Science & Technology	Project 4770 is a FY99 new start
BUDGET ACTIVITY 3: ADVANCE TECHNOLOGY DEVELO	DPMENT

0603108F, Integrated Data Systems

Project 4427 realigns to PE 0708611F, Project 4427

0603253F, Advanced Avionics Integration	Project 3833 realigns to Project 2735 beginning in FY99
0603302F, Space & Missile Rocket Propulsion	Project 6339 completes in FY00. Project 6339 terminates in FY00.
0603302F, Space and Missile Rocket Propulsion	Project 003 realigns to PE 0603401F, Project 1026 beginning in FY00.
0603401F, Advanced Spacecraft Technology	Project 4782 realigns to PE 0603856F, 4782 beginning in FY99. Spectal sensing work in PE 0603605F, Project 3150 realigns to Project 3784. Launch vehicle technology realigns form PE 0603302, Project 0003 to Project 1026.
0603707F, Weather Systems Technology	Project 2868 terminates in FY99
0603726F, C3 Subsystem Integration	Project 2863 realigns to Project 69CK, PE 0603203F beginning in FY01
BUDGET ACTIVITY 4: DEMONSTRATION AND VALIDAT	ION
0603441F, Space Based IR Arch (Dem/Val) (Space)	Project 0007 realigns to PE 06044422F
0603690F, Information Operations Technology	Project 4822 is a FY00 new start
0603876F, Space Based Laser (SBL) (Space)	Prior to FY98 program funded in PE 0603173C
0604442F, Space Based IR Arch (EMD)(Space)	Project 4598 is a FY99 new start

#### **INTRODUCTION AND EXPLANATION OF CONTENTS**

#### BUDGET ACTIVITY 5: ENGINEERING AND MANUFACTURING DEVELOPMENT

0604201F, Integrated Avionics Planning & Development	Project 2257 completes in FY01; Project 2258 completes in FY98
0604218F, Engine Model Derivative Program	Project 2634 completes in FY98
0604233F, Specialized Undergraduate Pilot Training	Project 4376 completes in FY00
0604270F, Electronic Warfare Development	Project 1011 completes in FY01
0604600F, Munitions Dispenser Development	Project 1015 completes in FY99
0604727F, Joint Standoff Weapons Systems	Project 1000 completes in FY01
0604851F, ICBM - EMD (GRP, PRP, MMRRT)	Project 4788 is an FY00 new start; Project 3085 completes in FY00; Project 4210 completes in FY00

## BUDGET ACTIVITY 6: RDT&E MANAGEMENT SUPPORT

0604256F, Threat Simulator Development	Project 7500 is a FY00 new start
0603402F, Space Test Funding	Project 2617 realigns to PE 0605864F

#### BUDGET ACTIVITY 7: OPERATIONAL SYSTEM DEVELOPMENT

0101120F, Advanced Cruise Missile

Project 4798 is a FY00 new start

0101122F, Air Launched Cruise Missile	Project 4797 is a FY00 new start
0102411F, North Atlantic Defense System (NADS)	Project 2980 completes in FY00
0102325F, Joint Surveillance System	Project 2996 completes in FY99
0102411F, North Atlantic Defense System	Project 2980 completes in FY99
0207131F, A-10 Squadrons	Project 4809 is a FY99 new start
02027253, Compass Call	Project 4804 is a FY00 new start
0207320F, Sensor Fused Weapons	Project 1016 completes in FY00
0207414F, Combat Intelligence System	Funding for the PE transfers to PE 0207438F, project 4790 in FY00.
0207423F, Advanced Communication System	Project 2982 completes in FY01
0207438F, Theater Battle Management (TMB) C4I	Projects 4287, 4288 and PE 27414, Project 4773 will be consolidated into project 4790 beginning in FY00. Project 4802 was previously funded in FY98 under PE 33152 and in FY99 under PE 33150.
0207601F, USAF Wargaming and Simulation	Projects 1011 and 4566 were transferred to PE 0308601F, beginning in FY99
0208019F, Integrated Broadcast Service	Realigns to PE 0603850F, Project 4778 beginning in FY00
0208031F, WRM-Equipment/Secondary Items	Project 4668 is a FY99 new start

0302015F, E-4B National Airborne Ops Center	Project 4777 begins in FY99
0303131F, Minimum Essential Emergency Communications	Project 4521 consolidates DIRECT efforts previously being performed in PE 0603851F, Project 1024; 0604851F, Project 13C4; and PE 0303131F, Project 2832.
0303150F, WWMCCS/Global Command and Control Sys	PE 0303152 and 0303150F are consolidated beginning in FY99 and the program title has been changed to Global Command and Control System (GCCS). The DCAPES effort will be realigned to Project 4802 in PE 27438.
0305099F, Global Air Traffic Management (GATM)	Project 4690 was transferred to PE
0305138F, Inert Upper Stage (IUS)	Project 4053 transfers to PE 0305144Fbeginning in FY00.
0305205F, Endurance Unmanned Aerial Vehicles	FY98 and FY99 funds are in PE 0305205D, Endurance Unmanned Aerial Vehicles
0305206F, Advanced Technology Development	FY98 and FY99 funds are in PE 0305206D, Airborne Reconnaissance Advanced Development.
0305208F, Distributed Common Ground	FY98 and FY99 funds are in PE 03052086D, Distributed Common Ground Systems (DCGS)
0305906F, NCMC-TW/AA Systems	Project 4806 is a FY00 new start; Project 3880 completes in FY99; Project 4409 completes in FY99
0305910F, Spacetrack (Space)	Project 4791 is a FY00 new start; Project 4241 completes in FY99.

0305911F, DSP (Space)	Project 3615 completes in FY01
0305917F, Space Architect	Funding prior to FY98 is in PE 0603855F
0305953F, Evolved Expendable Launch Vehicle	Project 4594 terminates in FY99
0308699F, Shared Early Warning System	Project 4838 established to standardize management of ongoing SEW program efforts
0302015F, E-4 National Airborne Operations Center	Project 4777 is a FY99 new start
0401119F, C-5 Airlift Squadrons	Project 4835 is a FY99 new start
0401214F, Air Cargo Materiel Handling	Project 5150 completes in FY00
0708026F, Product/Reliable/Avail/Maintain Prog	Project 4761 realigns to PE 0605011, Project 4685 beginning in FY 99
0708611F, Support Systems Development (SSD)	FY98 funds for Project 4654 is in PE 0603108F, Project 4427

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PE TITLE: Defense Research Sciences

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									bruary 19	999
BUDGET ACTIVITY       PE NUMBER AND TITLE         1 - Basic Research       0601102F         Defense Research Sciences										
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	188,216	209,731	209,505	177,513	178,523	182,013	186,185	200,020	Continuing	Continuing
2301 Physics	18,629	22,685	22,147	20,268	20,368	20,757	21,342	22,973	Continuing	Continuing
2302 Solid Mechanics and Structures	13,660	18,322	16,094	9,308	9,334	9,651	9,827	10,583	Continuing	Continuing
2303 Chemistry	24,185	25,826	27,536	24,641	24,805	25,262	25,707	27,701	Continuing	Continuing
2304 Mathematical and Computer Sciences	30,488	34,415	32,944	27,743	27,916	28,413	28,917	31,221	Continuing	Continuing
2305 Electronics	19,898	23,399	24,429	20,287	20,603	20,978	21,365	23,001	Continuing	Continuing
2306 Materials	10,116	12,122	13,257	13,380	13,556	13,773	14,093	15,099	Continuing	Continuing
2307 Fluid Mechanics	11,094	7,189	9,975	9,538	9,589	9,776	10,064	10,744	Continuing	Continuing
2308 Propulsion	12,757	14,629	17,263	16,553	16,633	16,950	17,447	18,755	Continuing	Continuing
2310 Atmospheric Sciences	5,584	5,544	5,661	5,082	5,106	5,207	5,365	5,721	Continuing	Continuing
2311 Space Sciences	5,103	6,805	8,625	8,541	8,540	8,691	8,932	9,514	Continuing	Continuing
2312 Biological Sciences	10,933	13,024	13,484	12,228	12,186	12,483	12,763	13,642	Continuing	Continuing
2313 Human Performance	10,500	12,528	13,212	9,944	9,887	10,072	10,363	11,066	Continuing	Continuing
4113 International Science Programs	15,269	13,243	4,878	0	0	0	0	0	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0
						·				
	Page 1 of 39 Pages Exhibit R-2 (PE 0601102F)									
			1							

RDT&E BUDGET ITEM JUS	DATE February 1999								
		PE NUMBER AN	D TITLE	soarch Scion	200				
(U) A. <u>Mission Description</u> : This Basic Research program, n comprised of in-house investigations in Air Force laboratories a engineering basic research in technologies critical to the Air Fo electronics, computer science, directed energy, conventional we process to harmonize efforts, eliminate duplication, and ensure technical review by tri-Service scientific planning groups that in Human Performance Program in 2001, research efforts in cogni Beginning in FY 2000, the Air Force will reduce funding in the (S&T) Program.	nanaged by the A and extramural ac rce mission. The apons, life science the most effective nterface and supp tive workload tra a International Ed	ir Force Office of stivities in academ se technologies i ces, and atmosphe e use of funds. A ort the Defense T sining and person ucation Science I	f Scientific Resea nia and industry. nclude aerospace eric and space sci .ll technology are Cechnology Area nel selection and Programs due to	arch (AFOSR), sup The program eler e structures, aerody iences. All project eas are subject to le Planning process. work related to co higher priorities w	pports Air Force research efforts ment funds broad-based scientific and mamics, materials, propulsion, power, as are coordinated through the Reliance ong-range research planning and Due to budget reductions in the ockpit design will be eliminated. within the Science and Technology				
<ul> <li>(U) B. <u>Budget Activity Justification</u>: This program is Budget increasing knowledge and understanding in those fields of the p</li> <li>(U) C. <u>Program Change Summary (\$ in Thousands)</u>:</li> </ul>	t Activity 1, Basic hysical, engineer	c Research, since ring, environmen	it includes effort tal, and life scien	ts of scientific stud aces related to long	ly and experimentation directed toward g-term national security needs.				
					Total				
	FY 1998	FY 1999	FY 2000	FY 2001	Cost				
(U) Previous President's Budget/FY 1999 PB	196.251	$\frac{111999}{209.395}$	$\frac{112000}{228.104}$	$\frac{112001}{230.992}$	Cont				
(U) Appropriated Value	207,249	210,395	,	,					
(U) Adjustments to Appropriated Value									
a. Congressional/General Reductions	-6,856	-664							
b. SBIR	-4,288								
c. Omnibus/Other Above Threshold Reprogrammings	-5,681								
d. Below Threshold Reprogrammings	-2,208								
(U) Adjustments to Budget Year Since FY 1999 PB			-18,599	-53,479					
(U) Current Budget Submit/FY 2000 PB	188,216	209,731	209,505	177,513	Cont				
(U) Significant Program Changes: Changes to this program since the President's Budget are due to higher priorities within the Science and Technology (S&T) Program. FY 1999: \$5,524 identified as a source for SBIR									
	Pag	ge 2 of 39 Pages		Ex	whibit R-2 (PE 0601102F)				
		2							

F	RDT&E BUDGET IT	EM JUS	TIFICAT	ION SH	IEET (R·	2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY       PE NUMBER AND TITLE         1 - Basic Research       0601102F Defense Research Sciences								S	F	PROJECT 2301	
C	OST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2301 Physics		18,629	22,685	22,147	20,268	20,368	20,757	21,342	22,973	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Description</u>: This project provides the fundamental knowledge required to conceptualize and develop new Air Force weapons and also establishes the basis for many technologies critical to the Air Force. Research in physics has an impact on electromagnetic countermeasures, nuclear weapons effects, communications, and non-destructive and non-intrusive testing and analysis, as well as new materials development. Other technologies affected include avionics, laser technology, and propulsion research. The primary areas of research supported by this project are Photonic Physics, Optics, Plasma Physics, and Atomic and Molecular Physics.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>\$ 1998 (\$ in Thousands)</u>:</li> <li>(U) \$ \$ 6,351</li> <li>Performed research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons; directed studies toward developing optimum lasers for high image quality telescopes for space surveillance. Examined the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$ 3,987</li> <li>Conducted plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examined the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon threats.</li> <li>(U) \$ 5,259</li> <li>Studied atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Developed advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$ 10, \$ 10, \$ 10, \$ 10, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20, \$ 20,</li></ul></li></ul>											
(U) <u>FY 1999 (</u>	<u>\$ in Thousands)</u> :										
<ul> <li>(U) \$9,397 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons; direct studies toward developing optimum lasers for high image quality telescopes for space surveillance. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$6,100 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon threats.</li> </ul>											
- (U) \$6	5,590 Study atomic, molecu Develop advanced ato	llar, and ima	ging physics lar processes	to enhance to produce Page 3 = 4	e space surve ideal perfor	illance capal mance time	bilities in the standards.	e area of targ	get detection $R_{-2A}$ (PE	and recogni	tion.
F10Ject 2301				ruge 5 Of	39 rages			EXHIDI		0001102F)	

BUDGET ACTIVITY         FENUMEER AND TITLE         PROJECT           1 - Basic Research         0.5598         Identified as a source for SBIR.         - (U) \$559         Identified as a source for SBIR.         - (U) \$22,685         Total         - (U) \$22,685         Total         - (U) \$22,685         Total         - (U) \$9,422         Perform researce, and optical physics for aerospace applications, optical devices for spoofing and damaging infrared socking missiles, countermeasures, and devices for directed energy weapons; direct studies toward developing optimum basers for high image quality telescopes for space surveillance. Examine the physics of lethal and nonlethal directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon interasts.         - (U) \$6,117         Conduct plasma physics research for faure directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced atomic molecular processes to produce ideal performance time standards.         - (U) \$22,147         Total         - (U) \$22,147         Total         - (U) \$8,519         Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared socking missiles, countermeasures, and devices for directed energy weapon iterast.         - (U) \$22,147         Total         - (U) \$25,676         Conduct plasma physics research for future directed-energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of light target kill.		February 1999				
1- Basic Research         0601102F         Defense Research Sciences         2301           - (U)         \$52,685         Total         -<	BUDGET ACTIVITY			PE NUMBER AND TITLE		PROJECT
<ul> <li>(1) \$598 Identified as a source for SBIR.</li> <li>(1) <u>FY 2000 (S in Thousands):</u> <ul> <li>(U) <u>S02,683</u> Total</li> </ul> </li> <li>(U) <u>S02,683</u> Total</li> <li>(U) <u>S0422</u> Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermoasures, and devices for directed energy weapons, direct studies toward developing optimum lasers for high image quality telescopes for space surveillance. Examine the physics of lethal and nonlethal directed-onergy for speed-of-light target kill.</li> <li>(U) \$6,117 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators: examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon threats.</li> <li>(U) \$6,608 Study atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$22,147 Total</li> <li>(U) \$5,576 Conduct plasma physics research for future directed-energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676 Xonduct plasma physics research for future directed-energy weapons. Section physics of specific devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy weapons, different devices of target devices for specific devices for specific devices for specific devices for directed energy weapons. Examine the physics of lethal</li></ul>	1 - Basic Res	earch		0601102F Defense Rese	arch Science	s 2301
<ul> <li>(U) \$22,685 Total</li> <li>(U) <u>FY 2000 (S in Thousands):</u> <ul> <li>(U) S9,422 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons; direct studies toward developing optimum lasers for high image quality telescopes for space surveillance. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$6,117 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon threats.</li> <li>(U) \$6,008 Study atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$22,147 Total</li> </ul> </li> <li>(U) \$8,519 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,576 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$5,670 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce develops explained surveillance.</li> <li>(U) \$5,676 Conduct plasma physics research for future directed-energy weapons,</li></ul>	- (U)	\$598	Identified as a source for SBIR.			
<ul> <li>(U) <u>FY 2000 (S in Thousands):</u> <ul> <li>(U) <u>S9,422</u> Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons, directed-energy for speed-of-light target kill.</li> <li>(U) <u>S6,117</u> Conduct plasma physics research for future directed-energy weapons, directed energy for speed-of-light target kill.</li> <li>(U) <u>S6,608</u> Study atomic, molecular, and inaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) <u>S22,147</u> Total</li> </ul> </li> <li>(U) <u>S5,676</u> Conduct plasma physics for directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven directed energy weapons. Examine the physics of Ichal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) <u>S22,147</u> Total</li> <li>(U) <u>S5,676</u> Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) <u>S5,676</u> Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) <u>S6,073</u> Study atomic and molecular processes to produce ideal performance time standards.</li> <li>(U) <u>S20,268</u> Total</li> </ul>	- (U) \$2	22,685	Total			
(U) PY 2000 (\$ in Thousands):         - (U)       \$9,422       Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons; direct studies toward developing optimum lasers for high image quality telescopes for space surveillance. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.         - (U)       \$6,117       Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon threats.         - (U)       \$6,608       Study atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.         - (U)       \$22,147       Total         (U) FY 2001 (\$ in Thousands):         - (U)       \$8,519         Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.         - (U)       \$5,676       Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and davanced explosive-driven power generato						
<ul> <li>(U) \$9,422 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for frietered energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapons, the structure capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$22,147 Total</li> <li>(U) \$22,147 Total</li> <li>(U) \$22,147 Total</li> <li>(U) \$8,519 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$5,673 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul>	(U) <u>FY 2000</u>	(\$ in The	ousands):			
<ul> <li>Project 2301</li> <li>Page 4 of 39 Pages</li> <li>Exhibit R-2A (PE 0601102F)</li> </ul>	- (U) \$	\$9,422	Perform research on laser and optical physics for aer	ospace applications, optical devices	for spoofing and d	amaging infrared seeking
<ul> <li>(U) \$6,117 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators; examine the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon threats.</li> <li>(U) \$6,608 Study atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$22,147 Total</li> <li>(U) \$22,147 Total</li> <li>(U) \$8,519 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676 Conduct phasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$6,073 Study atomic and molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul>			missiles, countermeasures, and devices for directed e	nergy weapons; direct studies towar	d developing optim	light target kill
<ul> <li>(b) 50.117 Contact plans plans that not not restrict energy equipation for the feasibility of using collisional ionized gas volumes to protect friendly assets from directed energy weapon threats.</li> <li>(U) \$6,608 Study atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:         <ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:</li> <li>(U) <u>58,519</u> Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$6,073 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul> </li> </ul>	– (II) 🕴	\$6 117	Conduct plasma physics research for future directed-	energy weapons affordable low-obs	servables space cor	munications and surveillance
From directed energy weapon threats.       - (U) \$6,608       Study atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.         - (U) \$22,147       Total         (U) <u>FY 2001 (S in Thousands):</u> - (U) \$8,519       Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.         - (U) \$5,676       Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.         - (U) \$6,073       Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular physics to enhance space surveillance time standards.         - (U) \$20,268       Total	(0) 4	0,117	and advanced explosive-driven power generators; ex-	amine the feasibility of using collision	onal ionized gas vo	lumes to protect friendly assets
<ul> <li>(U) \$6,608 Study atomic, molecular, and imaging physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:         <ul> <li>(U) <u>58,519</u> Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$6,073 Study atomic and molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul> </li> <li>Project 2301 <u>Page 4 of 39 Pages</u> Exhibit R-2A (PE 0601102F)</li> </ul>			from directed energy weapon threats.			······································
Develop advanced atomic molecular processes to produce ideal performance time standards.         - (U)       \$22,147       Total         (U) <u>FY 2001 (\$ in Thousands)</u> :         - (U)       \$8,519       Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.         - (U)       \$5,676       Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.         - (U)       \$6,073       Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.         - (U)       \$20,268       Total	- (U) \$	\$6,608	Study atomic, molecular, and imaging physics to enh	ance space surveillance capabilities	in the area of targe	et detection and recognition.
<ul> <li>(U) \$22,147 Total</li> <li>(U) FY 2001 (\$ in Thousands):         <ul> <li>(U) \$8,519 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$6,073 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul> </li> <li>Project 2301 Page 4 of 39 Pages Exhibit R-2A (PE 0601102F)</li> </ul>			Develop advanced atomic molecular processes to pro-	duce ideal performance time standa	rds.	
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:         <ul> <li>(U) \$8,519</li> <li>Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676</li> <li>Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$6,073</li> <li>Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268</li> <li>Total</li> </ul> </li> </ul>	- (U) \$2	22,147	Total			
(U) FY 2001 (\$ in Thousands):         - (U) \$8,519       Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.         - (U) \$5,676       Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.         - (U) \$6,073       Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.         - (U) \$20,268       Total						
<ul> <li>(U) \$8,519 Perform research on laser and optical physics for aerospace applications, optical devices for spoofing and damaging infrared seeking missiles, countermeasures, and devices for directed energy weapons. Examine the physics of lethal and nonlethal directed-energy for speed-of-light target kill.</li> <li>(U) \$5,676 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$6,073 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul>	(U) <u>FY 2001</u>	<u>(\$ in The</u>	<u>busands)</u> :	1 1.1 .	с с 1.1	
<ul> <li>- (U) \$5,676 Conduct plasma physics research for future directed energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>- (U) \$6,073 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>- (U) \$20,268 Total</li> </ul>	- (U) \$	\$8,519	Perform research on laser and optical physics for aer	ospace applications, optical devices	for spoofing and da	amaging infrared seeking
<ul> <li>(U) \$5,676 Conduct plasma physics research for future directed-energy weapons, affordable low-observables, space communications and surveillance, and advanced explosive-driven power generators.</li> <li>(U) \$6,073 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul>			of-light target kill	nergy weapons. Examine the physic		nethal directed-energy for speed-
(b)       b)       b)       and advanced explosive-driven power generators.         - (U)       \$6,073       Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.         - (U)       \$20,268       Total	- (U) -	\$5 676	Conduct plasma physics research for future directed-	energy weapons, affordable low-obs	servables, space cor	nmunications and surveillance.
<ul> <li>(U) \$6,073 Study atomic and molecular physics to enhance space surveillance capabilities in the area of target detection and recognition. Develop advanced atomic molecular processes to produce ideal performance time standards.</li> <li>(U) \$20,268 Total</li> </ul>		,010	and advanced explosive-driven power generators.	8,	····, ·····	
exhibit R-2A (PE 0601102F)	- (U) \$	\$6,073	Study atomic and molecular physics to enhance spac	e surveillance capabilities in the area	a of target detection	and recognition. Develop
– (U) \$20,268 Total <u>Project 2301</u> <u>Page 4 of 39 Pages</u> <u>Exhibit R-2A (PE 0601102F)</u>			advanced atomic molecular processes to produce idea	al performance time standards.		
Project 2301 Page 4 of 39 Pages Exhibit R-2A (PE 0601102F)	- (U) \$2	20,268	Total			
Project 2301 Page 4 of 39 Pages Exhibit R-2A (PE 0601102F)						
Project 2301 Page 4 of 39 Pages Exhibit R-2A (PE 0601102F)						
Project 2301 Page 4 of 39 Pages Exhibit R-2A (PE 0601102F)						
Project 2301         Page 4 of 39 Pages         Exhibit R-2A (PE 0601102F)						
Project 2301         Page 4 of 39 Pages         Exhibit R-2A (PE 0601102F)						
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Project 2301 Page 4 of 39 Pages Exhibit R-2A (PE 0601102F)						
Project 2301         Page 4 of 39 Pages         Exhibit R-2A (PE 0601102F)						
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110/ct 2301 1 uge 4 0/ 39 Fuges LAHIDIL N-2A (FE 0001102F)	Project 2201		Daw	A  of  30  Pagas	Evhihit	R-24 (PE 0601102E)
	F10ject 2501		rage	2 4 0J 39 Fuges	EXHIDIL	$\mathbf{N} = \mathbf{A} \left( \mathbf{F} \in \mathbf{U} \cup \mathbf{U} \mid \mathbf{U} \geq \mathbf{F} \right)$

RDT&E BUDGET ITEM JUSTIFICATIO	DATE February 1999	
BUDGET ACTIVITY <b>1 - Basic Research</b>	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT es 2301
(U) B. Project Change Summary - Description of Significant Changes: Not	t Applicable.	
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> </ul>		
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 2301 Pa	ge 5 of 39 Pages Exhib	oit R-2A (PE 0601102F)
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RD	<b>F&amp;E BUDGET IT</b>	EM JUS	TIFICAT		IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY <b>1 - Basic Researc</b>	h			PE N <b>06</b>	UMBER AND 01102F	title Defense I	Research	Science	es	F	PROJECT 2302
COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 EstimateFY 2005 EstimateCost f Complete									Cost to Complete	Total Cost	
2302 Solid Mechanics and	2302 Solid Mechanics and Structures 13,660 18,322 16,094 9,308 9,334 9,651 9,827							10,583	Continuing	Continuin	
<ul> <li>(U) A. <u>Mission Description</u>: This project seeks to develop a fundamental understanding of the behavior of aerospace materials, structures, and supporting facilities, leading to cost-effective development and safe and reliable operation of superior weapons and defensive systems. Research includes such diverse topics as the micromechanical design of advanced materials, modeling and simulation of the dynamic behavior of aircraft, missiles, and large space structures, and technology integration for the performance and survivability enhancement of these systems. This research will result in expanding the fundamental knowledge base to better understand the mechanics of deformation and damage of aerospace materials and structures. Also, this research will lead to an improved understanding of the aeroelastic and acoustic behavior of airframe and engine structures, and the dynamic behavior of launch vehicles and space structures.</li> <li>(U) <u>FY 1998 (§ in Thousands)</u>:         <ul> <li>(U) <u>S5,470</u></li> <li>Studied thermomechanical behavior of advanced structural materials, including micromechanics of materials for aerospace structural systems and coatings. Investigated the fracture behavior and thermomechanical behavior of high temperature alloys and composite materials for aerospace structures, including dynamics and mechanics of materials at very small scales, as necessary for the development of micro-electromechanical systems. Developed fundamental understanding of the behavior aerospace materials governing the behavior of geomaterial systems. Investigated the fundamental relationships to describe the fundamental mechanics governing the behavior of geomaterial systems. Investigated the fundamental relationship of geomaterials undergoing high strain rate loadings with increasing confining pressures, as occurs when impacted by penetrating weapons.</li> <li>(U) §3,060</li> <li>(U) <u>S13,660</u></li></ul></li></ul>											
Project 2302				Page 6 of	39 Pages			Exhibi	t R-2A (PE	0601102F)	)

	RDT&	E BUDGET ITEM JUSTIFICATION	I SHEET (R-2A E	xhibit)	DATE February 1999
BUDGET ACTIVITY			PE NUMBER AND TITLE		PROJECT
1 - Basic Res	earch		0601102F Defense	se Research Science	s 2302
- (U) S	\$6,022	Model development of materials for aerospace struc for the development of micro-electromechanical sys conduct research into the behavior of actuator/struct	tures, including dynamics tems. Develop fundament ture interaction for control	and mechanics of materials a tal understanding of the behav of shell structures in vibro/ad	t very small scales, as necessary vior of aeroelastic structures and coustic environments.
– (U) S	\$5,261	Seek fundamental particulate mechanics knowledge the behavior of geomaterial systems. Investigate the increasing confining pressures, as occurs when impa	, including quantitative re e fundamental relationship acted by penetrating weap	lationships to describe the fun o of geomaterials undergoing ons.	ndamental mechanics governing high strain rate loadings with
– (U)	\$482	Identified as a source for SBIR.			
- (U) \$1	18,322	Total			
(U) <u>FY 2000</u>	(\$ in Tho	usands):			
– (U) S	\$5,915	Study thermomechanical behavior of advanced struct aerospace structural systems and coatings. Investigat composite materials for engine and hypersonic vehic	ctural materials, including ate the fracture behavior a cle applications.	micromechanics of high-tem nd thermomechanical behavio	perature composite materials for or of high temperature alloys and
– (U) S	\$5,432	Model development of materials for aerospace struct for the development of micro-electromechanical syst conduct research into the behavior of actuator/struct	tures, including dynamics tems. Develop fundament ure interaction for control	and mechanics of materials a tal understanding of the behav of shell structures in vibro/ad	t very small scales, as necessary vior of aeroelastic structures and coustic environments.
– (U) S	\$4,747	Seek fundamental particulate mechanics knowledge the behavior of geomaterial systems. Investigate the increasing confining pressures, as occurs when impa	, including quantitative re e fundamental relationship acted by penetrating weap	lationships to describe the fun o of geomaterials undergoing ons.	ndamental mechanics governing high strain rate loadings with
- (U) \$1	16,094	Total			
(U) <u>FY 2001</u>	(\$ in Tho	<u>usands)</u> :			
– (U) S	\$5,289	Study thermomechanical behavior of advanced struct aerospace structural systems and coatings. Investigat composite materials for engine and hypersonic vehic	ctural materials, including ate the fracture behavior a cle applications.	micromechanics of high-tem nd thermomechanical behavio	perature composite materials for or of high temperature alloys and
– (U) S	\$3,149	Model development of materials for aerospace struc for the development of micro-electromechanical sys conduct research into the behavior of actuator/struct	tures, including dynamics tems. Develop fundament ure interaction for control	and mechanics of materials a tal understanding of the behav of shell structures in vibro/ac	t very small scales, as necessary vior of aeroelastic structures and coustic environments.
– (U)	\$870	Investigate and integrate material and structural beh the development of smart structures and MEMS. Do materials and structures	avior for future aerospace evelop fundamental under	structures such as multifunct standing of the energy dissip-	ional systems as necessary for ation mechanisms within these
– (U) S	\$9,308	Total			
Project 2302		Page	e 7 of 39 Pages	Exhibit	R-2A (PE 0601102F)
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BUDGET ACTIVITY     PE NUMBER AND TITLE     PROJECT       1 - Basic Research     0601102F Defense Research Sciences     2302       (U) B. <u>Project Change Summary - Description of Significant Changes</u> : Changes to this program since the President's Budget are due to higher priorities within the Science and Technology (S&T) Program.     (U) C. <u>Other Program Funding Summary:</u> (U) P. 60602017, Materials.     (U) PE 0602201F, Acrospace Flight Dynamics.     (U) DE 0603211F, Acrospace Structures.       (U) D. 60602203F, Acrospace Propulsion.     (U) D. <u>Acquisition Strategy:</u> Not Applicable.       (U) E. <u>Schedule Profile</u> : Not Applicable.	RDT&E BUDGET ITEM JUSTIFICATIO	DATE February 1999	
<ul> <li>(1) B. Project Change Summary - Description of Significant Changes: Changes to this program since the President's Budget are due to higher priorities within the Science and Technology (S&amp;T) Program.</li> <li>(1) C. Other Program Funding Summary: <ul> <li>(1) Related Activities:</li> <li>(1) PE 06022017; Materials.</li> <li>(1) PE 06022017; Acrospace Flight Dynamics.</li> <li>(1) PE 06022037; Acrospace Structures.</li> <li>(1) PE 06022037; Acrospace Structures.</li> <li>(1) PE 06022037; Acrospace Propulsion.</li> </ul> </li> <li>(1) D. Acquisition Strategy: Not Applicable.</li> <li>(1) F. Schedule Profile: Not Applicable.</li> </ul>	BUDGET ACTIVITY <b>1 - Basic Research</b>	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT S 2302
<ul> <li>(U) C. <u>Other Program Funding Summary:</u> <ul> <li>(U) <u>PE 0602102F</u>, Materials.</li> <li>(U) <u>PE 0602201F</u>, Aerospace Flight Dynamics.</li> <li>(U) <u>PE 0602201F</u>, Aerospace Structures.</li> <li>(U) <u>PE 0602202F</u>, Harman Systems Technology.</li> <li>(U) <u>PE 0602203F</u>, Aerospace Propulsion.</li> </ul> </li> <li>(U) <u>D. Acquisition Strategy</u>: Not Applicable.</li> <li>(U) <u>E. Schedule Profile</u>: Not Applicable.</li> </ul>	(U) B. <u>Project Change Summary - Description of Significant Changes</u> : C Science and Technology (S&T) Program.	Changes to this program since the President's Budget are d	ue to higher priorities within the
<ul> <li>(U) <u>Related Activities:</u> <ul> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0602201F, Aerospace Structures.</li> <li>(U) PE 0602203F, Aerospace Structures.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	(U) C. Other Program Funding Summary:		
Project 2302 Page 8 of 39 Pages Exhibit R-2A (PE 0601102F)	<ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0602202F, Human Systems Technology.</li> <li>(U) PE 0603211F, Aerospace Structures.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> </ul> (U) D. <u>Acquisition Strategy</u> : Not Applicable. (U) E. Schedule Profile: Not Applicable.		
Project 2302 Page 8 of 39 Pages Exhibit R-2A (PE 0601102F)	(b) E. <u>Schedule Prome</u> . Not Appleable.		
Project 2302 Page 8 of 39 Pages Exhibit R-2A (PE 0601102F)			
Project 2302 Page 8 of 39 Pages Exhibit R-2A (PE 0601102F)			
Project 2302 Page 8 of 39 Pages Exhibit R-2A (PE 0601102F)			
Project 2302 Page 8 of 39 Pages Exhibit R-2A (PE 0601102F)			
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Project 2302 Page 8 of 39 Pages Exhibit R-2A (PE 0601102F)			
	Project 2302	Page 8 of 39 Pages Exhibit	t R-2A (PE 0601102F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 1 - Basic Research			PE NUMBER AND TITLE 0601102F Defense Research Science						PROJECT S 2303		
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2303 Chemistry		24,185	25,826	27,536	24,641	24,805	25,262	25,707	27,701	Continuing	Continuing
20:00 Cheminary       23,00       23,00       24,04       24,00       25,00       27,00       27,00       Chinning       Columning         (U) A. Mission Description:       In the chemistry research program, knowledge and understanding is sought in chemical synthesis and reactivity, polymer chemistry, surface science, and molecular dynamics. The focus is on building the knowledge base required to develop new materials, biomimetic materials, electronicand and structural materials. Biomimetic materials, electronicand photonic materials, biomimetic materials, electronicand photonic materials, biomimetic materials, and environmentally safer materials. This program conducts novel synthesis and characterization of higher performance and lower cost nonmetallic and biomimetic materials for application as infrared sensors, and safer, more efficient fire suppressants and deicer/anti-ice materials, and mechanistic studies of biological corrosion and semiconductor nanolithography. The chemistry program also investigates effects of chemical and morphological structures on functional and mechanical properties of polymeric materials, and investigates pholecular energy release mechanisms and energy storage in metastable molecular systems to foster advances in laser weapons development and new chemical propellants.         (U)       FY 1998 (§ in Thousands):       - (U)       \$7,00       Studied chemical synthesis of compounds with tailored functional and structural properties for improved aerospace vehicle performance by investigating the long-term durability of polymers for optical signal processing and control of phased-array radar and laser radar.         - (U)       \$6,372       Investigated a chemical apropesto in prevention in aduminum aircraft components. Developed new va											
Project 2303				Page 9 of	39 Pages			Exhibi	t R-2A (PE	0601102F)	)

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	t)	February 1999			
BUDGET ACTIVITY	/		PE NUMBER AND TITLE		PROJECT
1 - Basic Re	search		0601102F Defense Res	earch Sciences	2303
– (U)	\$7,544	Study chemical synthesis of compounds with tailored investigating the long-term durability of polymers th applications and create functional polymers for opti	I functional and structural properties at operate in extreme environment cal signal processing and control of	es for improved aerosp s. Develop organic co of phased-array radar ar	ace vehicle performance by atings for aircraft protection nd laser radar.
– (U)	\$7,041	Investigate a chemical process at surfaces and interfa an atomistic model for corrosion prevention in alum extreme temperature environments.	aces to improve performance and n inum aircraft components. Develo	naintainability of Air F p new vapor phase lub	orce systems by formulating ricants for operations in
– (U)	\$10,561	Perform research on molecular-level energy transfer applications by investigating high-energy, metastable energy transfer in extreme aerospace environments t stability of molecular clusters for use as nanoscale se	, energy extraction, and chemical re e molecular states, and by develop o predict and interpret aircraft and ensors in aircraft, spacecraft, and air	eactivity research for a ing and applying methol spacecraft signatures. ir vehicles.	dvanced aerospace ods for simulating molecular Investigate the formation and
– (U)	\$680	Identified as a source for SBIR.	-		
– (U)	\$25,826	Total			
(U) <u>FY 200</u> – (U) – (U) – (U)	<u>00 (\$ in 1h</u> \$8,261 \$7,710 \$11,565	Study chemical synthesis of compounds with tailored investigating the long-term durability of polymers th applications and create functional polymers for option Investigate a chemical process at surfaces and interfa atomistic model for corrosion prevention in aluminum temperature environments. Perform research on molecular-level energy transfer, by investigating high-energy, metastable molecular s in extreme aerospace environments to predict and inter- mediate substant for a prevention in aluminum	I functional and structural properties at operate in extreme environments cal signal processing and control o ces to improve performance and m n aircraft components. Develop no energy extraction, and chemical re- tates, and by developing and apply repret aircraft and spacecraft signa	es for improved aerospa s. Develop organic coa f phased-array radar ar naintainability of Air Fo ew vapor phase lubrica eactivity research for a ring methods for simula atures. Investigate the	ace vehicle performance by atings for aircraft protection ad laser radar. orce systems by formulating an atts for operations in extreme dvanced aerospace applications ating molecular energy transfer formation and stability of
– (U)	\$27,536	Total	eran, spacecran, and an venicles.		
Project 2303		Page	10 of 39 Pages	Exhibit R	-2A (PE 0601102F)
			10		
BUDGET ACTIVITY     PE NUMBER AND TITLE     PEOLECT       1 - Basic Research     0601102F Defense Research Sciences     2303       (U) FV 2001 (\$ in Thousands):     - (U) \$7,146     Study chemical synthesis of compounds with tailored functional and structural properties for improved acrospace vehicle performance by investigating the long-term durability of polymers that operate in extreme environments. Create functional polymers for optical signal processing and control of phase-d-array radar and laser radar.     - (U) \$6,603     Investigate a chemical process at surfaces and interfaces to improve performance and maintainability of Air Force systems by formulating an admistic model for corrosion prevention in aluminum aircraft components.     - (U) \$10,892     Perform research evic cleargy transfer (c. energy extraction, and chemical reactivity research for advanced aerospace application: by investigating high-energy metasable molecular states, and by developing and applying methods for simulating molecular energy transfer in extreme earospace curvomments to prodict and interpret aircraft and spacecraft signatures. Investigate the formation and stability of molecular clusters for use as nanoscale sensors in aircraft, spacecraft, and air vehicles.     - (U) \$24,641     Total       (U) Related Activities:     - (U) \$26002102F, Materials.     - (U) \$26002102F, Materials.     - (U) \$26002102F, Materials.       - (U) PE 0002102F, Materials.     - (U) PE 0002102F, Materials.     - (U) PE 0002102F, Materials.       - (U) PE 0002102F, Materials.     - (U) PE 0002102F, Materials.       - (U) PE 0002102F, Materials.     - (U) PE 0002102F, Materials.       - (U) PE 0002102F, Materials.<	RDT	DATE February 1999			
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<ul> <li>(U) <u>FY 2001 (S in Thousands):</u> <ul> <li>(U) <u>S7,146</u> Study chemical synthesis of compounds with tailored functional and structural properties for improved aerospace vehicle performance by investigating the long-term durability of polymers that operate in extreme environments. Create functional polymers for optical signal processing and control of phased-array radar and laser radar.</li> <li>(U) <u>S7,146</u> Investigate a chemical process at surfaces and interfaces to improve performance and maintainability of Air Force systems by formulating an atomistic model for corrosion prevention in aluminum aircraft components.</li> <li>(U) <u>\$10,892</u> Perform research on molecular-level energy transfer, energy extraction, and chemical reactivity research for advanced aerospace applications by investigating high-energy, metastable molecular states, and by developing and applying methods for simulating molecular energy transfer, investigate the formation and stability of molecular clusters for use as nanoscale sensors in aircraft, spacecraft, and air vehicles.</li> <li>(U) <u>S24,641</u> Total</li> </ul> </li> <li>(U) <u>R elated Activities:</u> <ul> <li>(U) <u>R elated Activities:</u></li> <li>(U) <u>PE 0602102F</u>, Materials.</li> <li>(U) <u>PE 0602102F</u>, Materials.</li> <li>(U) <u>D Acquisition Strategy</u>: Not Applicable.</li> </ul> </li> <li>(U) <u>D Acquisition Strategy</u>: Not Applicable.</li> <li>(U) <u>B Schedule Profile</u>: Not Applicable.</li> </ul>	BUDGET ACTIVITY <b>1 - Basic Research</b>		PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT S 2303	
Project 2303 Page 11 of 39 Pages Exhibit R-2A (PE 0601102F)	<ul> <li>(U) <u>FY 2001 (\$ in The</u> - (U) \$7,146</li> <li>- (U) \$6,603</li> <li>- (U) \$10,892</li> <li>- (U) \$10,892</li> <li>- (U) \$24,641</li> <li>(U) B. <u>Project Change Str</u></li> <li>(U) C. <u>Other Program Fr</u></li> <li>(U) <u>Related Activities</u></li> <li>- (U) PE 0602102F</li> <li>- (U) PE 0602601F</li> <li>(U) D. <u>Acquisition Strate</u></li> <li>(U) E. <u>Schedule Profile</u>:</li> </ul>	ousands): Study chemical synthesis of compounds with tailored investigating the long-term durability of polymers th processing and control of phased-array radar and las Investigate a chemical process at surfaces and interfa atomistic model for corrosion prevention in aluminus Perform research on molecular-level energy transfer, by investigating high-energy, metastable molecular s in extreme aerospace environments to predict and inter- molecular clusters for use as nanoscale sensors in air Total <b>unmary - Description of Significant Changes:</b> Not A <b>unding Summary:</b> ; ; ; ; ; ; ; ; ; ; ; ; ;	I functional and structural properties for improved aero at operate in extreme environments. Create functional er radar. ces to improve performance and maintainability of Air m aircraft components. energy extraction, and chemical reactivity research for tates, and by developing and applying methods for sim terpret aircraft and spacecraft signatures. Investigate the craft, spacecraft, and air vehicles. Applicable.	space vehicle performance by polymers for optical signal Force systems by formulating an r advanced aerospace applications ulating molecular energy transfer he formation and stability of	
	Project 2303	Page	11 of 39 Pages Exhibit	R-2A (PE 0601102F)	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										DATE February 1999		
BUDGET ACTIVITY <b>1 - Basic Research</b>				PE N 060	UMBER AND 01102F [	title Defense F	Research	Science	S	F	PROJECT 2304	
COST <i>(\$ 1</i>	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
2304 Mathematical and Comp	uter Sciences	30,488	34,415	32,944	27,743	27,916	28,413	28,917	31,221	Continuing	Continuing	
2304       Mathematical and Computer Sciences       30,488       34,415       32,944       27,743       27,916       28,413       28,917       31,221       Continuing       Continuing         (U)       A. Mission Description:       This research focuses on mathematical modeling, simulation, and control of complex systems and provides analytical and computational tools for the design of aircraft, missiles, or other weapons; efficient production of large-scale, well documented computer programs and software; communication and information theory; signal processing; artificial intelligence in surveillance systems or independent weapons; reliability and maintainability; and the allocation of resources in logistics or operational activities using ideas from optimization and linear programming theories.       (U) <u>FY 1998 (\$ in Thousands)</u> ; <ul> <li>(U) <u>S10,113</u></li> <li>Studied physical mathematics, control and signal processing, and modeling of advanced materials including composites and smart skins in support of the Air Force's New World Vista (NWV) programs. Developed modeling, identification, control, and signal processing capabilities necessary for the integrated control of jet engines, aerodynamics, and combustor instabilities.</li> <li>(U) \$10,962</li> <li>Performed research on computer software and systems for battlespace information management. Expanded research in transportable agent technology to support defensive information warfare applications and real-time problem solving strategies to support dynamic planning and execution.</li> <li>(U) \$9,413</li> <li>Investigated computational science for improved design and simulation of advanced materials including composites and smart skins in support of the Air Force's NWV programs. Developed digorithms</li></ul>												
Project 2304				Page 12 of	f 39 Pages			Exhibi	t R-2A (PE	0601102F)		

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	RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DA	February 1999
BUDGET ACTIVIT	Ϋ́		PE NUMBER AND TITLE		PROJECT
1 - Basic R	esearch		0601102F Defense Researc	ch Sciences	2304
– (U)	\$10,052	Investigate computational science for improved design optimization design strategies with higher order, tim components. Develop algorithms incorporating activ	gn and simulation of advanced aerospac e accurate flow solvers for improved de ve control procedures.	e systems. Integra sign of jet engines	ate new multidisciplinary and other aerospace
– (U)	\$906	Identified as a source for SBIR.			
– (U)	\$34,415	Total			
(U) <u>FY 20</u>	000 (\$ in The	<u>busands)</u> :			
- (U)	\$12,200	Study physical mathematics, control and signal processupport of the Air Force's New World Vista (NWV) necessary for the integrated control of jet engines, are Perform research on computer software and systems	essing, and modeling of advanced mater programs. Develop modeling, identifica rodynamics, and combustor instabilities for battlespace information management	rials including con tion, control, and a. b. Expand researc	nposites and smart skins in signal processing capabilities
(0)	¢11,001	technology to support defensive information warfare execution.	applications and real-time problem solv	ving strategies to s	upport dynamic planning and
– (U)	\$9,883	optimization design strategies with higher order, time components. Develop algorithms incorporating activ	gn and simulation of advanced aerospace e accurate flow solvers for improved des re control procedures.	e systems. Integra sign of jet engines	and other aerospace
- (U)	\$32,944	Total			
(U) <u>P120</u> - (U)	\$11,228	Study physical mathematics, control and signal processupport of the Air Force's NWV programs. Develop integrated control of jet engines, aerodynamics, and statements of the statement of the sta	essing, and modeling of advanced mater modeling, identification, control, and sig combustor instabilities.	rials including con gnal processing ca	nposites and smart skins in pabilities necessary for the
– (U)	\$8,884	Perform research on computer software and systems technology to support defensive information warfare execution.	for battlespace information managemer applications and real-time problem solv	nt. Continue reseation ving strategies to s	rch in transportable agent upport dynamic planning and
– (U)	\$7,631	Investigate computational science for improved design optimization design strategies with higher order, time components. Develop algorithms incorporating active	n and simulation of advanced aerospace e accurate flow solvers for improved des re control procedures.	e systems. Integra sign of jet engines	and other aerospace
– (U)	\$27,743	Total			
Project 2304		Page	13 of 39 Pages	Exhibit R	-2A (PE 0601102F)
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RDT&E BUDGET ITEM JUSTIFICATI	ON SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY <b>1 - Basic Research</b>	PE NUMBER AND TITLE 0601102F Defense Research Scient	ces 2304
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Science and Technology (S&T) Program.	Changes to this program since the President's Budget ar	e due to higher priorities within the
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0602702F, Command, Control, and Communications.</li> <li>(U) PE 0603728F, Advanced Computer Technology.</li> </ul>		
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 2304	Page 14 of 39 Pages Exh	ibit R-2A (PE 0601102F)

RDT	&E BUDGET ITI	EM JUS	TIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 1 - Basic Research				PE N <b>06</b>	UMBER AND 01102F	title Defense F	Research	Science	S	F	PROJECT 2305
COST <i>(</i> \$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2305 Electronics		19,898	23,399	24,429	20,287	20,603	20,978	21,365	23,001	Continuing	Continuing
Construction       Construction <thconstructin< th="">       Constructin       Co</thconstructin<>									on ectronic d in .log signal cations. le signal signal age on tions.		
Project 2305				Page 15 of	f 39 Pages			Exhibi	t R-2A (PE	0601102F)	

	RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	February 1999
BUDGET ACTIVIT	Y esearch	F	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT
- (U)	\$3,945	Investigate superconducting and nanoscopic materials processing and denser memory. Create high current, space platforms.	s, devices, and applications for advanced communicat high temperature, superconducting materials for pow	ions and higher speed signal er generation and storage on
– (U)	\$616	Identified as a source for SBIR.		
– (U)	\$23,399	Total		
(U) <u>FY 20</u>	00 (\$ in The	<u>usands)</u> :		
– (U)	\$13,167	Study semiconductor electronic materials, advanced de Investigate methods to electronically tailor compound environments.	evices, interface control, and stability for improved la semiconductors and examine high-temperature electr	ser and detector applications. onics for use in hostile
– (U)	\$7,034	Seek fundamental understanding of optoelectronic information processing, and computing; and examine novel micro-	ormation processing and storage. Investigate advance lasers and ultra-high density information storage and	ed communications, signal retrieval.
– (U)	\$4,228	Investigate superconducting and nanoscopic materials processing and denser memory. Create high current, I space platforms.	, devices, and applications for advanced communication high temperature, superconducting materials for power	ons and higher speed signal er generation and storage on
– (U)	\$24,429	Total		
(U) FY 20	01 (\$ in The	usands):		
- (U)	\$11,395	Study semiconductor electronic materials, advanced de electronically tailor compound semiconductors and ex	evices, and stability for improved detector application amine high-temperature electronics for use in hostile	s. Investigate methods to environments.
– (U)	\$4,634	Examine novel micro-lasers and ultra-high density inf	formation storage and retrieval.	
– (U)	\$4,258	Investigate superconducting and nanoscopic materials processing and denser memory. Create high current, I space platforms.	, devices, and applications for advanced communication high temperature, superconducting materials for power	ons and higher speed signal er generation and storage on
– (U)	\$20,287	Total		
Project 2205		Daras	16 of 30 Pagas Evhibit	R-24 (PE 0601102E)
110/001 2303		ruge I	16	

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999		
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT S 2305	
(U) B. Project Change Summary - Description of Significant Changes: Not A	Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602204F, Aerospace Avionics.</li> <li>(U) PE 0602702F, Command, Control, and Communications.</li> <li>(U) PE 0603728F, Advanced Computer Technology.</li> </ul>			
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2305 Page	17 of 39 Pages Exhibit	t R-2A (PE 0601102F)	

RDT <i>{</i>	LE BUDGET ITI	EM JUS	TIFICAT	ION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999	
BUDGET ACTIVITY <b>1 - Basic Research</b>	PE N <b>06</b>	UMBER AND 01102F	title Defense F	Research	Science	PROJECT 2306						
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	00 FY 2001 ate Estimate	00 FY 2001 ate Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2306 Materials		10,116	12,122	13,257	13,380	13,556	13,773	14,093	15,099	Continuing	Continuin	
improving the performance, toughness, fatigue resistance composites, metal and cerar processing methods comple further increase thrust-to-we related to high temperature (U) FY 1998 (\$ in Th - (U) \$5,152 - (U) \$4,032 - (U) \$4,032 - (U) \$932 - (U) \$10,116 (U) FY 1999 (\$ in Th - (U) \$6,373 - (U) \$4,248	<ul> <li>in resolution rocuses on a cost, and reliability of se, and corrosion resistan nic matrix composites, a ments research on matereight ratio of engines, de strength, toughness, fati</li> <li><u>ousands</u>):</li> <li>Performed fundamenta Investigated coupled to and ultra-high temper</li> <li>Performed research or systems for very-high Studied life and reliat Investigated free-volu Total</li> <li><u>nousands</u>):</li> <li>Perform fundamental Investigate coupled the and ultra-high temper</li> </ul>	tal studies of thermal and advanced rials properti- evelop impro- igue, and envi- tal studies of thermal and rature materi n metallic systent oility of poly ime effect in studies of ve- nermal and n rature materi metallic systent temperature	ery-high tem hery-high tem hery hery-high tem hery-high tem hery	emperature, and a such as alum oals of this ce vehicle s conditions. emperature, stability of v based on can agines and a s and invest posities by res moisture ab	non-metallic very-high terr rbides for ro- irframe appl tigated funct sorption metallic rery-high terr rbides for ro- irframe appl tigated funct sorption metallic r ery-high terr rbides for ro- rame application	h studies a b aterials. Em carbide, silio to increase terials, and c c materials, and c c materials, and c c materials for perature oxi- chanisms and naterials for perature oxi- cket propuls ations. Stud- onally gradie	road range of phasis is on con nitride, a the operating control or eli or air-breath ide composi- ion applicati- ided therma- tent structures e evaluation d rates in po- air-breathin de compositu- ion applicati- y thermal an ent structures	of material p refractory a and carbon/c g temperatur minate adva ing engine a ites and eute ons. al and mecha es for thermat techniques o lymer matrix g engine and es and eutec ons. d mechanica s for thermal	and space vel crics for engine arbon. Rese re of engine r nce material and space vel ctics for enginal barrier coa an adhesive-ba composites I space vehic tics for enginal stability of barrier coat	h as strengt etallics, poly arch in new naterials wh reliability is nicle applica ine blade ap y of refractor tings. onded struc le application te blade app refractory r ings.	h, ymer hich will ssues ations. plications ory metal tures. ons. lications netal	
D : ( 2207												

RD	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT						
1 - Basic Researd	h	0601102F Defense Research Scient	ces 2306						
- (U) \$1,181	Study life and reliability of polymeric composites b	by researching non-destructive evaluation techniques	on adhesive-bonded structures.						
	Investigate free-volume effect in controlling moist	ure absorption mechanisms and rates in polymer matr	ix composites.						
-(U) \$32	) Identified as a source for SBIR.								
-(0) \$12,122	lotal								
(U) FY 2000 (\$ in	Thousands):								
– (U) \$7,159	Perform fundamental studies of very-high temperat	ture, non-metallic materials for air-breathing engine a	nd space vehicle applications.						
	Investigate coupled thermal and mechanical stabilit	y of very-high temperature oxide composites and eut	ectics for engine blade applications						
	and ultra-high temperature materials systems based	l on carbides for rocket propulsion applications.	a al atabilitar of rafas atoms matal						
-(0) \$4,772	systems for very-high temperature applications and	in annual applications. Study thermal and mechanic investigate functionally gradient structures for therm	al barrier coatings						
- (U) \$1.326	Study life and reliability of polymeric composites b	by researching non-destructive evaluation techniques of	n adhesive-bonded structures.						
	Investigate free-volume effect in controlling moistu	ire absorption mechanisms and rates in polymer matri	x composites.						
- (U) \$13,257	Total								
(II) EV 2001 (\$ in	Chousen de)								
$(0) \frac{F12001(3)m}{-(10)}$	<u>Perform fundamental studies of very-high temperat</u>	ture non-metallic materials for air-breathing engine a	nd space vehicle applications						
(0) \$7,22.	Investigate coupled thermal and mechanical stabilit	ty of very-high temperature oxide composites and eut	ectics for engine blade applications						
	and ultra-high temperature materials systems based	on carbides for rocket propulsion applications.							
- (U) \$4,810	Perform research on metallic systems for engines a	nd airframe applications. Study thermal and mechani	cal stability of refractory metal						
	systems for very-high temperature applications and	l investigate functionally gradient structures for therm	al barrier coatings.						
- (U) \$1,339	Study life and reliability of polymeric composites b Investigate free volume effect in controlling moistu	by researching non-destructive evaluation techniques of the second rates in polymer matrix	n adhesive-bonded structures.						
- (U) \$13.380	Total	the absorption meenanisms and rates in porymer math	x composites.						
(0) \$10,000									
D. 1. (2007		10 (20 D							
Project 2306	Pag	ge 19 of 39 Pages Exh	DIT R-2A (PE 0601102F)						
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RDT&E BUDGET ITEM JUSTIFICATIO	DATE February 1999		
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT 2306	
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : No	t Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0603211F, Aerospace Structures.</li> <li>(U) PE 0708011F, Manufacturing Technology.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> </ul> (U) D. <u>Acquisition Strategy</u> : Not Applicable. (U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2306 Pag	ge 20 of 39 Pages Exhibi	it R-2A (PE 0601102F)	
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										bruary 1	999
BUDGET ACTIVITY 1 - Basic Researc	h	PE N <b>06</b>	UMBER AND 01102F	TITLE Defense F	Research	Science	s	PROJECT			
COST	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost			
2307 Fluid Mechanics 11,094 7,189					9,538	9,589	9,776	10,064	10,744	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Descrip</u> internal fluid dynamics. aerospace vehicles. Rese flow control concepts and flows, prediction of real p of unsteady and separated instabilities in gas turbin</li> <li>(U) <u>FY 1998 (\$ in 7</u> - (U) \$2,262</li> <li>(U) \$5,467</li> <li>(U) \$5,467</li> <li>(U) \$3,365</li> <li>(U) \$11,094</li> <li>(U) <u>FY 1999 (\$ in 7</u> - (U) \$1,610</li> <li>(U) \$1,610</li> <li>(U) \$3,342</li> <li>(U) \$2,048</li> <li>(U) \$189</li> <li>(U) \$7,189</li> </ul>	<b>otion and Budget Item Ju</b> This research provides fur         carch provides an understand         d predictive methods to exigas effects in high-speed fl         d flows, thrust vectoring and         e engines, flow-structure i <u>Conducted external aerood</u> Developed fluid/structuration         to reduce the size and we         Performed turbulence and         systems (MEMS) actuated         Conducted internal flow         MEMS devices for turbin         Total <u>Conduct external aerody</u> Develop fluid/structural i         reduce the size and weight         Performed turbulence and systems (MEMS)         Develop fluid/structural flow         MEMS devices for turbin         Total	stification: idamental kr nding of key pand current light, control nd high lift of nteractions i dynamics and al interaction regist of new d flow control research to in the engine con namics and l interaction n th of new hy low control rems and invise search to im e control and SBIR.	Research in nowledge, too fluid flow p t flight perfor and predict concepts asso in both exter d hypersonica of research to ors for micro improve the ntrol and Lar hypersonics limodels based personic air research to e restigate the p prove the pe d LES method	volves turbu ols, data, co ohenomena, rmance bour ion of turbu ociated with nal and inte es basic rese ed on flow fi air vehicles. o enhance a -air vehicle performance rge Eddy Sir basic researd on flow fiel vehicles. enhance air use of MEM rformance a odology for t	alence predic ncepts, and r improves the ndaries. Res lence in fligl enhanced pernal flows, a arch for imp field interact ir vehicle state systems and e and reliability mulation (LH ch for impro ld interaction vehicle stabi IS devices of nd reliability turbomachin	etion and cor methods for eoretical mo- search includ nt vehicles, p erformance a nd transport roved flight ion research. ability, perfor investigated lity/maintain ES) methodo ved flight pe n research. I lity, perform n swept wing y/maintainab ery flows.	atrol, unstead improving the dels for aero es the devel- propulsion sy and maneuver phenomena performance Investigate rmance, and the use of M ability of ain logy for turb rformance a nvestigate nu- ance, and co g air vehicles ility of airbr	dy and separ ne efficiency odynamic pre- opment of co- ystems, aero- erability, hea in structura e and control ed novel con- control. De- MEMS device rbreathing pro- pomachinery and control o ovel concept ontrol. Deve s. reathing pro-	ated flows, h y, effectivene ediction and omputational optic applic at transfer an 1 materials p 1 of Air Forc cepts for hyp eveloped mic ces on swept ropulsion syste elop MEMS pulsion syste t R-2A (PE	aypersonics, ess, and relia design, and l methods for ations, the d d compressor rocessing. e air vehicle personic flow croelectrome wing air veh stems. Deven air vehicle sy onic flow co actuators an ms. Develo	and bility of originates or complex ynamics or e systems. v control echanical nicles. eloped ystems. ontrol to d sensors p MEMS
F10/ect 2307				ruge 21 0]	Jy ruges				L IN-27 (FE	0001102F)	

RD	DATE February 1999		
BUDGET ACTIVITY <b>1 - Basic Researc</b>	h	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT <b>2307</b>
<ul> <li>(U) <u>FY 2000 (\$ in 7</u></li> <li>(U) \$2,294</li> <li>(U) \$4,762</li> <li>(U) \$2,919</li> <li>(U) \$9,975</li> </ul>	<u>Thousands</u> ): Conduct external aerodynamics and hypersonics basic re Develop fluid/structural interaction models based on flor reduce the size and weight of new hypersonic air vehicle Perform turbulence and flow control research to enhance systems (MEMS) actuators and sensors for micro-air vel Conduct internal flow research to improve the performa devices for turbine engine control and Large Eddy Simu Total	esearch for improved flight performance and control o w field interaction research. Investigate novel concep es. e air vehicle stability, performance, and control. Deve hicle systems and investigate the use of MEMS device nce and reliability/maintainability of airbreathing prop lation (LES) methodology for turbomachinery flows.	f Air Force air vehicle systems. ts for hypersonic flow control to elop microelectromechanical es on swept wing air vehicles. pulsion systems. Develop MEMS
(U) <u>FY 2001 (\$ in 7</u> - (U) \$2,262	<u>Thousands</u> ): Conduct external aerodynamics and hypersonics basic re Develop fluid/structural interaction models based on flo	esearch for improved flight performance and control o w field interaction research. Investigate novel concep	f Air Force air vehicle systems. ts for hypersonic flow control to
- (U) \$4,399 - (U) \$2,877	Perform turbulence and flow control research to enhance for micro-air vehicle systems and investigate the use of I Conduct internal flow research to improve the performa daviage for turbing anging control and LES methodology	e air vehicle stability, performance, and control. Deve MEMS devices on swept wing air vehicles. nce and reliability/maintainability of airbreathing prop of for turbomaching flows.	elop MEMS actuators and sensors pulsion systems. Develop MEMS
– (U) \$9,538	Total	for turboinachinery nows.	
Project 2307	Page	22 of 39 Pages Exhibi	t R-2A (PE 0601102F)
		22	

RDT&E BUDGET ITEM JUSTIFICATIO	February 1999		
BUDGET ACTIVITY <b>1 - Basic Research</b>	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT S 2307	
(U) B. Project Change Summary - Description of Significant Changes: Not	Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0603211F, Aerospace Structures.</li> </ul>			
(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2307 Pag	te 23 of 39 Pages Exhibi	t R-2A (PE 0601102F)	
	23		

RDT8	<b>E BUDGET ITI</b>	EM JUS	TIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY <b>1 - Basic Research</b>				PE N <b>06(</b>	UMBER AND 01102F	TITLE Defense F	Research	Science	s	F	PROJECT 2308
COST <i>(\$ 1</i>	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2308 Propulsion	2308 Propulsion 12,757 14,629 17,263 16,553 16,633 16,950 17,447							17,447	18,755	Continuing	Continuing
2308         Propulsion         12,757         14,629         17,263         16,633         16,950         17,447         18,755         Continuing         Continuing           (U) A. Mission Description:         Efforts include space power and propulsion, airbreathing propulsion, and propulsion diagnostics. Research is focused on the efficient utilization of energy in airbreathing engines and chemical an non-chemical rockets. Research is organized into the areas of chemically reacting flow, non-chemical energetic systems include plasma and beamed energy propulsion for orbit raising space missions and efficient ultra-high energy techniques for space-based energy utilization. Thermal management of space-based power and propulsion systems will be addressed.         (U) FY 1998 (§ in Thousands):         – (U) \$5,922         Performed research on space and rocket propulsion and power through the development of supercritical combustion models for rocket propulsion and model predictions of mini-satellite propulsion and performance for high precision clusters of cooperating autonomous microsatellite operations. Performed experimental and numerical studies of high altitude ultraviolet (UV) and infrared (IR) signatures to protect space assets.           - (U) \$1,478         Investigated propulsion diagnostics of new propulsion system concepts through that reduction and interpretation approaches. Extended diode-laser spectroscopic technique for on-board control of propulsion system operation and performance.           - (U) \$1,478         Investigated propulsion diagnostics of new propulsion system concepts through that reduction and interpretation approaches. Extended diode-laser spectroscopic technique for on-board control of propulsion system operation and performance.									ch is focused reacting flow es which tran issions and of sed. mbustion mode of cooperatir and infrared bustion produ- to Studied the etation appro- position mode of cooperatir res to protec ustion products Study the con		

	RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVIT	Y		PE NUMBER AND TITLE	PROJECT
1 - Basic Re	esearch		0601102F Defense Research Science	es 2308
– (U)	\$756	Investigate propulsion diagnostics of new propulsion laser spectroscopic technique for on-board control of	system concepts through data reduction and interpret propulsion system operation and performance.	ation approaches. Extend diode-
– (U)	\$386	Identified as a source for SBIR.		
– (U)	\$14,629	Total		
(U) <u>FY 20</u>	<u>00 (\$ in The</u>	pusands):		
– (U)	\$6,906	Perform research on space and rocket propulsion and propulsion and model predictions of mini-satellite pr microsatellite operations. Perform experimental and assets.	power through the development of supercritical comb opulsion and performance for high precision clusters of numerical studies of high altitude ultraviolet (UV) an	oustion models for rocket of cooperating autonomous d (IR) signatures to protect space
– (U)	\$9,441	Study airbreathing combustion for propulsion system turbine engines and explore supercritical fuel behavi- between turbulence and liquid hydrocarbon fuel inject	s for hypersonic flight capability by examining combu or under high temperatures and pressure conditions. S ction in gas turbine and scramiet engines.	stion product formation in gas Study the coupling mechanisms
– (U)	\$916	Investigate propulsion diagnostics of new propulsion laser spectroscopic technique for on-board control of	system concepts through data reduction and interpret propulsion system operation and performance.	ation approaches. Extend diode-
– (U)	\$17,263	Total		
(U) <u>FY 20</u>	01 (\$ in The	ousands):		
– (U)	\$6,992	Perform research on space and rocket propulsion and propulsion and model predictions of mini-satellite pr microsatellite operations. Perform experimental and	power through the development of supercritical comb opulsion and performance for high precision clusters of numerical studies of high altitude UV and IR signature	oustion models for rocket of cooperating autonomous res to protect space assets.
– (U)	\$4,906	Study airbreathing combustion for propulsion system explore supercritical fuel behavior under high temper hypersonic propulsion.	s for hypersonic flight capability by examining combu- rature and pressure conditions. Examine the impact of	stion product formation and f weakly ionized flows on
– (U)	\$4,655	Study the coupling mechanisms between turbulence models for turbulence/chemistry interactions affectin	and liquid hydrocarbon fuel injection in gas turbine en g combustor system operations and performance.	gines. Investigate reduced
– (U)	\$16,553	Total		
Project 2308		Page	25 of 39 Pages Exhibi	t R-2A (PE 0601102F)

RDT&E BUDGET ITEM JUSTIFIC	DATE February 1999	
BUDGET ACTIVITY <b>1 - Basic Research</b>	PE NUMBER AND TITLE 0601102F Defense Research S	PROJECT 2308
(U) B. <u>Project Change Summary - Description of Significant Chan</u>	<b>ges:</b> Not Applicable.	
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0603211F, Aerospace Structures.</li> </ul>		
(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 2308	Page 26 of 39 Pages	Exhibit R-2A (PE 0601102F)
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RD	<b>F&amp;E BUDGET IT</b>	EM JUS	<b>TIFICAT</b>	ION SH	IEET (R·	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY <b>1 - Basic Researc</b>	h			PE NI <b>060</b>	UMBER AND <b>D1102F</b>	TITLE Defense F	Research	Science	s	F	PROJECT 2310
COST	COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 Estimate								FY 2005 Estimate	Cost to Complete	Total Cos
2310 Atmospheric Science	S	5,584	5,544	5,661	5,082	5,106	5,207	5,365	5,721	Continuing	Continuir
(U) FY 1999 (\$ in (U) FY 1999 (\$ in (U) FY 1999 (\$ in (U) $FY 1998 (S Structure) = 0$ (U) $FY 1999 (S Structure) = 0$	of processes that determi and optical/infrared (IR) to opment of models for spec- id their impacts on optical . Major research efforts for structure of the atmosphere <u>Fhousands</u> ): Improved space weat field (IMF), and the of Community Modelin Analyzed atmospheric estimate the impacts ambient atmospheric p solar activity which of Total	ther specifica and IR weap ocus on ionos re. ther specifica g Center to b ic physics to r of weather lin vorticity fielo physics to enl disrupt global	re and varia emissivity al redicting we pon systems, spheric dyna tion and fore etosphere by ring researcl understand <i>a</i> nitations on ds that affec nance global radio comm	bility of the bility of the ll affect the p eather and ot and on und mics, mesos ecast models using satell hers directly and exploit t the employn t optical atm surveillance nunications a	earth's atmo performance ther atmosphe erstanding the scale meteore s, and studied lites to analy y in touch wi he aerospace ment of dire- nospheric em e capability and space su	d the couplin the here. Atm of Air Force are conditioned dynamics ology, trigged d the coupling ze the IMF at the DoD to e environment cted energy tissions obse and investig rveillance.	and interoro nospheric pro- e systems. Fons. Emphas and structur red and natur ng between the and solar wir iser commun- nt and impro- weapons. In rved from or ated ionosph	togy: This operties sucl Research inc sis is placed e of the iono ral lightning me solar win ad ions. Dev hity. ved atmospl vestigated g bit. ere phenom	h as wind, de ludes new m on understar osphere that g, cloud pred d, the interpl veloped a Co heric radiativ ravity wave ena. Examin	ensity, cloud easurement ading fundar affect comm iction, and r lanetary mag bordinated ve transfer m interactions ned signature	Is and mental nunication nodels gnetic nodels to with es of
- (U) \$1,658	<u>Fhousands</u> ): Improve space weath magnetosphere by us	er specificatio	on and forect to analyze the DoD	ast models, and s	and study th solar wind ic	e coupling b ons. Develop	etween the s	olar wind, tl ted Commu	he IMF, and nity Modelir	the earth's ng Center to	bring
- (U) \$1,658 - (U) \$1,132	<ul> <li><u>Chousands</u>):</li> <li>Improve space weath magnetosphere by using researchers directly in Analyze atmospheric estimate the impacts of ambient atmospheric</li> </ul>	er specification ing satellites in touch with the physics to un of weather lin vorticity field	on and forec to analyze th he DoD use aderstand an nitations on ls that affect	ast models, ne IMF and s r community d exploit the the employr coptical atm	and study th solar wind ic y. e aerospace of nent of direct ospheric em	e coupling b ons. Develop environment cted energy v issions obser	etween the s o a Coordina and improve veapons. In ved from or	olar wind, tl ted Commu ed atmosphe vestigate gra bit.	he IMF, and nity Modelir eric radiative wity wave in	the earth's ng Center to transfer mo teractions w	bring dels to rith

RDT8	DATE February 1999		
BUDGET ACTIVITY 1 - Basic Research		PE NUMBER AND TITLE 0601102F Defense Research Scienc	PROJECT es 2310
- (U) \$2,608 - (U) \$146 - (U) \$5,544	Study ionospheric physics to enhance global surveilla activity which disrupt global radio communications a Identified as a source for SBIR. Total	ance capability and investigate ionosphere phenomer and space surveillance.	a. Examine signatures of solar
(U) <u>FY 2000 (\$ in The</u> – (U) \$1,739 – (U) \$1,187 – (U) \$2,735 – (U) \$5,661	<u>busands</u> ): Improve space weather specification and forecast mo (IMF), and the earth's magnetosphere by using satell Modeling Center to bring researchers directly in touc Analyze atmospheric physics to understand and expl- estimate the impacts of weather limitations on the err ambient atmospheric vorticity fields that affect optica Study ionospheric physics to enhance global surveilla activity which disrupt global radio communications a Total	dels, and study the coupling between the solar wind, ites to analyze the IMF and solar wind ions. Develo th with the DoD user community. oit the aerospace environment and improved atmosph poloyment of directed energy weapons. Investigate g al atmospheric emissions observed from orbit. ance capability and investigate ionosphere phenomer and space surveillance.	the interplanetary magnetic field p a Coordinated Community neric radiative transfer models to ravity wave interactions with a. Examine signatures of solar
(U) <u>FY 2001 (\$ in The</u> – (U) \$1,222 – (U) \$1,168 – (U) \$2,692 – (U) \$5,082	<u>busands</u> ): Improve space weather specification and forecast mo magnetosphere by using satellites to analyze the IMF researchers directly in touch with the DoD user com Analyze atmospheric physics to understand and expl- estimate the impacts of weather limitations on the em ambient atmospheric vorticity fields that affect optica Study ionospheric physics to enhance global surveilla activity which disrupt global radio communications a Total	dels, and study the coupling between the solar wind, and solar wind ions. Develop a Coordinated Comm nunity. oit the aerospace environment and improved atmosph poloyment of directed energy weapons. Investigate g al atmospheric emissions observed from orbit. ance capability and investigate ionosphere phenomer and space surveillance.	the IMF, and the earth's nunity Modeling Center to bring neric radiative transfer models to ravity wave interactions with a. Examine signatures of solar
Project 2310	Page	28 of 39 Pages Exhit	bit R-2A (PE 0601102F)

RDT&E BUDGET ITEM JUSTIFICATIO	DATE February 1999		
BUDGET ACTIVITY <b>1 - Basic Research</b>	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT S 2310	
(U) B. Project Change Summary - Description of Significant Changes: Not	Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0305160F, Defense Meteorological Satellite Program.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0603220C, Surveillance, Acquisition, Tracking, and Kill.</li> </ul>			
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2310 Pag	e 29 of 39 Pages Exhibi	t R-2A (PE 0601102F)	
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	RDT&E BUDGET IT	EM JUS	TIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 1 - Basic Res	search			PE N <b>06</b>	UMBER AND 01102F	title Defense F	Research	Science	S	F	PROJECT 2311
COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 Estimate								FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2311 Space Science	2311         Space Sciences         5,103         6,805         8,625         8,541         8,540         8,691         8,932							9,514	Continuing	Continuing	
(U) A. <u>Mission D</u> advanced Air Force forecasting techniq the earth's magneto (U) FY 1999 - (U) - (U) - (U) - (U) (U) FY 1999 - (U)	2011 Optic Control       0.000       0.001 </td										
– (U)	<ul> <li>\$2,670</li> <li>\$2,670</li> <li>Study the particle and evaluation of the solar wind shock determines of the solar wind shock determines</li></ul>	nces. I interplaneta valuate techn ection algorit	ary magnetic niques to stu hms.	c field prope dy solar sou	erties of the surce regions	solar wind w and infer the	hich transpo magnetic st	orts solar dis ructures of i	turbances to nterplanetary	the Earth's y disturbance	es. Test
Project 2311				Page 30 of	f 39 Pages			Exhibi	t R-2A (PE	0601102F)	

	RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)		DATE February 1999
BUDGET ACTIVITY	Y		PE NUMBER AND TITLE		PROJECT
1 - Basic Re	esearch		0601102F Defense Resear	ch Science	s 2311
– (U)	\$2,003	Study magnetospheric and radiation belt processes to criteria for substorm onset and model rapid variation coefficients estimated from electric field propagation	b eliminate operational deficiencies, and s in the interaction between the solar was studies.	d fluid and part vind and magne	cle dynamics to determine tosphere using diffusion
– (U)	\$179	Identified as a source for SBIR.			
– (U)	\$6,805	Total			
(U) <u>FY 200</u>	00 (\$ in The	<u>busands)</u> :			
– (U)	\$2,542	Analyze physics of solar magnetic fields, flares, and solar disturbances on near-Earth space to predict the be related to disturbances.	coronal mass ejections to provide a phy- state of the interplanetary medium usir	sical basis for p ng solar magnet	redictive models of the effects of ic field and coronal data that can
– (U)	\$3,476	Study the particle and interplanetary magnetic field p magnetosphere and evaluate techniques to study sola solar wind shock detection algorithms.	properties of the solar wind which trans r source regions and infer the magnetic	ports solar distr structures of ir	urbances to the Earth's atterplanetary disturbances. Test
– (U)	\$2,607	Study magnetospheric and radiation belt processes to criteria for substorm onset and model rapid variation coefficients estimated from electric field propagation	eliminate operational deficiencies, and s in the interaction between the solar w studies.	l fluid and parti ind and magnet	cle dynamics to determine cosphere using diffusion
– (U)	\$8,625	Total			
(U) <u>FY 200</u>	01 (\$ in The	busands):			
– (U)	\$2,749	Analyze physics of solar magnetic fields, flares, and solar disturbances on near-Earth space to predict the be related to disturbances.	coronal mass ejections to provide a phy- state of the interplanetary medium usir	sical basis for p ng solar magnet	redictive models of the effects of ic field and coronal data that can
– (U)	\$3,759	Study the particle and interplanetary magnetic field p magnetosphere and evaluate techniques to study sola solar wind shock detection algorithms.	properties of the solar wind which trans r source regions and infer the magnetic	ports solar distr structures of ir	urbances to the Earth's atterplanetary disturbances. Test
– (U)	\$2,033	Study magnetospheric and radiation belt processes to criteria for substorm onset and model rapid variation coefficients estimated from electric field propagation	eliminate operational deficiencies, and s in the interaction between the solar w studies.	I fluid and parti ind and magnet	cle dynamics to determine cosphere using diffusion
– (U)	\$8,541	Total			
Project 2311		Page	31 of 39 Pages	Exhibit	: R-2A (PE 0601102F)
			31		

RDT&E BUDGET ITEM JUSTIFICATION	<b>February 1999</b>		
BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT 2311	
(U) B. Project Change Summary - Description of Significant Changes: Not	Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0302101F, Geophysics.</li> <li>(U) PE 0602702F, Command, Control, and Communications.</li> <li>(U) PE 0603410F, Space System Environmental Interactions.</li> </ul>			
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2311 Page	32 of 39 Pages Exhib	τκ-2Α (PE 0601102F)	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999	
BUDGET ACTIVITY       PE NUMBER AND TITLE         1 - Basic Research       0601102F Defense Research Science									F	PROJECT 2312
COST (\$ In Thousands)	COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 								Cost to Complete	Total Cost
2312 Biological Sciences	2312         Biological Sciences         10,933         13,024         13,484         12,228         12,186         12,483         12,763							13,642	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Description</u>: This project Understanding how microbes degrade Air preventing exposure to hazards due to Air agents produce toxic effects will enable the materials and systems. Basic research in performance due to jet-lag and shift-work (U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$6,638 Studied tox associated techniques</li> <li>(U) \$1,221 Performed</li> <li>(U) \$10,933 Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>: <ul> <li>(U) \$10,933 Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>: <ul> <li>(U) \$10,933 Total</li> </ul> </li> <li>(U) \$5,065 Investigate effects of n</li> <li>(U) \$1,283 Perform residence of the state of the</li></ul>	ect consists of two rese Force chemicals will of Force operations. Like the development of safe neuroscience and chro- transfer operations, and icology of biohazardous with the inhalation of J for modifying microbia d biological mechanism cts of night operations research in mechanism ology of biohazardous with the inhalation of J for modifying microbia biological mechanism ight operations and jet search in mechanisms of s a source for SBIR.	arch areas: I enable the de cewise, know ty assessmen nobiology w the loss of 1 us agents to P-8 jet fuel; al enzyme cans responsib and jet lag as of animal agents to in P-8 jet fuel; al enzyme cans is of animal	biodegradation evelopment of vledge of the nt strategies vill result in n life and aircr investigate r and develop apacity to en ole for circad on military p sensing system vestigate mod and develop apacity to en e for circadia ary personna nsing system	on and the to of efficient a e mechanism and technolo new strategie raft due to st molecular an bed mathema bersonnel. ems through objecular and pomathematic gineer bio-c an rhythmici el. ns through in	bxicology of and cost-effe as by which ogies to ensu es to prevent ress, inatten d biochemical atalysis of re- city by exami- a investigation biochemical cal models to atalysis of re- ty by exami- nvestigation	biohazards a ctive strategi Air Force ch- re the hazaro G-induced I tion, or lack al effects in a to predict re- eactions in the ining individe on of insect in the predict reti- eactions in the ining individu of insect infr	and chronob ies for clean emical and p l-free develo loss of conso of vigilance the brain an etinal damage he synthesis lual different nfrared system and damage. he synthesis ual differenc cared system	iology and n ing up Air F physical (lass opment and u ciousness in d the neurob ge. Used mo and manufac and manufac ems. the neurobelt Use molecu and manufac es in circadi as.	eural adapta orce bases a ers and micr ise of future pilots, impai ehavioral co lecular biolo cture of mate lian systems havioral corr ular biologic cture of mate an systems t	tion. The nd owaves) aerospace ired orrelates ogical erials. to elates eal erials. o predict
(U) <u>FY 2000 (\$ in Thousands)</u> : Project 2212			Dage 22 -4	20 Dagaa			Evhihi	t ₽_2∧ /₽⊑	06011025	
P10ject 2312			rage 33 of	39 Fages				L IX-ZA (FE	0001102F)	

RDT8	E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
1 - Basic Research	0601102F Defense Research Science	s 2312
– (U) \$6,734	Study toxicology of biohazardous agents to investigate molecular and biochemical effects in the brain and t associated with the inhalation of JP-8 jet fuel; and develop mathematical models to predict retinal damage. techniques for modifying microbial enzyme capacity to engineer bio-catalysis of reactions in the synthesis a	he neurobehavioral correlates Use molecular biological and manufacture of materials.
– (U) \$5,385	Investigate biological mechanisms responsible for circadian rhythmicity by examining individual difference effects of night operations and jet lag on military personnel.	es in circadian systems to predict
– (U) \$1,365	Perform research in mechanisms of animal sensing systems through investigation of insect infrared systems	5.
– (U) \$13,484	Total	
(U) <u>FY 2001 (\$ in The</u>	usands):	
– (U) \$5,364	Use molecular biological techniques for modifying microbial enzyme capacity to engineer bio-catalysis of r manufacture of materials.	eactions in the synthesis and
– (U) \$5,475	Investigate biological mechanisms responsible for circadian rhythmicity by examining individual difference effects of night operations and jet lag on military personnel.	es in circadian systems to predict
- (U) \$1,389	Perform research in mechanisms of animal sensing systems through investigation of insect infrared systems	S.
– (U) \$12,228	Total	
(U) B. <u>Project Change Su</u>	mmary - Description of Significant Changes: Not Applicable.	
(U) C. <u>Other Program Fu</u>	nding Summary:	
(U) <u>Related Activities</u> - (U) PE 0602202F	Human Systems Technology.	
(U) D. <u>Acquisition Strates</u>	y: Not Applicable.	
(U) E. <u>Schedule Profile</u> :	Not Applicable.	
Project 2312	Page 34 of 39 Pages Exhibit	R-2A (PE 0601102F)

RD	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										
BUDGET ACTIVITY 1 - Basic Researc	h			PE N <b>060</b>	UMBER AND 01102F [	title Defense F	Research	Science	es	F	PROJECT 2313
COST	(\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2313 Human Performance	12,528	13,212	9,944	9,887	10,072	10,363	11,066	Continuing	Continuing		
2313       Human Performance       10,500       12,528       13,212       9,944       9,887       10,072       10,363       11,066       Continuing       C         (U) A. Mission Description:       This project provides fundamental knowledge of information processing in humans and other complex organisms needed to advance technologies for autonomous systems, command and control, human systems integration, and personnel selection and training. Research on sensory systems impacts technologies of computer image and speech processing, human interface, sensors, and sensor fusion. Research on cognitive and perceptual processes impacts technologies of computer image and speech processing, human interface, sensors, and sensor fusion.       Research on cognitive and perceptual processes impacts technologies of computer image and speech processing, human interface, sensors, and sensor fusion.       Research on cognitive and perceptual processes impacts technologies of computer image and speech processing, and Intelligent Tutors; and Team Situational Awareness.         (U) FY 1998 (\$ in Thousands):       - (U) \$3,168       Performed sensory and perceptual system analysis for human-machine interface and image exploitation by developing image represent theory and investigating algorithms for visual attention to improve performance in command and control environments.         - (U) \$4,065       Conducted cognitive workload, and extending the cognitive models to include characterization of on-line job aiding system used in command and control environments.         - (U) \$10,500       Total         (U) FY 1999 (\$ in Thousands):       - (U) \$10,500       Total <td< th=""><th>nce acts hnologies sis on: sentation orted els, stems theory of ind ntation ort model- s, stems</th></td<>								nce acts hnologies sis on: sentation orted els, stems theory of ind ntation ort model- s, stems			
Project 2313				Page 35 of	f 39 Pages			Exhibi	t R-2A (PE	0601102F)	

	RDT8	t)	February 1999							
BUDGET ACTIVIT	Y		PE NUMBER AND TITLE		PROJECT					
1 - Basic Re	esearch		0601102F Defense Res	earch Science	s 2313					
– (U)	\$4,260	Study synthetic task environments for baseline perforutility for performance enhancement techniques. Examplities and the performance of the perfor	rmance measurement and conduct stend experimental techniques for c UAVs) surveillance and targeting.	experiments leading command and contro	to a more general theory of l team performance and develop					
– (U)	\$330	Identified as a source for SBIR.								
– (U)	\$12,528	Total								
(U) <u>FY 20</u>	00 (\$ in The	ousands):								
– (U)	\$3,524	Perform sensory and perceptual system analysis for l theory and investigating algorithms for visual attenti based predictions of limits in speech communication	numan-machine interface and imag on to improve performance in com	e exploitation by de mand and control er	veloping image representation wironments; also support model-					
– (U)	\$5,074	Conduct cognitive workload analysis for crew trainin developing a theory of cognitive workload, and exten in command and control environments.	ng and performance enhancement be adding the cognitive models to inclu	by examining cognitide characterization of the charact	ve performance models, f on-line job aiding systems used					
– (U)	\$4,614	Study synthetic task environments for baseline performance measurement and conduct experiments leading to a more general theory of utility for performance enhancement techniques. Extend experimental techniques for command and control team performance and develop multi-ship modeling for UAV surveillance and targeting.								
– (U)	\$13,212	Total								
(U) <u>FY 20</u>	01 (\$ in The	ousands):								
– (U)	\$2,094	Perform sensory and perceptual system analysis for l theory and investigating algorithms for visual attenti based predictions of limits in speech communication	numan-machine interface and imag on to improve performance in com	e exploitation by de mand and control er	veloping image representation wironments; also support model-					
– (U)	\$3,172	Conduct cognitive workload analysis for crew trainin developing a theory of cognitive workload, and exten- in command and control environments.	ng and performance enhancement be adding the cognitive models to inclu	by examining cognitide characterization of the charact	ve performance models, of on-line job aiding systems used					
– (U)	\$4,678	Study synthetic task environments for baseline perfo utility for performance enhancement techniques. Ex multi-ship modeling for UAV surveillance and targe	rmance measurement and conduct tend experimental techniques for c ting.	experiments leading ommand and contro	to a more general theory of team performance and develop					
– (U)	\$9,944	Total								
During 2212		5	26 - f 20 p							
Project 2313		Page	SU OF SY Pages		K-2A (PE 0001102F)					
			36							

	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)						
1 - Basic Research	PE NUMBER AND TITLE 0601102F Defense Research Science	PROJECT 2313					
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Science and Technology (S&T) Program.	Changes to this program since the President's Budget are	e due to higher priorities within the					
(U) C. Other Program Funding Summary:							
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602202F, Human Systems Technology.</li> <li>(U) PE 0602702F, Command, Control, and Communication.</li> </ul>							
(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.							
(U) E. <u>Schedule Profile</u> : Not Applicable.							
Project 2313	Page 37 of 39 Pages Exh	ibit R-2A (PE 0601102F)					

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 1 - Basic Research			PE N <b>06</b>	UMBER AND 01102F	TITLE Defense F	Research	Science	s		PROJECT 4113	
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
4113 International Science Programs	15,269	13,243	4,878	0	0	0	0	0	Continuing	Continuing	
<ul> <li>(U) A. <u>Mission Description</u>: This project stimulate (including the international research community) and minorities, with advanced degrees in science and engmembers conduct research at Air Force research sites; the University R Force research needs and operations; the U.S. Air Fordoctoral and senior scientists and engineers opportune research sites; the Laboratory Graduate Fellowship F programs at the research sites; and the National Defe and the Defense Advanced Research Projects Agency international programs such as Windows on Science</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$4,924</li> <li>Funded international s and engineers perform institutes.</li> <li>(U) \$5,956</li> <li>Supported science and and researchers at the</li> <li>(U) \$4,389</li> <li>Conducted fellowship government, and acade research relevant to Air (U) \$15,269</li> </ul> </li> </ul>	es scientific d the Air Fo gineering. T s; the Gradu tesident Res orce Nationa nities to rese Program wh ense Science y for the pu which prov acience and ing laborato l technology Air Force R awards pro emia to forr ir Force Res	e and engined orce research These program late Student search Progra al Research ( earch problem ich is design e and Engine rpose of incu- vides insight personnel ex- pory research a personnel e Research Lab gram and rom nulate a nati search Labor	ering educat sites. Emp ms include: Research P am where fa Council (NF ns of their of reasing their and experied achange pro- in foreign c exchanges w oratory. undtable on onal science atory issues	tion and incre- shasis is plac the Summer rogram when aculty member (C) Resident own choice the late doctoral uate Fellowsh number of U ence in intern grams and the ountries. Pre- vithin the Un national scie e technology	eases the int ed on increa r Faculty Re re graduate s ers spend on Research A hat are comp candidate ir hip Program .S. citizens t national rese echnology lia ovided Air F ited States, t ence and tech policy. Fun	eraction betw sing the num search Progr tudents in an e year at an ssociateship patible with t atterest in Ain which is joi rained in sci arch. Bison mission Force share of hrough vario	ween the bro nber of U.S. ram under w reas of intere Air Force re Program wh the research Force resea ntly sponsor ence and engins in Europe of funding for bus exchange cy for senior ding univers	bader researc citizens, esp hich selected est to the Air esearch site c nich provides interests of s arch sites and red by the Ar gineering, an e and Asia to or NATO-aff e programs f r leaders from ity research s	th community becially wond d university Force perfor- contributing s outstanding selected Air d the researce rmy, Navy, ad various o support sci- iliated researce for faculty, s m industry, scientists to	y nen and faculty orm to Air g post- Force h Air Force, entists rch tudents, pursue	

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit) February 1999									
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT							
1 - Basic Research		0601102F Defense Research Science	s 4113							
(II) <b>FV 1000 (\$ in T</b>	housands).									
$(0) \frac{111339}{3} (3) \frac{111}{3} (3) \frac{111}{$	Fund international science and personnel exchange	programs								
- (U) \$5.057	Support technology liaison missions in Europe and	Asia to support scientists and engineers performing lab	oratory research in foreign							
(0) \$5,007	countries.									
- (U) \$3,583	Provide Air Force share of funding for NATO-affili	ated research institutes.								
- (U) \$349	Identified as a source for SBIR.									
- (U) \$13,243	– (U) \$13,243 Total									
(U) FY 2000 (\$ in T	housands):									
$(0) \frac{112000}{-} (U) \frac{1.611}{-}$	Fund international science and personnel exchange	programs.								
- (U) \$1.913	Support technology liaison missions in Europe and	Asia to support scientists and engineers performing labor	pratory research in foreign							
(0) \$1,710	countries.									
- (U) \$1,354	Provide Air Force share of funding for NATO-affilia	ated research institutes.								
- (U) \$4,878	Total									
<ul> <li>(U) <u>FY 2001</u>: Not A</li> <li>(U) B. <u>Project Change 8</u></li> <li>Science and Technology (</li> <li>(U) C. <u>Other Program 1</u></li> <li>(U) <u>Related Activitie</u></li> <li>(U) PE 0601103</li> <li>(U) D. Acquisition Strat</li> </ul>	pplicable. Summary - Description of Significant Changes: Char S&T) Program. Funding Summary: S: D, University Research Initiative. egy: Not Applicable.	nges to this program since the President's Budget are d	ue to higher priorities within the							
(-)	<u></u>									
(U) E. <u>Schedule Profile</u>	Not Applicable.									
Project 4113	Daar	20 of 30 Pages Evhibit	R-24 (PE 0601102E)							

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PE TITLE: Materials

	RDT&E BUDGET IT		DATE February 1999								
BUDG <b>2 - /</b>	BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602102F Materials						
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	65,628	73,855	63,334	4 69,521	68,517	70,467	71,964	73,511	Continuing	Continuing
4347	Materials for Structures, Propulsion, and Subsystems	39,766	43,862	37,94	6 40,752	39,659	40,587	41,785	42,989	Continuing	Continuing
4348	Materials for Electronics, Optics, and Survivability	13,140	15,231	8,57	5 9,050	8,526	8,811	8,696	8,590	Continuing	Continuing
4349	Materials Technology for Sustainment	12,722	14,762	16,81	3 19,719	20,332	21,069	21,483	21,932	Continuing	Continuing
	Quantity of RDT&E Articles	0	0		0 0	0	0	0	0	0	0

(U) A. <u>Mission Description</u>: This Applied Research program is the primary source of advanced materials and processes to reduce life cycle costs and improve performance, affordability, supportability, reliability, and survivability of current and future Air Force systems. Structural, propulsion, and sub-systems materials and processes are developed for aircraft, missile, space, satellite, and launch systems applications. Electronic and optical, advanced electromagnetic, and laser protection materials and processes are developed for application in Air Force aircraft, missile, space, and personnel protection systems. Advanced nondestructive materials evaluation methods, materials design data, pollution prevention materials, materials failure analysis, and materials repair methods are developed to improve the sustainment of Air Force systems for the current and future warfighters. Note: In FY 1999, Congress added \$2.0 million for inorganic/organic optical limiters, \$1.2 million for friction stir welding, \$1.5 million for environmentally safe aircraft coatings, and \$8.0 million for advanced materials research which explains the perceived decrease in FY 2000.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

Page 1 of 10 Pages

Exhibit R-2 (PE 0602102F)

RDT&E BUDGET ITEM JUS	DATE February 1999					
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE			-
2 - Applied Research		0602102F	Materials			
(U) C. Program Change Summary (\$ in Thousands):						
					Total	
	<u>FY 1998</u>	FY 1999	<u>FY 2000</u>	FY 2001	Cost	
(U) Previous President's Budget/FY 1999 PB	69,339	62,578	63,927	70,330	Cont	
(U) Appropriated Value	73,224	75,278				
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-2,915	-1,423				
b. SBIR	-1,036					
c. Omnibus/Other Above Threshold Reprogrammings	-2,504					
d. Below Threshold Reprogrammings	-1,141					
(U) Adjustments to Budget Year Since FY 1999 PB			-593	-809		
(U) Current Budget Submit/FY 2000 PB	65,628	73,855	63,334	69,521	Cont	
(U) Significant Program Changes: Not Applicable.						
FY1999: \$1.288 indentified as a source for SBIR.						
				_		
	Pa	ge 2 of 10 Pages		E	Exhibit R-2 (PE 06021	02F)

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RDT&E BUDGET ITI		DATE February 1999								
BUDGET ACTIVITY 2 - Applied Research			PE N <b>06</b>	UMBER AND 02102F	TITLE <b>/laterials</b>				PROJECT <b>4347</b>	
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
4347 Materials for Structures, Propulsion, and Subsystems	37,946	40,752	39,659	40,587	41,785	42,989	Continuing	Continuing		
<ul> <li>(U) A. <u>Mission Description</u>: Develops materials performance of current and future Air Force system lightweight, dimensionally stable, thermally conduct systems. A family of affordable lightweight material capability for existing aircraft, spacecraft, missile, a materials with operating capabilities from 1700°F to Spacecraft material technologies are developed to maintain the technologies are developed for the subsystems on ait (U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$5,703 Developed C-C and the strategic and tactical strategic and tactical</li></ul></li></ul>	technologies s. Advanced tive, and/or als are devel- nd propulsio o 2800°F that are lightwei e performand rcraft, spaced hermal prote systems. ural materials life cycle con nonmetallic rt skins, and supports, and tioned afford technology to natrix compo volutionary	for aircraft, I thermal pro- ablation and oped, includ n systems to t will enable ght, dimens ce of aging of craft, and mi- ction materi s (such as flu- sts. composite s engine com- d space vehi lable lightwe o enable enh sites to deve- performance	spacecraft, ptection and erosion res ing metals, o meet the re- e engine des ionally stab- operational r issile system al (TPM) tec- nids, lubrica tructural ma pressor fram cle bus struc- eight metals anced perfo- elop an under	and missiles carbon-carb istant to mee metallic and equirements igns to doub le, noncontar reentry system is as well as chnologies to nts, seals, gr aterials that a hes and ducts ctures. and metal normance, low erstanding of ents in advan	with impro- on (C-C) co et the require nonmetallic for new syste le the thrust minating, an ms. Fluids, 7 their propuls o improve pe- eases, and co are affordable s, and for spa- natrix compo- er acquisitio material res- aced propuls	ved affordab mposites ma composites, ems beyond to weight of d resistant to lubricants, se sion systems erformance, a batings) for i e for aircraft acecraft appl osites, highen n costs, and ponse to ser- ion systems	ility, mainta terials are de craft, spaced , and cerami- the year 200 1986 engine o the space e eals, coating affordability improved sy : application c-temperatur improved re vice life env and high ten	inability, and eveloped tha craft, missile cs which can 0. Included e performand nvironment. s, and other , and operati stem perform s including lightw e intermetall liability of <i>A</i> ironments an nperature air	d enhanced t are afforda s, and ballist provide upg are turbine of capabilitie Alternative nonstructuration onal capabil hance, reduc ightweight a reight trusse ic alloys, an air Force weat d to charact	ble, tic reentry graded engine es. or il material ity of ed irframes, s, struts, d apon erize ures.
Project 4347			Page 3 of	10 Pages			Exhibi	t R-2A (PE	0602102F)	

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									
BUDGET ACTIVITY 2 - Applied Researc	:h	PE NUMBER AND TITLE 0602102F Materials	-	PROJECT <b>4347</b>						
(U) FY 1999 (\$ in Th	ousands):									
- (U) \$8,332	Develop carbon-carbon (C-C) and thermal protection	n material (TPM) technologies to in	prove performance, affordabi	lity, and operational						
– (U) \$7,187	capability of strategic and tactical systems. Develop nonstructural materials (such as fluids, lubricycle costs.	icants, seals, greases, and coatings)	for improved system performa	ance and reduced life						
– (U) \$9,556	Develop advanced nonmetallic composite structural control surfaces, smart skins, and engine compressor	materials that are affordable for air frames and ducts, and for spacecra	craft applications including lig ft applications including light	chtweight airframes, weight trusses, struts,						
– (U) \$9,654	solar arrays, antenna supports, and space vehicle bus Develop and transition affordable lightweight metals processing technology to enable enhanced performar	s structures. and metal matrix composites, high ace, lower acquisition costs, and imp	ner-temperature intermetallic a proved reliability of Air Force	lloys, and materials weapon systems.						
- (U) \$8,368	Develop ceramic matrix composites to develop an ur materials to enable revolutionary performance impro-	iderstanding of material response to	service life environments and	l to characterize						
– (U) \$765	Identified as a source for SBIR.	wements in advanced propulsion sy	stems and high temperature a	maine sudetures.						
- (U) \$43,862	Total									
$\begin{array}{c} (U) & \underline{FY\ 2000\ (\ \ in\ \ Tr} \\ & -\ (U) & \$3,046 \\ \\ & -\ (U) & \$5,948 \\ \\ & -\ (U) & \$11,897 \\ \\ & -\ (U) & \$9,518 \\ \\ & -\ (U) & \$7,537 \end{array}$	ousands): Develop C-C and advanced thermal management ma future space vehicles. Develop nonstructural materials (such as fluids, lubri cycle costs. Develop advanced nonmetallic composite structural n control surfaces, smart skins, and engine compressor solar arrays, antenna supports, and space vehicle bus Develop and transition affordable lightweight metals processing technology to enable enhanced performan Develop ceramic matrix composites to develop an un	terials to improve performance, affective cants, seals, greases, and coatings) materials that are affordable for airco frames and ducts, and for spacecra structures. and metal matrix composites, high ce, lower acquisition costs, and imp derstanding of material response to	ordability, and operational cap for improved system performa craft applications including lig ft applications including lighty er-temperature intermetallic a proved reliability of Air Force service life environments and	ability of aircraft and ince and reduced life htweight airframes, weight trusses, struts, lloys, and materials weapon systems. to characterize						
- (U) \$37,946	materials to enable revolutionary performance impro Total	vements in advanced propulsion sy	stems and high temperature ai	rframe structures.						
Project 4347	Page	4 of 10 Pages	Exhibit R-2A (PE	0602102F)						
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RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									
BUDGET ACTIVITY 2 - Applied Resear	ch	PE NUMBER AND TITLE 0602102F Materials		PROJECT <b>4347</b>						
(U) <u>FY 2001 (\$ in T</u>	housands):									
- (U) \$3,364	Develop carbon-carbon (C-C) and advanced capability of aircraft and future space vehicle	thermal management materials to imp	rove performance, affordability, and op	perational						
- (U) \$6,373	Develop nonstructural materials (such as flui	ids, lubricants, seals, greases, and coat	ings) for improved system performance	e and reduced life						
- (U) \$12,746	cycle costs. Develop advanced nonmetallic composite str control surfaces, smart skins, and engine cor	ructural materials that are affordable for npressor frames and ducts, and for spa	or aircraft applications including lightw cecraft applications including lightwei	veight airframes, ght trusses, struts,						
- (U) \$10,197	Develop and transition affordable lightweigh	the metals and metal matrix composites	, higher-temperature intermetallic alloy	ys, and materials						
_ (II) \$8072	processing technology to enable enhanced pe	erformance, lower acquisition costs, and	d improved reliability of Air Force wea	apon systems.						
- (0) \$8,072	- (U) \$8,072 Develop ceramic matrix composites to develop an understanding of material response to service life environments and to characterize materials to enable revolutionary performance improvements in advanced propulsion systems and high temperature airframe structures.									
- (U) \$40,752	Total									
(U) B. <u>Project Change S</u>	Summary - Description of Significant Changes	s: Not Applicable.								
(U) C. Other Program	Funding Summary:									
(U) <u>Related Activit</u>	<u>es</u> :									
- (U) PE 0603112 (U) PE 0603211	F, Advanced Materials for Weapon Systems.									
- (U) PE 0603202	F, Aeropropulsion Subsystem Integration.									
– (U) PE 0603216	F, Aeropropulsion and Power Technology.									
<ul> <li>(U) DOD Metal</li> <li>(U) This project</li> </ul>	Matrix Composite Steering Group.	and to harmonize offerts and eliminate	dualization							
- (0) This project	has been coordinated through the Renance proc	cess to narmonize errorts and errinnate	duplication.							
(U) D. Acquisition Stra	tegy: Not Applicable.									
(U) E. <u>Schedule Profile</u>	Not Applicable.									
Project 4347		Page 5 of 10 Pages	Exhibit R-2A (PE 06	602102F)						
		45								

RDT&E BUDGET I	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research			PE N <b>06</b>	IUMBER AND	TITLE <b>/laterials</b>				F	PROJECT <b>1348</b>		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
4348 Materials for Electronics, Optics, and Survivability 13,140 15,231				9,050	8,526	8,811	8,696	8,590	Continuing	Continuing		
<ul> <li>(U) A. <u>Mission Description</u>: Develops material also develops new materials for protection of aircr and infrared countermeasures are used in target de constrained by the quality and physical characteris speeds, greater tunability, higher output power, in range. The improved materials also increase product the power level and wavelength or color emanating dependent on other characteristics of the laser such the most prominent threat wavelengths and new in threat wavelengths.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$5,820</li> <li>(U) \$5,820</li> <li>(U) \$1,606</li> <li>(U) \$1,606</li> <li>(U) \$1,606</li> <li>(U) \$1,3,140</li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>:</li> <li>(U) \$1,5,21</li> <li>(U) \$5,624</li> <li>(U) \$265</li> <li>(U) \$15,231</li> <li>(U) \$15,231</li> </ul> </li> </ul>	erials and proce s to enhance the openhance the enhance the enhance the	s for space se aircraft, and ronic warfare materials. M hal managem increase yie ser device an y of the wav eveloped to b cesses to pro- he safety and he survivability	ensor system space system e, active airo faterials are hent, (includ elds, and red d the suscep elength and respond to e ovide improve d survivabili lity and mission survivability y and mission	is, radars, an ims from lase craft protection developed in ling higher op luce costs for obtibility of the mode of ope emerging three wed performant ity of aircrews son effectivent	d subsystem er threats. Rison, and comin in this project perating tem i radar and se e material or ration (conti- eat waveleng ince, afforda vs against lase eness of air and ress of air and	s for aircraft adar module munications it that enable peratures), g ensor system system beir nuous wave ths and ultir bility, and op er threats ar ind space se ity, and open threats and space sense	, missile, an s, microwav . The perfor radars and s greater sensi- ns. Protection glased. Ad or pulsed). nately to rej- perational ca ad heat seeking rational capa heat seeking or systems a	d space appl e devices, in mance of the sensors with tivity, and er on from laser lditionally, p Materials ar ect laser ene apability for ing IR missil s against laser ability for Ai g IR missiles gainst laser to	r Force rada threats.	is project letectors, is ating amic amic amic amic on upon nemes are to counter dent of dar and r and		
Project 4348			Page 6 of	10 Pages			Exhibi	t R-2A (PE	0602102F)			
RDT	DATE February 1999											
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BUDGET ACTIVITY 2 - Applied Resear	ch	PE NUMBER AND TITLE 0602102F Materials	PROJECT <b>4348</b>									
(U) <u>FY 2000 (\$ in T</u> – (U) \$3,773 – (U) \$4,111 – (U) \$691 – (U) \$8,575	<u>'housands</u> ): Develop new materials and processes to provide impose space sensor systems. Develop materials to enhance the safety and surviva Develop materials to enhance the survivability and Total	proved performance, affordability, and ability of aircrews against laser threats a mission effectiveness of air and space s	operational capability for Air Force radar and and heat seeking infrared (IR) missiles. sensor systems against laser threats.									
<ul> <li>(U) <u>FY 2001 (\$ in T</u></li> <li>(U) \$3,982</li> <li>(U) \$4,343</li> <li>(U) \$725</li> <li>(U) \$9,050</li> </ul> (U) <u>B. Project Change S</u> (U) C. Other Program	<ul> <li><u>housands</u>):</li> <li>Develop new materials and processes to provide important space sensor systems</li> <li>Develop materials to enhance the safety and surviva Develop materials to enhance the survivability and Total</li> <li><u>summary - Description of Significant Changes</u>: Not a Funding Summary:</li> </ul>	proved performance, affordability, and ability of aircrews against laser threats a mission effectiveness of air and space s Applicable.	operational capability for Air Force radar and and heat seeking IR missiles. sensor systems against laser threats.									
<ul> <li>(U) <u>Related Activiti</u></li> <li>(U) PE 0603112</li> <li>(U) PE 0602202</li> <li>(U) PE 0602204</li> <li>(U) PE 0603231</li> <li>(U) PE 0603211</li> <li>(U) PE 0603211</li> <li>(U) Tri-Service</li> <li>(U) This project</li> </ul>	Tes: 2F, Advanced Materials for Weapon Systems. 2F, Human Effectiveness Applied Research. 3F, Aerospace Sensors. F, Crew Systems and Personnel Protection Technology F, Aerospace Structures. Laser Hardening Materials and Structures Group. Thas been coordinated through the Reliance process to 19	7. harmonize efforts and eliminate duplica	ation.									
<ul> <li>(U) D. <u>Acquisition Stra</u></li> <li>(U) E. <u>Schedule Profile</u></li> </ul>	<b>tegy:</b> Not Applicable. <b>:</b> Not Applicable.											
Project 4348	Pas	ge 7 of 10 Pages	Exhibit R-2A (PE 0602102F)									

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RDT	&E BUDGET ITI	EM JUS	TIFICAT	ION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 2 - Applied Resear	BUDGET ACTIVITY 2 - Applied Research					TITLE <b>/laterials</b>			PROJECT <b>4349</b>		
COST (\$	OST ( <i>\$ In Thousands</i> ) FY 1998 FY 1999 FY 2000 FY 2001 FY 2002 FY 2003 FY 2004 Estimate Stimate						FY 2005 Estimate	Cost to Complete	Total Cost		
4349 Materials Technology f	Materials Technology for Sustainment 12,722 14,762 16,813 19,719 20,332 21,069 21,48						21,483	21,932	Continuing	Continuin	
<ul> <li>systems, transitioning more reliable and maintainable materials, establishing capability to detect and characterize performance threatening defects, eliminating the dependency on hazardous and toxic materials in repair and maintenance, and providing quick reaction support to the operational commands and repair centers. Non-destructive inspection/evaluation (NDI/E) methods are essential to ensure optimum quality in the design and production of aircraft, spacecraft, propulsion, and missile systems. NDI/E methods are essential to monitor and detect the onset of any service-initiated damage and/or deterioration. This project develops techniques that increase the capability and reliability of currently used methods to detect and characterize performance threatening defects in metallic and nonmetallic composite structures.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>S4,509</u></li> <li>Developed NDI/E technologies to evaluate and characterize damage in complex, low-observable materials and structures, and to inspect and maintain integrity of aging aerospace structures and propulsion systems.</li> <li>(U) <u>\$6,520</u></li> <li>Developed support capabilities, information, and processes to resolve problems in the use of materials, in conducting failure analysis of components, in materials repair of aircraft structures, and in reducing corrosion in aircraft structures.</li> <li>(U) <u>\$1,693</u></li> <li>Developed alternative materials, processes, and environmentally friendly technologies which will eliminate dependency on hazardous and toxic substances in the acquisition, maintenance, and propulsion systems.</li> <li>(U) <u>\$12,722</u></li> <li>Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands):</u> <ul> <li>(U) <u>\$12,722</u></li> <li>Develop NDI/E technologies to evaluate and characterize damage in complex, low-observable materials and structures, and to inspe</li></ul></li></ul>											
Project 4349				Page 8 of	f <u>10 Pages</u>			Exhibi	t R-2A (PE	<u>0602102F)</u>	

RDT	<b>February 1999</b>		
BUDGET ACTIVITY 2 - Applied Resear	ch	PE NUMBER AND TITLE 0602102F Materials	PROJECT <b>4349</b>
$(U) \frac{FY 2000 (\$ in Thousa}{- (U) \$5,377} - (U) \$5,377 - (U) \$7,568 - (U) \$3,868 - (U) \$16,813 (U) FY 2001 (\$ in TH - (U) $6,310 - (U) $8,873 - (U) $4,536 - (U) $19,719 (U) \$19,719 $	ands): Develop non-destructive inspection/evaluation (NDI/ materials and structures, and to inspect and maintain Develop support capabilities, information, and proce components, in materials repair of aircraft structures Develop alternative materials, processes, and enviror toxic substances in the acquisition, maintenance, and Total housands): Develop NDI/E technologies to evaluate and charact maintain integrity of aging aerospace structures and Develop support capabilities, information, and proce components, in materials repair of aircraft structures Develop alternative materials, processes, and enviror toxic substances in the acquisition, maintenance, and Total	<ul> <li>(E) technologies to evaluate and characterize damage integrity of aging aerospace structures and propulsic sses to resolve problems in the use of materials, in co a, and in reducing corrosion in aircraft structures.</li> <li>amentally friendly technologies which will eliminate repair of aerospace systems.</li> <li>erize damage in complex, low-observable materials a propulsion systems.</li> <li>sses to resolve problems in the use of materials, in co and in reducing corrosion in aircraft structures.</li> <li>amentally friendly technologies which will eliminate repair of aerospace systems.</li> </ul>	in complex, low-observable n systems. nducting failure analysis of dependency on hazardous and nd structures, and to inspect and nducting failure analysis of dependency on hazardous and
Project 4349	Page	e 9 of 10 Pages Exhil	bit R-2A(PE 0602102F)
		49	

RDT&E BUDGET ITEM JUST	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)					
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602102F Materials	PROJECT <b>4349</b>				
(U) B. <u>Project Change Summary - Description of Significant</u>	Changes: Not Applicable.					
(U) C. Other Program Funding Summary:						
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603112F, Advanced Materials for Weapons System (U) PE 0603211F, Aerospace Structures.</li> <li>(U) Office of Science and Technology Committee Materials (U) This project has been coordinated through the Relians</li> </ul>	stems. rials Working Group on Non-Destructive Mate nce process to harmonize efforts and eliminate	rials. duplication.				
(U) D. <u>Acquisition Strategy</u> : Not Applicable.						
(U) E. <u>Schedule Profile</u> : Not Applicable.						
Project 4349	Page 10 of 10 Pages	Exhibit R-2A (PE 0602102F)				
	50					

PE TITLE: Aerospace Flight Dynamics

RDT&E BUDGET	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									
BUDGET ACTIVITYPE NUMBER AND TITLE2 - Applied Research0602201F Aerospace Flight Dynamics								S		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	55,734	64,063	43,898	47,142	54,016	61,289	64,970	67,136	Continuing	Continuing
2401 Structures	14,939	17,407	16,728	16,959	16,876	18,703	20,407	17,448	Continuing	Continuing
2402 Vehicle Equipment	9,787	11,682	3,759	4,848	5,566	7,016	9,549	8,896	Continuing	Continuinç
2403 Flight Controls and Pilot-Vehicle Interface	15,808	17,492	10,592	11,740	12,531	14,955	14,731	15,947	Continuing	Continuing
2404 Aeromechanics and Integration	14,736	16,123	11,372	12,306	18,352	18,392	18,122	22,402	Continuing	Continuing
4397 Air Base Technology	464	1,359	1,447	1,289	691	2,223	2,161	2,443	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

(U) A. <u>Mission Description</u>: This Applied Research program determines the technical feasibility of aerospace vehicle technologies in aeromechanics, structures, flight control, air vehicle-pilot interface, vehicle subsystems, and air base technologies to reduce life cycle costs and improve the performance of existing and future manned and unmanned aerospace vehicles, and the maintenance and survivability of air bases. The payoffs from these technology programs include: decreased vulnerability, and increased affordability, reliability, maintainability, and supportability for aerospace vehicles and subsystems; improved air base operations; and safe aerospace vehicle all-weather operations. Note: In FYs 1999 and out, additional emphasis has been placed on aerospace flight dynamics technologies that can be applied to prolonging the life of our aging aircraft fleet.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary aerospace vehicle technologies.

Page 1 of 17 Pages

Exhibit R-2 (PE 0602201F)

RDT&E BUDGET ITEM JUS	DATE February 1999					
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AN 0602201F	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynamics				
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :		ļ	•			
					Total	
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost	
(U) Previous President's Budget/FY 1999 PB	57,446	64,932	63,212	63,305	Cont	
(U) Appropriated Value	60,509	64,932				
(U) Adjustments to Appropriated Value	2.461	0.60				
a. Congressional/General Reductions	-2,461	-869				
b. SBIR	-698					
c. Omnibus/Other Above Threshold Reprogrammings	-1,695					
d. Below Threshold Reprogrammings	79		10 01 4	16160		
(U) Adjustments to Budget Year Since FY 1999 PB	5 5 70 A	(10)	-19,314	-16,163		
(U) Current Budget Submit/FY 2000 PB	55,734	64,063	43,898	47,142	Cont	
<ul><li>(U) Significant Program Changes: Changes to this program s Program.</li><li>FY 1999: \$696 identified as a source for SBIR</li></ul>	ince the previous	President's Bud	get are due to hig	her priorities with	in the Science and Technology (S&T)	

Page 2 of 17 Pages

Exhibit R-2 (PE 0602201F)

BUDGET ACTIVITY <b>2 - Applied Research</b> COST (\$ In Tho 2401 Structures (U) A. <u>Mission Description</u> : 7 metericle and folgiering of the second sec	usands)	FY 1998 Actual	FY 1999 Estimate	PE NI 060	UMBER AND <sup>•</sup>	TITLE Aerospac	e Flight [	Dynamics		P	ROJECT		
COST (\$ In The 2401 Structures (U) A. <u>Mission Description</u> :	usands)	FY 1998 Actual	FY 1999 Estimate	FY 2000		BUDGET ACTIVITYPE NUMBER AND TITLEPRO2 - Applied Research0602201F Aerospace Flight Dynamics240							
2401 Structures (U) A. <u>Mission Description</u> : 7 metaziala and fabrication			COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2003 Estimate						FY 2005 Estimate	Cost to Complete	Total Cost		
(U) A. <u>Mission Description</u> :		14,939	17,407	16,728	16,959	16,876	18,703	20,407	17,448	Continuing	Continuinç		
<ul> <li>U) A. <u>Mission Description</u>: This project develops advanced aerospace structures; investigates new structural concepts and design techniques which exploit new naterials and fabrication processes to strengthen and extend the life of manned and unmanned aerospace vehicle structures while reducing weight and cost; and develops daptive structures that will improve operability and maintainability of aerospace vehicles.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$609</li> <li>Designed, developed, and tested advanced structures that incorporated distributed vibration suppression technologies for life extension and exploit wing warping, camber shaping, and adaptive structures technologies that enhance aerospace vehicle performance. These technologies included distributed vibration suppression technologies.</li> <li>(U) \$2,288</li> <li>Developed advanced structural design methods that enhanced affordability and decreased vulnerability for upgraded, derivative, and future aiveraft. Design methods included assessment of advanced composite structures technologies and analytical techniques to provide design</li> </ul> </li> </ul>													
- (U) \$11,040 Ex	aircraft. Design methods included assessment of advanced composite structures technologies and analytical techniques to provide design guidance for active aeroelastic wings. Extended usable structural lives and/or reduced costs of aging aircraft through techniques that accounted for life, risk, repairs, and dynamic loads. Technology development consisted of assessment of widespread fatigue damage and assessment of weapon bay acoustic suppression												
– (U) \$1,002 Im vit hiş	proved durability for a caused by engineering of the providence of	or existing a ngine exhaus amic matrix	nd future ste at which resu composite to	ealth vehicle ilted in incre echnology a	es structures eased life and nd through a	operating in d decreased of active structu	extreme env cost. Improv ral control c	vironments s ved durabilit oncepts.	uch as tempe y resulted fro	erature, nois om assessme	e, and ent of		
– (U) \$14,939 To	tal												
<ul> <li>(U) <u>FY 1999 (\$ in Thousands)</u>:         <ul> <li>(U) \$875</li> <li>Continue design, development, and test of advanced structures that incorporate distributed vibration suppression technologies for life extension and exploit wing warping, camber shaping, and adaptive structures technologies that enhance air vehicle performance. Technologies under development include distributed vibration suppression techniques, and evaluation and assessment of wing twisting and control surface warping.</li> <li>(U) \$1,601</li> <li>Develop composite structures that enhance affordability and survivability of future aircraft. Develop fail safe design criteria for translaminar reinforced composite structures to reduce inspection and repair costs. Integrate aerodynamics, flight control, and electromagnetics (radar/infrared) analyses into multi-disciplinary structural design methods to reduce design costs and improve accuracy.</li> </ul> </li> </ul>													
Project 2401				Page 3 of	17 Pages			Exhibit	R-2A (PE	0602201F)			

RDT	ibit)	DATE February 1999		
BUDGET ACTIVITY		PE NUMBER AND TITLE		PROJECT
2 - Applied Resear	ch	0602201F Aerospac	e Flight Dynamics	s 2401
- (U) \$1,723	Develop multifunctional adaptive structures that sen	se aeromechanical loads, cont	trol structural response, a	nd integrate subsystem
– (U) \$11,669	functionality to reduce system level manufacturing c Extend usable structural lives and/or reduce costs of dynamic loads. Structural lives can be extended by c techniques to assess risk of failure of structural comp	osts and increase tactical perf- aging aircraft with technolog levelopment of bonded compo- ponents due to corrosion and y	ormance of aerospace vel ies that account for life, r posite repairs of metallic st widespread fatigue damag	nicles. isk, repairs, and ructures and evaluation of re.
- (U) \$1,350	Improve durability for existing and future aerospace well as passive and active cooling to withstand the ex- and increase life of aerospace vehicle structures. Du thermal energy management/structure design.	vehicle structures by develop xtreme environments of high rability technologies include	ing technologies that inco temperatures, vibrations, advanced thermal protect	orporate advanced materials as and acoustic noise to reduce cost ion systems and an integrated
- (U) \$ 189	Identified as a source for SBIR			
- (U) \$17,407	Total			
(U) <u>FY 2000 (\$ in T)</u> – (U) \$840 – (U) \$1,511 – (U) \$1,679 – (U) \$10,851	<ul> <li><u>nousands</u>):</li> <li>Continue design, development, and test of advanced extension and exploit wing warping, camber shaping Technologies under development include distributed control surface warping of manned and unmanned ae Develop unitized composite and metallic concepts that translaminar reinforced composites to reduce inspect design time.</li> <li>Continue development of multifunctional structures the level manufacturing costs and increase tactical perfort Extend usable structural lives and/or reduce costs of risk, repairs, and dynamic loads. Structural lives can evaluation of techniques to assess risk of failure of structures of the structure of techniques to assess risk of failure of techniques.</li> </ul>	structures that incorporate dis , and adaptive structures tech vibration suppression techniq erospace vehicles. at reduce manufacturing costs ion and repair costs. Develop that tailor structural response, mance of future aerospace ve aging aircraft, and unmanned be extended by development	tributed vibration suppresent nologies that enhance aer jues, and evaluation and a s of future aerospace vehic o integrated multidisciplin and integrate subsystem hicles. aerospace vehicles with of bonded composite rep	assion technologies for life ospace vehicle performance. assessment of wing twisting and cles. Verify design criteria for ary design methods to reduce functionality to reduce system technologies that account for life, airs of metallic structures and
<ul><li>(U) \$1,847</li><li>(U) \$16,728</li></ul>	techniques. Continue durability improvements for existing and fu well as passive and active cooling to withstand the ex acoustic noise to reduce cost and increase life of aero systems, high temperature composite structures, and Total	ature aerospace structures by a streme environments of high t space vehicle structures. Dura integrated thermal subsystem	developing concepts that temperatures, cryogenic t ability technologies includ s/structures.	incorporate advanced materials as emperatures, vibrations, and de advanced thermal protection
Project 2401	Page	2 4 of 17 Pages	Exhibit	R-2A (PE 0602201F)

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							
BUDGET ACTIVITY 2 - Applied Researe	ch	PE NUMBER AND TITLE 0602201F Aerospace Flight	Dynamics	PROJECT 2401				
(U) FY 2001 (\$ in Th	nousands):							
– (U) \$849	Evaluate the design of advanced structures/concepts	that incorporate distributed vibration supp	ression technologies for	or life extension and				
– (U) \$1,528	Continue development of unitized structural concept	s and multidisciplinary optimization meth	odologies that enhance	affordability and				
– (U) \$1,698	decrease vulnerability for future aerospace vehicles. Evaluate the integration of multifunctional structures	Develop integrated design architecture to that tailor structural response, and integra	reduce design time an ate subsystem function	d improve performance. ality to reduce system				
(T) ¢11 019	level manufacturing costs and increase tactical perfor	mance of future aerospace vehicles.	hieles with technologi	as that account for life				
- (0) \$11,018	risk, repairs, and dynamic loads. Structural lives can	be extended by development of bonded c	omposite repairs of me	etallic structures, and				
	evaluation of techniques to assess risk of failure of st techniques	ructural components. Dynamic loads can	be reduced through ac	tive suppression				
– (U) \$1,866	Improve durability of existing and future aerospace v	whicle structures by developing technolog	ies that incorporate ad	vanced materials as well				
	as passive and active cooling to withstand the extrem increase life of aerospace vehicle structures. Concept	s under development consist of design, fal	rations, and acoustic neorication, and assessme	onse to reduce cost and ent of high temperature				
(U) \$16 <b>05</b> 0	composite aerospace vehicle structures.							
- (0)\$10,939	Total							
(U) B. <u>Project Change S</u>	Summary - Description of Significant Changes: Not A	Applicable.						
(U) C. Other Program H	Funding Summary:							
(U) <u>Related Activitie</u>	<u>s</u> :							
- (U) PE 0602102	F, Materials.							
- (U) PE 06032111	F, Aerospace Structures.							
- (U) PE 0603112	F, Advanced Materials for Weapon Systems.	amonize offerts and eliminate duplication						
- (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.								
(U) D. <u>Acquisition Strategy</u> : Not Applicable.								
(U) E. <u>Schedule Profile</u> :	(U) E. <u>Schedule Profile</u> : Not Applicable.							
Project 2401	Page	e 5 of 17 Pages	Exhibit R-2A (P	E 0602201F)				
		55						

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									February 1999		
BUDGET ACTIVITY 2 - Applied Research			PE N 060	UMBER AND	TITLE Aerospac	e Flight I	Dynamic	s	F	PROJECT 2402	
COST (\$ In Thousands)	(\$ In Thousands) FY 1998 Actual FY 1999 FY 1999 FY 2000 FY 2000 FY 2001 FY 2002 FY 2003 FY 2003 FY 2004 FY 2004 FY 2005 Cost to Complete							Cost to Complete	Total Cost		
2402 Vehicle Equipment	Equipment 9,787 11,682 3,759 4,848 5,566 7,016 9,549					8,896	Continuing	Continuing			
<ul> <li>(U) A. <u>Mission Description</u>: This project develops technologies to reduce subsystem and component life cycle costs in operational environments and improve subsystem performance for current and future manned and unmanned aerospace vehicles.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) \$1,478</li> <li>Developed and assessed component combat damage repair technologies, deflagration suppression techniques, hydrodynamic ram tolerance techniques, and critical component armoring techniques that decrease aerospace vehicle vulnerability. Assessed techniques including methodology for lightweight armoring of critical components and analytical models that predicted aerospace vehicle vulnerability.</li> <li>(U) \$2,940</li> <li>Developed and evaluated subsystem technologies that enhance aerospace vehicle protection. Developed technologies including a methodology that verified compliance of transparency designs and conducted dust erosion tests that predicted transparency coating performance.</li> <li>(U) \$3,369</li> <li>Developed and studied technologies for aircraft internal energy management systems which reduced aerospace vehicle size and weight. Fabricated full-scale advanced composite material heat exchanger and assessed aircraft subsystem energy interactions.</li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>:</li></ul></li></ul>								subsystem olerance ing ight. olerance opression			
<ul> <li>- (U) \$1,906 Develop a study to as develop te</li> <li>- (U) \$4,681 Develop a vehicles 1</li> </ul>	Develop and evaluate affordable subsystem technologies that enhance aerospace vehicle safety and reliability and reduce cost. Complete study to assess the feasibility of applying electric actuation to utility subsystems to reduce aircraft maintenance costs. Initiate program to develop technologies required to apply electric actuation to manned and unmanned aerospace vehicles. Develop and evaluate process for affordable structural life for an increase in maintenance/durability of existing and future aerospace vehicles.										
- (U) \$2,259 Develop a developm - (U) \$ 127 Identified	damaged or cracked components. Develop and assess technologies for aerospace vehicle internal energy management systems to reduce cost and weight. Complete development of a full-scale advanced composite material heat exchanger to demonstrate a 50% reduction in heat exchanger weight. Identified as a source for SBIR.										
Project 2402			Page 6 of	17 Pages			Exhibi	t R-2A (PE	0602201F)		

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT					
2 - Applied Researc	h	0602201F Aerospace Flight Dynamics	s 2402					
- (U) \$11,682	Total							
(U) <u>FY 2000 (\$ in Th</u>	ousands):							
– (U) \$1,035 I t r	Develop and assess component combat damage repair to echniques that decrease aerospace vehicle vulnerability am effects on composite fuel tanks.	echnologies, deflagration suppression techniques, and it. Techniques to be developed include analytical tools t	hydrodynamic ram tolerance o define and model hydrodynamic					
– (U) \$767 I	Develop and evaluate process for affordable structural lip Process includes noise suppression techniques as well as	ife for an increase in maintenance/durability of existing development of a composite repair process for damage	g and future aerospace vehicles.					
– (U) \$153 I	Develop and assess affordable subsystem technologies the	hat enhance aerospace vehicle safety and reliability and ris actuation to manual and unmanuel acrospace webi	l reduce cost. Continue to					
– (U) \$1,804 I	<ul> <li>develop and assess technologies required to apply electric actuation to manned and unmanned aerospace vehicles.</li> <li>(U) \$1,804</li> <li>Develop and assess technologies for aerospace vehicle energy management systems and components to reduce vehicle size and weight by developing high efficiency, lightweight thermal energy components and advanced heat transport techniques.</li> </ul>							
– (U) \$3,759	Fotal	r r						
(U) FY 2001 (\$ in Th	ousands):							
(0) = (0) \$1,607 I t	Develop and assess component combat damage repair to echniques that decrease aerospace vehicle vulnerability	echnologies, deflagration suppression techniques, and it. Techniques to be developed include rapid repair method combat assets to the commander for use without res	hydrodynamic ram tolerance hods for combat damaged low- triction					
– (U) \$183 I	Develop and assess affordable subsystem technologies the levelop technologies required to apply electric actuation	hat enhance aerospace vehicle safety and reliability and n to manned and unmanned aerospace vehicles throug	l reduce cost. Continue to h full-scale hardware					
– (U) \$3,058 I	Develop and assess technologies for manned and unmar- tize and weight by integrating previously developed adv torable thermal management systems	aned aerospace vehicle energy management systems ar vanced heat transfer techniques and materials, and dev	d components to reduce vehicle eloping enabling technologies for					
– (U) \$4,848 7	Fotal							
Project 2402	Page	e 7 of 17 Pages Exhibit	t R-2A (PE 0602201F)					
		57						

Project 2402     Project 2402     Project 2402     Project 2402       Project 2402     Project 2402     Project 2402	RDT&E BUDGET ITEM JUSTIFICATIO	DATE February 1999	
Control Recognition     Description of Significant Changes:     Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.       (U) C. Other Program Funding Summary:     (U) Related Activities:     (U) PE 0603100F, Logistics System Technology.       (U) DE 0603102F, Flight Vehicle Technology.     (U) PE 0603205F, Flight Vehicle Technology Integration.       (U) DE 0604212F, Arcraft Equipment Development.     (U) PE 0604212F, Arcraft Equipment Development.       (U) DE 0604212F, Arcraft Equipment Development.     (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.       (U) D. Acquisition Strategy: Not Applicable.     (U) E. Schedule Profile: Not Applicable.	BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace Flight Dyna	PROJECT
<ul> <li>Within the Science and Technology (S&amp;T) Program.</li> <li>(U) C. Other Program Funding Summary: <ul> <li>(U) Related Activities:</li> <li>(U) PE 0603105F, Legistics System Technology.</li> <li>(U) PE 0603245F, Flight Vehicle Technology Integration.</li> <li>(U) PE 0604212F, Alicraft Equipment Development.</li> <li>(U) PE 06040609F, Reliability and Maintainability Technology Insertion Program.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul> </li> <li>(U) D. Acquisition Strategy: Not Applicable.</li> <li>(U) E. Schedule Profile: Not Applicable.</li> </ul>	(U) B. Project Change Summary - Description of Significant Changes: Change Summary - Description of Significant Change Summary - Description of Signifi	nges to this program since the previous President's	s Budget are due to higher priorities
(U) D. Acquisition Strategy: Not Applicable.         (U) E. Schedule Profile: Not Applicable.         Project 2402       Page 8 of 17 Pages         Exhibit R-2A (PE 0602201F)	<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0603106F, Logistics System Technology.</li> <li>(U) PE 0603205F, Flight Vehicle Technology.</li> <li>(U) PE 0603245F, Flight Vehicle Technology Integration.</li> <li>(U) PE 0604212F, Aircraft Equipment Development.</li> <li>(U) PE 0604609F, Reliability and Maintainability Technology Insertio</li> <li>(U) This project has been coordinated through the Reliance process to</li> </ul> </li> </ul>	n Program. harmonize efforts and eliminate duplication.	
(U) E. Schedule Profile: Not Applicable.           Project 2402         Page 8 of 17 Pages         Exhibit R-2A (PE 0602201F)	(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
Project 2402 Page 8 of 17 Pages Exhibit R-2A (PE 0602201F)	(U) E. <u>Schedule Profile</u> : Not Applicable.		
	Project 2402 Pag	ge 8 of 17 Pages E	xhibit R-2A (PE 0602201F)

RDT	&E BUDGET I	TEM JUS	TIFICAT		IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 2 - Applied Resear	ch			PE N <b>06</b>	IUMBER AND	TITLE Aerospac	e Flight	Dynamic	PROJECT S 2403		
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2403 Flight Controls and Pilo	ot-Vehicle Interface	15,808	17,492	10,592	2 11,740	12,531	14,955	14,731	15,947	Continuing	Continuing
<ul> <li>venicles under an condition awareness leading to enhar environments for evaluatio</li> <li>(U) <u>FY 1998 (\$ in Th</u> - (U) \$5,011</li> <li>- (U) \$5,011</li> <li>- (U) \$4,010</li> <li>- (U) \$1,999</li> <li>- (U) \$1,999</li> <li>- (U) \$3,111</li> <li>- (U) \$1,677</li> <li>- (U) \$15,808</li> </ul>	is, provide the prior w need mission performa n of advanced concept <u>nousands</u> ): Developed and eva decreased vulnerate enabled interactive Studied and develor decreased vulnerate induced control pro- Developed enhance time on-board/off- Developed control as well as developed Developed capabil Total	aluated advance bility with decre e flights of man oped new flight bility and cost. oblems; also de ed pilot-vehicle board data for e integration tec ed display requi	ed flight con ed flight con eased cost ar ned and unn control desi Improved m eveloped tecl e surface inte enabling hur hnologies ar irements for e ways for ir	trol technique de robust ca ight control trol technique dair vehicl nanned airce ign methods ethodology hnologies for egration tech man-machin ad simulatio	ues which pr le supportabi raft and glob and criteria including cri or global rang nologies for e interface te ns for the ab in-flight miss ospace vehic	ovided air co ovided air co lity requiren al operations that provide teria and sta ge transport a improved o echnologies. ility to deplo sion plannin le performan	ft after dama anned and ur ombat advan nents. Specif al analyses f d air comba ndards for ff aircraft. verall weapo by unmanned g. nce through 1	age and failu manned aer itage with in ic developm or advanced t advantage light control on systems p l combat air high angle o	creased perfores oreased perfores oreased perfores optical air d with increase systems that erformance a vehicles in c f attack air co	ased situation work synthet eles. ormance and d strategies in ata sensors. ed performant prevented p and exploited combat envir ombat.	nai ic that nce and pilot- d real- ronments,
(U) <u>FY 1999 (\$ in T</u> - (U) \$4,470	housands): Develop and demo	onstrate advance	ed flight con	trol techniq	ues for manr	ned and unm	anned aeros	pace vehicle	s to provide	air combat a	idvantage
	by increasing perfo optical air data sys vehicle manageme rates and life cycle	ormance while stem that elimin ent system that e e upgrade poten	decreasing v lates need fo exploits pho- tial.	runerability or non-stealt tonics to im	r, cost, and su hy, expensiv prove manne	ipportability e air data pro ed and unma	requiremen obes, vanes, nned aerospa	ts. Continue and ports. I ace vehicles	to develop f nitiate develo subsystem c	tlight test ha opment of a ommunicati	rdware of dvanced on data
Project 2403				Page 9 of	17 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0602201F)</u>	

RDT	&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT
2 - Applied Researce	ch	0602201F Aerospace Flight Dynamic	s 2403
- (U) \$4,467	Develop new flight control design methods and crite vulnerability and cost. Complete algorithm developr aerospace vehicles and initiate development of unste	ria that provide air combat advantage by increasing penent for battle-damage resistant flight control system ady aerodynamic modeling techniques for use in fligh	rformance and decreasing for manned and unmanned t control system design.
- (U) \$2,058	Develop enhanced vehicle-pilot integration technolog board data for human-machine technology interface. integrated technologies for in-flight mission plannin	gies to improve overall weapon systems performance a Specific technologies include advanced pilot air-to-ai g and automated low-level flight.	nd exploit real-time on-board/off- r situation awareness and
- (U) \$3,475	Develop capabilities to evaluate technologies for inc. improving probability of mission success. Initiate si effectiveness and flight safety.	reased aerospace vehicle performance and decreased v mulations to assess new unmanned aerospace vehicle	ulnerability and cost and technologies and confirm mission
- (U) \$2,832	Initiate control technology development that address improve flight safety and combat effectiveness.	ses the automatic maneuvering of unmanned aerospace	vehicles in the terminal area to
– (U) \$ 190	Identified as a source for SBIR.		
- (U) \$17,492	Total		
<ul> <li>- (U) \$3,197</li> <li>- (U) \$2,813</li> <li>- (U) \$2,451</li> <li>- (U) \$2,131</li> <li>- (U) \$10,592</li> </ul>	Develop and demonstrate advanced flight control tec by increasing performance while decreasing vulneral air data system and transition the capability to user. and identify key component demonstrations. Develop new flight control design methods and criter vulnerability and cost. Complete algorithm developm Develop capabilities to evaluate technologies for incr improved probability of mission success. Conduct m determine design guides for effective mission manage controllability boundaries for safe aerospace vehicles Continue to develop control technology for the auton flight safety and combat effectiveness. Develop and algorithms. Total	hniques for manned and unmanned aerospace vehicles bility, cost, and supportability requirements. Complete Continue development of advanced vehicle management ria that provide air combat advantage by increasing per ment for on-board pilot-induced oscillation prevention. reased aerospace vehicle performance and decreased vehicles and ement systems. Conduct aerospace vehicle technology flight. nomous maneuvering of unmanned aerospace vehicles integrate high integrity, four-dimensional precision tra	to provide air combat advantage flight demonstration of optical ent system architecture concepts rformance and decreasing alnerability and cost, and d unmanned aerospace vehicles; r simulations and identify in the terminal area to improve ajectory generation and control
Project 2403	Page	10 of 17 Pages Exhibi	t R-2A (PE 0602201F)

RDT&	<b>E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE Febr	uary 1999
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602201F Aerospace Flight	Dynamics	PROJECT <b>2403</b>
(U) <u>FY 2001 (\$ in The</u> - (U) \$3,541	<u>busands</u> ): Develop and demonstrate advanced flight control tec by increasing performance while decreasing vulnerab management system architecture concepts and perfor	hniques for manned and unmanned aero bility, cost, and supportability requirement m laboratory demonstrations of key indi	space vehicles to provide air nts. Continue development o ividual components. Initiate	combat advantage f advanced vehicle investigation into
– (U) \$3,163	Develop new flight control design methods and criter	ia that provide air combat advantage by	increasing performance and	development cost. decreasing
– (U) \$2,693	Vulnerability and cost. Continue development of unst Develop capabilities to evaluate technologies for incr improved probability for mission success. Complete of strike packages with manned and unmanned aeros mission effectiveness criteria for new aerospace vehic	easy aerodynamic modeling techniques eased aerospace vehicle performance an unmanned aerospace vehicle technology pace vehicles. Complete aerospace vehi	d decreased vulnerability and assessments and confirm mi icle simulations; and transitio	in design. cost, and ssion effectiveness on flight safety and
– (U) \$2,343	Continue to develop control technology for the autom to improve flight safety and combat effectiveness. C	omous maneuvering of manned and unr onduct simulations to evaluate control ir	nanned aerospace vehicles in ntegration strategies and iterat	the terminal area te to an acceptable
– (U) \$11,740	Total			
(U) <b>B.</b> <u><b>Project Change Su</b></u> within the Science and Tech	<b>ummary - Description of Significant Changes:</b> Chang unology (S&T) Program.	ges to this program since the previous Pr	resident's Budget are due to h	nigher priorities
(U) C. Other Program Fi	<u>ınding Summary</u> :			
<ul> <li>(U) <u>Related Activities</u></li> <li>(U) PE 0602202F</li> <li>(U) PE 0602204F</li> <li>(U) PE 0603205F</li> <li>(U) PE 0603245F</li> <li>(U) PE 0603245F</li> <li>(U) This project F</li> </ul>	: , Human Effectiveness Applied Research. , Aerospace Sensors. , Flight Vehicle Technology. , Flight Vehicle Technology Integration. as been coordinated through the Reliance process to ha	armonize efforts and eliminate duplication	on.	
(U) D. <u>Acquisition Strate</u>	gy: Not Applicable.			
(U) E. <u>Schedule Profile</u> :	Not Applicable.			
Project 2403	Page	11 of 17 Pages	Exhibit R-2A (PE 06	02201F)

RDT	&E BUDGET ITI	EM JUS	TIFICAT		IEET (R	-2A Exh	ibit)		DATE Fe	ebruary 1999	
BUDGET ACTIVITY 2 - Applied Researc	ch			PE N <b>06</b>	UMBER AND	TITLE Aerospac	e Flight	Dynamic	s	F	PROJECT <b>2404</b>
COST (\$	In Thousands)	Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 EstimateFY 2005 EstimateCost Comp									
2404 Aeromechanics and Inte	404 Aeromechanics and Integration 14,736 16,123 11,372 12,306 18,352 18,392 18,122 22,402								Continuing	Continuing	
focusing on speed regimes r improve maneuverability, at design assessment and analy (U) <u>FY 1998 (\$ in Th</u> – (U) \$8,717	anging from low to high nd reduce observability. ysis tools. housands): Developed affordable	Mach. The This project	ese technologit evaluates a	gies have po and develops	amic perform	for content and duce costs, ir es for manne mance and de	nprove rang d and unmar	nerability w	ith reduced of	al force proj and aerospac	ection, ce vehicle
- (U) \$2,958 - (U) \$3,061 - (U) \$14,736	fraction, enhanced ma inlet designs which re Developed numerical aircraft designs such a increased aerodynami Developed fixed wing Total	aneuverabili esulted in im technologie as tailless ae c performar g aerospace	ty and contro proved aero s which incl rospace veh ice. vehicle adva	ol with high space aerody uded mather icle geometr nced aerody	payoff aero ynamics. matical mod ry for low cr mamic conce	dynamic con els for aerod uise drag wit epts, design,	cepts, and re ynamic and th increased and analytic	educed signa structural in performance al tools for t	ature through ateractions th e and reduced he Air Force	a integrated of at derived a d signature f , Navy, and	compact dvanced for NASA.
(U) FY 1999 (\$ in Th	ousands):										
- (U) \$4,580 - (U) \$3,944	Conduct aerodynamic with signature and co unmanned aerospace Develop computation and unmanned aerosp	e design, ana st constraint vehicles. al tools and ace vehicles	llysis, test, a s. Perform techniques f s. Continue	nd performa validation te for predictin developmen	ance assessme ests of innova- g and optimi- at of compute	ents of adva ative aerodyn izing aerodyn er design coo	nced manne namic contro namic and st le addressin	d and unmar ol concepts f tructural per g fluid/struc	nned aerospa for low signa formance of tural interact	ce vehicles of ture, manned advanced m ions. Initiat	consistent d and anned te
- (U) \$4,644 - (U) \$2,780 - (U) \$ 175 (U) \$16 123	development of next a other scientific discip Develop and demonst vulnerability. Initiate Develop conceptual d microwaves, high ene Identified as a source	generation, f lines. rate afforda developme esigns and a rgy lasers, a for SBIR.	multi-discipl ble fixed-win nt of aerody ussess technol nd kinetic e	linary optim ng vehicle ad namic and st ologies to de nergy weapo	ization comp erodynamic tructural inte termine imp ons into aero	puter design technologies ggration inclu acts of integr space vehicl	code integra to increase uding flow c rating directe es.	ating aerodyn aerospace vo ontrol in pay ed energy sy	namic, struct ehicle perform yload bays. ystems such a	ural, signatu mance and d as high powe	ure, and lecreased er
Project 2404				Page 12 of	f 17 Pages			Exhibi	it R-2A (PE	0602201F)	)

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RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhib	it) DATE Fe	bruary 1999
BUDGET ACTIVITY 2 - Applied Researd	ch	PE NUMBER AND TITLE 0602201F Aerospace	Flight Dynamics	PROJECT 2404
(U) <u>FY 2000 (\$ in Th</u>	nousands):			
– (U) \$3,879	Conduct aerodynamic design, analysis, test, and perf consistent with signature and cost constraints. Desig for a transport aircraft.	formance assessments of advance in and perform sub-scale compon	d tactical transport aircraft and ac ent test of a signature compatible	erospace vehicles , powered lift system
– (U) \$3,386	Develop computational tools and techniques for prec and unmanned aerospace vehicles. Complete develo development of next generation, multi-disciplinary of other scientific disciplines.	licting and optimizing aerodynan pment of computer design code a optimization computer design cod	nic and structural performance of addressing fluid/structural interac le integrating aerodynamic, struct	advanced manned tions. Continue tural, signature, and
– (U) \$4,107	Develop and demonstrate affordable fixed-wing vehi vulnerability. Continue development of aerodynami	cle aerodynamic technologies to c and structural integration include	increase aerospace performance a ling flow control in payload bays	nd decrease
- (U) \$11,372	Total			
(U) FY 2001 (\$ in Th	ousands):			
– (U) \$4,224	Conduct aerodynamic design, analysis, test, and perf consistent with signature and cost constraints. Perfo	ormance assessments of advance rm sub-scale wind tunnel tests of	d tactical transport aircraft and ac powered lift system. Initiate aer	erospace vehicles odynamic and test
- (U) \$3,674	Develop computational tools and techniques for prec and unmanned aerospace vehicles. Complete develo integrating aerodynamic structural signature and o	licting and optimizing aerodynan pment of next generation, multi-	nic and structural performance of disciplinary optimization computed	advanced manned er design code
– (U) \$4,408	Develop and demonstrate affordable fixed-wing vehi vulnerability. Continue development of aerodynamic	cle aerodynamic technologies to c and structural integration include	increase aerospace vehicle performed and the second seco	mance and decrease
– (U) \$12,306	Total		8	
Project 2404	Page	13 of 17 Pages	Exhibit R-2A (PE	0602201F)
		63	· · · · · · · · · · · · · · · · · · ·	,

RDT&E BUDGET ITEM JU	t) DATE Februar	y 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602201F Aerospace F	light Dynamics	PROJECT 2404
(U) B. <u>Project Change Summary - Description of Signif</u> within the Science and Technology (S&T) Program.	ficant Changes: Changes to this program since the previ	ous President's Budget are due to highe	r priorities
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603205F, Flight Vehicle Technology.</li> <li>(U) PE 0603260F, Hypersonic Technology Develor</li> <li>(U) PE 0603245F, Flight Vehicle Technology Into</li> <li>(U) This project has been coordinated through the</li> </ul>	opment. egration. e Reliance process to harmonize efforts and eliminate du	plication.	
(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2404	Page 14 of 17 Pages	Exhibit R-2A (PE 060220	01F)

RDT	&E BUDGET IT	EM JUS	TIFICAT	ION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 2 - Applied Resear	ch			PE N <b>06</b>	UMBER AND	TITLE Aerospac	e Flight I	Dynamic	s	P 4	ROJECT <b>397</b>
COST (\$	: In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	000 FY 2001 FY 2002 Estimate Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
4397 Air Base Technology		464	1,359	1,447	1,289	691	2,223	2,161	2,443	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Descripti</u> survivability, air base recover a survivability, and the survivability,</li></ul>	ion: This project develop very, protective systems, <u>housands</u> ): Developed aircraft ar personnel protective Total <u>housands</u> ): Develop aircraft and protective clothing, fi infrared imaging. Develop utilities and development of waste Evaluate and develop Identified as a source Total	ps technologi fire protection and air base fire clothing, fire air base fire ire risk asses shelters tech e management o air transpor for SBIR.	ies for fixed on, and crash re fighting tec e risk assess fighting tech sment techno mologies tha nt system, in table shelter	and bare ba a rescue. echnologies nent technic mologies (e ologies, and t improve a support of a s that are lig	se operations (e.g., clean, ques, and fire .g., clean env l fire fighting ir mobility sy Air Expedition ghtweight an	s, including a environment e fighter train vironmentall g training sys ystems perfo onary Force d suitable fo	airfield pave tally safe fire ning systems y safe fire fi stems) and in ormance and (AEF) opera or AEF opera	e fighting agent (s). (ghting agent mprove fire to reduce airlif ations. (ations.	gy systems, a gents, vehicles, a fighting resc ft requiremen	utomation, a equipment, p ue technolog nts, with the	ir base t, personnel sy with

Project 4397     PE NUMBER AND TILE     PROJECT       2 - Applied Research     0602201F Aerospace Flight Dynamics     4397         (U) FY 2000 (S in Thousands):     -     (U) \$Y7     Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies (and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.       - (U) \$550     Develop uitflies and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of vaste management system, in support of AT Expeditionary Force (AEF) operations.       - (U) \$18     Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.       - (U) \$14,47     Total       (U) FY 2001 (S in Thousands):     -       - (U) \$157     Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting rescue technology with infrared imaging.       - (U) \$157     Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting rescue technology with infrared imaging.       - (U) \$157     Develop uitlites and shelters technologies (that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of AFF operations.       - (U) \$17     Develop uitlites and shelters technologies that are lightweight and suitable for AEF operations.       - (U) \$1289     Total	R	DT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
<ul> <li>(U) <u>FY 2000 (S in Thousands):</u> <ul> <li>(U) \$579 Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.</li> <li>(U) \$550 Develop utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of Air Expeditionary Force (AEF) operations.</li> <li>(U) \$518 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.</li> <li>(U) \$526 Develop aircraft and air base fire fighting technologies, e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.</li> <li>(U) \$526 Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.</li> <li>(U) \$526 Develop aircraft and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of AEF operations.</li> <li>(U) \$288 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.</li> <li>(U) \$1,289 Total</li> </ul> </li> </ul>	BUDGET ACTIVITY 2 - Applied Res	earch	PE NUMBER AND TITLE 0602201F Aerospace Flight Dynam	PROJECT
Project 4397       Page 16 of 17 Pages       Exhibit R-2A (PE 0602201F)	(U) <u>FY 2000 (\$</u> - (U) \$579	<u>in Thousands)</u> : Develop aircraft and air base fire fighting technologies protective clothing, fire risk assessment technologies, a	(e.g., clean environmentally safe fire fighting agen nd fire fighting training systems) and improve fire	ts, vehicles, equipment, personnel fighting rescue technology with
<ul> <li>(U) \$318 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.</li> <li>(U) \$1,447 Total</li> <li>(U) \$2526 Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.</li> <li>(U) \$475 Develop utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of AEF operations.</li> <li>(U) \$288 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.</li> <li>(U) \$1,289 Total</li> </ul>	– (U) \$550	Develop utilities and shelters technologies that improve of waste management system, in support of Air Expedit	air mobility systems performance and reduce airlinionary Force (AEF) operations.	t requirements, with the development
(U) FY 2001 (\$ in Thousands):         - (U) \$526       Develop aircraft and air base fire fighting technologies (e.g., clean environmentally safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment technologies, and fire fighting training systems) and improve fire fighting rescue technology with infrared imaging.         - (U) \$475       Develop utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of AEF operations.         - (U) \$288       Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.         - (U) \$1,289       Total	- (U) \$318 - (U) \$1,447	Evaluate and develop air transportable shelters that are Total	lightweight and suitable for AEF operations.	
<ul> <li>(U) \$475 Develop utilities and shelters technologies that improve air mobility systems performance and reduce airlift requirements, with the development of waste management system, in support of AEF operations.</li> <li>(U) \$288 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.</li> <li>(U) \$1,289 Total</li> </ul>	(U) <u>FY 2001 (\$</u> - (U) \$526	in Thousands): Develop aircraft and air base fire fighting technologies protective clothing, fire risk assessment technologies, ar infrared imaging.	(e.g., clean environmentally safe fire fighting agen nd fire fighting training systems) and improve fire	ts, vehicles, equipment, personnel fighting rescue technology with
<ul> <li>(U) \$288 Evaluate and develop air transportable shelters that are lightweight and suitable for AEF operations.</li> <li>(U) \$1,289 Total</li> </ul>	– (U) \$475	Develop utilities and shelters technologies that improve of waste management system, in support of AEF operat	air mobility systems performance and reduce airlinions.	t requirements, with the development
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)	- (U) \$288 - (U) \$1,289	Evaluate and develop air transportable shelters that are Total	lightweight and suitable for AEF operations.	
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)				
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)				
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)				
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)				
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)				
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)				
Project 4397 Page 16 of 17 Pages Exhibit R-2A (PE 0602201F)				
	Project 4397	Page	16 of 17 Pages Ex	nibit R-2A (PE 0602201F)

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
2 - Applied Research (II) B. Project Change Summary - Description of Significant Change: Change	es to this program since the previous President's B	udget are due to higher priorities
within the Science and Technology (S&T) Program.	es to this program since the previous riesident's D	udget are due to higher priorities
(U) C. <u>Other Program Funding Summary</u> :		
(U) Related Activities:		
- (U) PE 0603205F, Flight Vehicle Technology.		
<ul> <li>(U) PE 0603231F, Crew Systems and Personnel Protection Technology.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul>	armonize efforts and eliminate duplication	
(b) This project has been coordinated through the Renance process to h	annonize errorts and emininate dupreation.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 4397 Page	17 of 17 Pages Ext	nibit R-2A (PE 0602201F)
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PE TITLE: Human Effectiveness Applied Research

	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									February 1999			
BUDGET A <b>2 - App</b>	CTIVITY Dlied Research		PE NUMBER AND TITLE 0602202F Human Effectiveness Applied Research										
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
Tot	tal Program Element (PE) Cost	70,027	58,114	51,512	56,629	55,554	55,252	62,867	66,653	Continuing	Continuing		
1123 Ma	anpower, Personnel, and Training	18,633	13,805	9,041	10,287	14,156	14,690	15,052	15,561	Continuing	Continuing		
1710 Dep	ployment and Logistics Technologies	4,700	3,173	5,851	5,994	4,982	3,484	5,365	5,702	Continuing	Continuing		
1900 Env	vironmental Quality Technology	4,230	3,637	0	0	0	0	0	0	TBD	TBD		
7184 Cre	ew Technology	24,419	25,352	28,052	29,724	25,499	26,001	31,593	34,144	Continuing	Continuing		
7755 Airc	crew Physiology Technology	4,086	0	0	0	0	0	0	0	TBD	TBD		
7757 Dire	ected Energy Bioeffects	13,959	12,147	8,568	10,624	10,917	11,077	10,857	11,246	Continuing	Continuing		
Qua	antity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C		

NOTE: The decrease between FY 1998 and FY 1999 is due to elimination of Aircrew Physiology Technology (Project 7755) and significant reductions to Deployment and Logistics Technologies (Project 1710) and Manpower, Personnel, and Training (Project 1123). The decrease between FY 1999 and FY 2000 is due to the elimination of Environmental Quality Technology (Project 1900) and reductions to Manpower, Personnel and Training (Project 1123) for intelligent computer adaptive instruction and knowledge-based technologies. Due to restructuring within the Air Force Research Laboratory, the environmental noise portion of Project 7757 moved to Project 7184 in FY 1999, studies in support of Distributed Mission Training will move from Project 7184 to Project 1123 in FY 2000, and the toxicology hazards research program will move from Project 7757 to Project 1710 in FY 2000.

(U) A. <u>Mission Description</u>: This Applied Research program establishes technology feasibility and develops the technology base for Air Force human interface needs required for weapon systems, operational readiness, and environmental quality. The program addresses crew systems; manpower, personnel, training, and logistics; aerospace physiology investigation; occupational and environmental safety; and environmental compliance, site remediation, and pollution prevention. Crew systems technologies increase the performance of humans in weapon systems operation by improving aircrew life support systems, man-machine integration (to include aircraft information display systems), and protection from dynamic forces (acceleration/escape/windblast). Manpower, personnel, training, and logistics technologies focus on reducing manpower required to operate and support weapon systems by: providing more effective methods to classify, train, and retain warfighters and their support force; modeling human cognitive functioning on complex tasks to enhance operational performance; increasing weapon systems supportability and affordability; and improving wartime logistics planning. Occupational and environmental health and safety technologies support deployment, operation, and maintenance of Air Force weapon systems

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Exhibit R-2 (PE 0602202F)

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RDT&E BUDGET ITEM JUS	TIFICATIO	N SHEET (	R-2 Exhib	it)	DATE February 1999				
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602202F Human Effectiveness Applied Research							
by developing: occupational and operational exposure safety gui disposal of pollutants from Air Force operations; and cleaning up effectiveness by expanding all parameters defining operational p	delines for militar contaminated Ai performance limits	rily relevant elec ir Force sites. Pa 3.	ctromagnetic rad ayoff from these	iation's and toxica technology develo	nts; detection, control, reduction, and opment efforts is to improve combat				
(U) <b>B.</b> <u>Budget Activity Justification</u> : This program is in Bud utility of evolutionary and revolutionary technologies. This App human interface needs required for weapon systems, operational	get Activity 2, Ap lied Research pro- readiness, and er	pplied Research, gram establishes wironmental qua	since it develops s technology feas ality.	s and determines th bility and develop	ne technical feasibility and military os the technology base for Air Force				
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					Total				
<ul><li>(U) Previous President's Budget/FY 1999 PB</li><li>(U) Appropriated Value</li></ul>	<u>FY 1998</u> 72,118 76,102	<u>FY 1999</u> 60,805 60,805	<u>FY 2000</u> 55,802	<u>FY 2001</u> 57,661	<u>Cost</u> Cont				
<ul> <li>(U) Adjustments to Appropriated Value</li> <li>a. Congressional/General Reduction</li> <li>b. SBIR</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>d. Palawy Threshold Paper grammings</li> </ul>	-2,641 -1,164 -2,117	-2,691							
<ul> <li>(U) Adjustments to Budget Year Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> </ul>	70,027	58,114	-4,290 51,512	-1,032 56,629	Cont				
(U) Significant Program Changes: Changes to this program sind Program.	ce the previous Pr	esident's Budge	t are due to high	er priorities within	the Science and Technology (S&T)				
FY 1999: \$937 identified as a source for SBIR.									

Page 2 of 21 Pages

Exhibit R-2 (PE 0602202F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)											
BUDGET ACTIVITY 2 - Applied Research				PE N <b>06</b>	UMBER AND 02202F	title <b>Human E</b> f	fectiven	ess Appli	ied Rese	arch	PROJECT 1123
COST (\$ In 7	Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
1123 Manpower, Personnel, and	I Training	18,633	13,805	9,041	10,287	14,156	14,690	15,052	15,561	Continuing	Continuing
of specific areas, including: a training; information warfare t ways to determine needs and d desktop tutors, courseware dev effectiveness for specific need crew, aircraft, and support pers methods and approaches to cla systems and on improving the and knowledge-based technolo (U) <u>FY 1998 (\$ in Thou</u> – (U) \$ 9,717 – (U) \$ 4,725 – (U) \$ 4,191 – (U) \$18,633	aircrew training; techn training; and warfare deficiencies, design ar velopment tools and te ls at minimum cost. T sonnel readiness. Thi assify, assign, train, as effectiveness of the o ogies will be eliminate <u>usands</u> ): Developed technologi trainers/simulators, ev strategies using eye tr Developed knowledgy instructional authorin evaluation technologi Developed and transit and mission accompli Total	ical training readiness tra ad implement echnologies, This project v s Applied R ssess, and re operators, maded in FY 200 ies required valuating sin racking technolog es. tioned technolog es.	;; logistics tr aining. It im at training, an assessment will contribu esearch prog tain personn aintainers, ar 00. to create an nulation-bas nology. adaptive tra ies, intellige ologies to se	aining; miss vestigates th nd to evalua methodolog te to a more gram develo el. This pro- nd other sup integrated I ed mission p ining techno nt/adaptive lect, classify	sion rehearsa ne spectrum of te training ef jies, and simu highly train- ps technolog ogram focuse port personn Distributed M preparation a plogies includ training and y, and assess	l; training in of new and a ffectiveness. ulation-based ed and flexili ies to increa es on reducin el for those s lission Train and rehearsa ding represen instructiona Air Force p	a support of o dvanced trai It develops I systems to ble cadre of j se operation g the manpo systems. Not ing environn l effectivene htation/stude l design tech ersonnel and	complex dec ining and ed and evaluate determine he personnel an al readiness ower required ote: Intelligen ment by asse ss, and asses ent modeling mologies, ar	cision makin ucation tech es specific tr ow to achiev d reduce the by providing d to operate nt computer sssing concep- ssing alterna schemes an ad student as oD jobs to m	g; space ope nologies for aining syste re maximum cost of mai g more effec and support adaptive ins ots and tive training d associated sessment ar	erations optimal ems, a learning ntaining tive weapon truction

RUI & E DUDGET TI ENI JUSTIFICATIO	February 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Human Effec	PROJECT tiveness Applied Research 1123
<ul> <li>(U) <u>FY 1999 (\$ in Thousands)</u>: <ul> <li>(U) \$10,581 Develop technologies required to enhance the integral information operations systems and by developing menvironment, and High Level Architecture (HLA) constrained on the second s</li></ul></li></ul>	ted Distributed Mission Training (DM ission rehearsal training technologies, mpliant systems. scenarios, and techniques for use in A oring system based on knowledge rep ng and media selection. e operations center by creating perform utomated brief/debrief, simulation, ac	AT) environment by incorporating space and a more representative electronic combat ir Force aircrew, space, and information operations resentation/student modeling technologies and nance specifications for a seamless, integrated ademics, weapon systems, and Command, Control,
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:</li> <li>(U) \$ 5,515 Develop technologies required to enhance the integr simulators/trainers, and representation, human syste</li> <li>(U) \$ 2,600 Develop Air Force training guidelines, instructional performance measurement systems into aircrew, spa</li> <li>(u) \$ 926 Develop concept and technologies to enable a warfa operations center with the distributed mission traini</li> <li>(U) \$ 9,041 Total</li> </ul>	ated DMT environment by developing ms, and interconnection technologies scenarios, and techniques by transition ice, and information operations environ re operations center by integrating the ng environment.	g space and information operations oning combat aerial training technologies and nments. command and control systems of the warfare
Project 1123 Pe	age 4 of 21 Pages	Exhibit R-2A (PE 0602202F)

RDT&E BUDGET ITEM J	bit) DATE February	1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Human Effe	ectiveness Applied Research	PROJECT <b>1123</b>
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:</li> <li>(U) \$ 7,227 Develop technologies required operations simulators/trainers, a</li> <li>(u) \$ 1,200 Develop Air Force training gui performance measurement syst</li> <li>(U) \$ 1,860 Develop concept and technolog operations center with the distr</li> <li>(U) \$ 10,287 Total</li> </ul> (U) B. <u>Project Change Summary - Description of Sign</u> within the Science and Technology (S&T) Program.	to enhance the integrated Distributed Mission Training e and representation, human system, and interconnection idelines, instructional scenarios, and techniques by transi- tems into aircrew, space, and information operations env gies to enable a warfare operations center by integrating to ributed mission training environment.	environment by developing space and inform technologies. itioning combat aerial training technologies ironments. the command and control systems of the wa evious President's Budget are due to higher	nation and fare priorities
<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) <u>Related Activities</u>: <ul> <li>(U) PE 0602233N, Mission Support Technology</li> <li>(U) PE 0602716A, Human Factors Engineering</li> <li>(U) PE 0602727A, Non-System Training Device</li> <li>(U) PE 0602785A, Manpower, Personnel, and T</li> <li>(U) PE 0603106F, Logistics Systems Technolog</li> <li>(U) PE 0603227F, Personnel, Training, and Sin</li> <li>(U) PE 0604227F, Distributed Mission Training</li> <li>(U) PE 0604243F, Manpower, Personnel, and T</li> <li>(U) This project has been coordinated through t</li> </ul> </li> </ul>	y: Personnel, Training, and Simulation Technology Area Technology Development. es Technology. Training Technology. gy. nulation Technology. g (DMT). Fraining Development. he Reliance process to harmonize efforts and eliminate o	a. duplication.	
<ul> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>			

RDT&E BUDGET IT	EM JUS	TIFICAT		IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 2 - Applied Research			PE N <b>06</b>	UMBER AND	TITLE <b>Iuman E</b> f	fectivene	ess Appl	ied Rese	arch	PROJECT <b>1710</b>
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
1710 Deployment and Logistics Technologies	4,700	3,173	5,851	5,994	4,982	3,484	5,365	5,702	Continuing	Continuin
<ul> <li>(U) A. <u>Mission Description</u>: This project investigates and researches technologies to support the enhancement of the deployment and sustainment technologies critical to the goals and requirements of Agile Combat Support and Air Expeditionary Force operations. The research focuses on technologies with the potential to: reduce the time required for units to plan, pack up, and deploy: reduce airlift requirements while enhancing deployed capability: enhance sustainment of deployed forces in contingency environments; improve logistics support for both combat and peacetime operations; and develop toxicological tools and technology to minimize the health risks and mission impact to DoD personnel from exposure to hazardous chemicals while also reducing weapon system life cycle cost.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>S 831</u></li> <li>Explored and defined advanced logistics technology concepts in on-orbit servicing, remote diagnostics, and logistics models for improved support of space operations to increase the availability and flexibility of space assets.</li> <li>(U) <u>S 1,269</u></li> <li>Explored technology options to improve agile combat support capabilities by conducting trade studies on advanced visualization presentation capabilities for use by maintenance technicians in advanced research projects, and evaluated speech intelligibility of synthetic voice software packages for use in depots and on flightlines.</li> <li>(U) \$2,600</li> <li>Adapted and refined information technologies to enhance logistics and deployment planning capabilities by including software tools and architectures that added high levels of intelligence to logistics information system interfaces and databases for more effective use in rapid response contingency and deployed operations.</li> <li>(U) \$4,700</li> </ul> </li> </ul>										

RDT&	DATE February 1999				
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602202F Human E	ffectiveness Appli	ed Research	PROJECT <b>1710</b>
(U) <u>FY 1999 (\$ in Th</u>	ousands):				
– (U) \$ 658	Explore and define highly reliable, low footprint, mu will increase deployment speed and decrease airlift r	lti-function, rapid on-load/off	f-load, and ground moven le combat support and rar	nent technology cond	cepts which
– (U) \$1,062	Explore and develop technology options to improve a oculographic and electromyographic capabilities, to capability), and requiring free hands (prohibiting ma	agile combat support capabilit be used in various maintenand nual control). Investigate adv	ties by assessing alternative ce environments which are vanced user interfaces to a	ve input devices, suc re loud (prohibiting v support wing level lo	h as electro- voice control ogistics
– (U) \$1,419	Adapt and refine information technologies to enhance knowledge representation schemes and computations weapon systems design data.	al linguistics methods to autor	anning capabilities by de matically extract mainten	fining and evaluating ance manual informa	g advanced ation for
- (U) \$ 34	Identified as a source for SBIR.				
– (U) \$3,173	Total				
(U) FY 2000 (\$ in Th	ousands):				
- (U) \$ 500	Develop interoperable and intermodal containerization during on-load/off-load operations at aerial ports and	on and pallet optimization technologies to directly	hnologies that will signif	icantly streamline ca	rgo handling
– (U) \$3,051	Explore and develop advanced logistics technology of technology development programs. Identify diagnoss prognostic/diagnostic program which will improve ar architectures for the representation of human behavior decrease the number of required wargame-support per	pptions and perform specialize tic strategies and develop initi and reduce aircraft down time. or in synthetic environments to ersonnel.	d technical research to su ial algorithms to support Develop enabling techno o increase the fidelity of	pport large-scale adv the advanced ology for innovative s wargame simulations	vanced software s and
– (U) \$2,300	Develop and expand capabilities of robust bio-techno Integrate biological assay results using novel mathem prediction of adverse human health and mission perfo	logy force protection tools to natical models to provide Air ormance impact.	assess real-world mixed o Expeditionary Force com	operational chemical manders with near-re	exposures. eal-time
– (U) \$5,851	Total				
Project 1710	Page	7 of 21 Pages	Exhibit	R-2A (PE 060220)	2F)
		75			

RDT	DATE February 1999				
BUDGET ACTIVITY 2 - Applied Researd	ed Research	PROJECT <b>1710</b>			
(U) <u>FY 2001 (\$ in Th</u> - (U) \$ 500	<u>nousands</u> ): Develop deployable, cargo-compartment-sized contai locations, thereby decreasing deployment times and i	iners that will significantly decrease the tin ncreasing sortie generation rates. Develop	ne required t point of use	to set up operations a e delivery and extrac	at deployed
– (U) \$2,799	Explore and develop advanced logistics technology of technology concepts to extend the Distributed Missic capability by enhancing technical performance. Development	ptions to further enhance large-scale advar on Training capability into the maintenance elop innovative software architectures for a	and logistic atomated tr	pment programs. Investigation of weather the second	vestigate combat pon system
- (U) \$2,695	Demonstrate and continue to develop and evaluate fo models to assess operational chemical exposures and adverse human health mission performance impact.	rce protection technologies in the form of l to provide Air Expeditionary Force comm Initiate studies using deployment field sam	biological as anders with aples to align	ssays and mathematic near-real-time predi- n and validate model	cal predictive ctions of l predictions.
<ul> <li>– (U) \$5,994</li> <li>(U) B. <u>Project Change S</u></li> </ul>	Total           Summary - Description of Significant Changes:         Not A	Applicable.			
(U) C. Other Program I	Funding Summary:				
<ul> <li>(U) <u>Related Activities</u></li> <li>(U) PE 06022331</li> <li>(U) PE 06027162</li> <li>(U) PE 06031061</li> <li>(U) This project</li> </ul>	<u>s:</u> N, Mission Support Technology: Personnel, Training, an A, Human Factors Engineering Technology Developme F, Logistics Systems Technology. has been coordinated through the Reliance process to ha	nd Simulation Technology Area. nt. armonize efforts and eliminate duplication.			
(U) D. <u>Acquisition Strate</u>	egy: Not Applicable.				
(U) E. <u>Schedule Profile</u> :	Not Applicable.				
Project 1710	Page	e 8 of 21 Pages	Exhibit	R-2A (PE 060220	i2F)
		76			

R	DT&E BUDGET ITI	EM JUS	TIFICAT	TION S	HEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 2 - Applied Rese	earch			PE 0	NUMBER AND	title <b>Iuman E</b> f	fectiven	ess Appl	ied Rese	arch <sup>r</sup>	PROJECT <b>1900</b>
cos	T (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
1900 Environmental Qua	ality Technology	4,230	3,637		0 0	0	0	0	0	TBD	TBD
COST (\$ In Thousands)         FY 1998         FY 2009         FY 2000         FY 2004         FY 2004         Estimate         Estimate <td>err f and trol posed by ir Force ce an s.</td>									err f and trol posed by ir Force ce an s.		
Project 1900				Page 9 d	of 21 Pages			Exhibi	t R-2A (PE	0602202F)	)

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RDT&E BUDG	ibit) DATE February 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Human Ef	PROJECTfectiveness Applied Research1900
(U) FY 1999 (\$ in Thousands):		
– (U) \$ 927 Investigate a by developin volatile mate	d develop environmentally acceptable replacement materials and pro- g new selection criteria for Air Force industrial solvents and fuels, and rials.	cesses to reduce the cost of weapon systems sustainment d by characterizing the air quality effects of Air Force
– (U) \$ 893 Develop env unnecessary Air Force-ge other Air For	ronmental instrumentation for chemical detection and monitoring and Air Transport and Dispersion (ATD) launch holds and reducing liabil herated particulate matter (PM); and developing innovative instrumen ce-monitored chemicals.	l process controls by: identifying and correcting ity risks; developing techniques to accurately characterize itation to detect chlorinated solvents, explosives, and
– (U) \$1,759 Reduce weap enzymes for characterizin control regul fuels and sol	on systems sustainment costs and enhance Air Force readiness by: devolver chlorate chlorate and chlorite reduction; converting propellant from g strategies for energy generation and water recovery from waste treat ated emissions from depainting and other corrosion-control operation; vents.	veloping engineering tools to isolate and synthesize n missiles and rockets to benign compounds; tment systems; enhancing DoD capability to contain and s; and studying environmental interactions of advanced
– (U) \$ 58 Identified as	a source for SBIR.	
– (U) \$3,637 Total		
<ul> <li>(U) <u>FY 2000</u>: Not Applicable.</li> <li>(U) <u>FY 2001</u>: Not Applicable.</li> </ul>		
Project 1900	Page 10 of 21 Pages	Exhibit R-2A (PE 0602202F)
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RDT&E BUDGET ITEM JUSTIFICATION	DATE February	1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Human Effectiveness Ap	oplied Research	PROJECT <b>1900</b>
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Changwithin the Science and Technology (S&T) Program.	ges to this program since the previous President's	Budget are due to higher	priorities
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0601102F, Defense Research Sciences.</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0603112F, Advanced Materials for Weapon Systems.</li> <li>(U) PE 0603211F, Aerospace Structures.</li> <li>(U) PE 0603723F, Environmental Engineering Technology.</li> <li>(U) PE 0603716D, Strategic Environmental Research and Development</li> <li>(U) This project has been coordinated through the Reliance process to h</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	Program. armonize efforts and eliminate duplication.		
Project 1900 Page	11 of 21 Pages Ex	hibit R-2A (PE 060220)	2F)
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)						DATE Fe	bruary 1	999			
BUDGET ACTIVITY 2 - Applied Researc	ch			PE N <b>06(</b>	UMBER AND 02202F	TITLE <b>Iuman E</b> f	ffectiven	ess Appl	ied Rese	arch	PROJECT <b>7184</b>
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
7184 Crew Technology		24,419	25,352	28,052	29,724	25,499	26,001	31,593	34,144	Continuing	Continuing
7184         Crew Technology         24,419         25,352         28,062         29,724         25,499         26,001         31,593         34,144         Continuing         Continuing           (U) A. Mission Description:         This project develops the technology required to improve human performance, protection, and survivability in operational stresses such as noise, impact, vibration, sustained acceleration, spatial disorderation, and (e., workload, and sustained operations; and opimizing the human-machine interface. The project produces human-centered design criteria, guidelines, and automated design tools for the development of effective technologies for information display, team communications, crew scheduling and fatigue management, control interfaces, crew station layout and functional integration, emergency escape, crash protection, aircrew oxygen systems, acceleration protection, and aircrew life support.           (U) <u>FY 1998 (\$ in Thousands):</u> – (U) \$ 1,710         Developed unobtrusive, reliable predictors of human system safety and effectiveness, including metrics for crew workload, situational awareness, and physical accommodation. Established workload and performance baselines in simulators. Demonstrated performance metrics in joint field exercises. Completed cockpit aircrew accommodation surveys for 50 percent of Air Force aircraft types and completed 50 percent U.S. data collection under a multi-national, whole-body three-dimensional size survey.           – (U) \$ 4,454         Demonstrated system design technologies that integrate human factors data for workstations to accommodate an expanded crew population and demonstrated an effective crew workplace integration of DoD common surveillance automakic target recognition technology in operational f											
- (U) \$24,419	Total										

RDT	DATE February 1999				
BUDGET ACTIVITY		PROJECT			
2 - Applied Researc	ch	0602202F Human Effectiv	veness Appli	ed Research	7184
• (U) <u>FY 1999 (\$ in Th</u> - (U) \$ 2,340	nousands): Continue to develop unobtrusive, reliable predictors	of human system effectiveness based	on crew workload	d and situational awa	areness.
	eliminate crew task overload. Validation and select predictive select predictin select predictive sele	workload model to advance technolog netrics with simulation of Predator Un Force inventory aircraft. Complete U	y for human perf hihabited Air Veh S. part of interna	ormance design asso icle control station. tional whole-body th	Complete hree-
- (U) \$ 5,641	Continue to develop system design technologies that related computer-aided design templates, by develop command centers, and by initiating development of	integrate human factors data for wor bing network models to streamline the multi-sensory adaptive control as a ne	kstations by intege sharing of data a w design technol	rating an on-line da mong intelligence a ogy.	ta system and nalysts and
– (U) \$ 7,590	Continue to develop visual display technology for in including integrated display and information process ejection-safe, panoramic night vision goggles with e adapts to pilot physiological and behavioral state.	nproved human-machine interfaces ar sing standards; design alternatives for xternal sensor inputs to enhance nigh	nd demonstrate ad r next generation at operations; and	aptive interface tech helmet-mounted sig a pilot-vehicle inter	nology, ht/displays, face that
- (U) \$ 1,775	Continue expansion of audio technologies to establis workload environments.	sh new information management met	hods to improve o	perator performance	e in high
- (U) \$ 1,580	Continue aircrew life support and performance reseat color cues on head-up and head-down displays.	rch including the effect of high G on	pilot color percep	otion and the ability	to discern
- (U) \$ 3,606	Develop tolerance criteria for assessing effects of for performance while using head/helmet mounted equi	ces experienced during escape, sustainment.	ined, and transien	t accelerations on cr	ew safety and
- (U) \$ 2,300	Improve integrated mission rehearsal training technol	blogies for aircrew and battlestaff in s	simulated and fiel	d extended/continue	d operations.
- (U) \$ 95	Support the joint Air Force/Defense Advanced Resea	arch Projects Agency Uninhabited Co	mbat Air Vehicle	(UCAV) program.	
- (U) \$ 425 - (U) \$25,352	Identified as a source for SBIR. Total				
Project 7184	Page	13 of 21 Pages	Exhibit	R-2A (PE 060220	)2F)
		81			

RDT	DATE February 1999							
BUDGET ACTIVITY 2 - Applied Researe	ch	PE NUMBER AND TITLE 0602202F Human Effectiveness A	PROJECT pplied Research 7184					
(U) <u>FY 2000 (\$ in Th</u>	ousands):							
- (U) \$4,254	Continue to develop unobtrusive, reliable predictors of time classification of overload, and apply to next-gene Air Force-France-United Kingdom agreements. Demo Unihabited Air Vehicle control station. Complete NA cockpit accommodation model.	f human performance by extending workload met eration multi-sensory fighter cockpit with high-fic onstrate performance metric technology in design TO part of multi-national whole-body three-dime	ric technology to include a near real- elity immersive simulation under joint evaluation of advanced Predator ensional survey, and begin to validate					
- (U) \$ 3,030	Continue to develop system design technologies that i synchronization of operational performance data amon problem facing multi-place air battle staff operations.	ntegrate human factors including network models ng intelligence analysts and command centers, an	s to streamline the sharing and d to overcome the data overload					
- (U) \$ 3,861	Advance crew system design technologies for airborne technology to enable rapid affordable crew station des perceptual, and physical performance in the operation	e and ground control stations, and begin to develo ign. Introduce the ability to define and visualize al task environment.	p a new human performance model the human operator's cognitive,					
- (U) \$ 4,469	Continue to develop visual display technology concentrating on next generation helmet trackers, display visual performance criteria, on- board/off-axis weapon cueing, sensor display definitions, and monochrome active-matrix organic light-emitting-diode for helmet display; assess anti-reflection visors and ejection-safe, panoramic night vision goggles (PNVGs) with head-up display insert. Develop comprehensive transparency design guidelines							
– (U) \$ 2,349	Develop and demonstrate integrated three-dimensional audio, active noise reduction, voice control, and voice activated switch technologies in a low-cost, high reliability, reconfigurable aircraft audio interface system to enhance performance and reduce workload. Continue to explore audio information management for improvement of operator performance in high-workload/high-noise environments and audio enhancements for improvements in remote threat detection. Demonstrate reduced cost noise monitoring systems for environmental							
– (U) \$ 5,489	Continue development of injury criteria and technolog accommodation of the full aircrew population. Devel	ies for improved aircrew and support personnel p op criteria for human performance in a high susta	rotective equipment focusing on safe ined acceleration environment.					
- (U) \$ 3,600	Continue to provide human systems technology suppo Combat Air Vehicle (UCAV) program.	rt to the joint Air Force/Defense Advanced Resea	rch Projects Agency Uninhabited					
- (U) \$ 1,000 - (U) \$28,052	Conduct international cooperative effort with Australi Total	a for Virtual Air Commanders.						
Project 7184	Page	14 of 21 Pages Ex	hibit R-2A (PE 0602202F)					
RD	<b>F&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)		DATE February 1999				
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BUDGET ACTIVITY 2 - Applied Resea	rch	PE NUMBER AND TITLE 0602202F Human Effective	ness Appli	ed Research	PROJECT <b>7184</b>			
(U) <u>FY 2001 (\$</u> in 7	Thousands):							
- (U) \$ 4,756	Continue to develop unobtrusive, reliable predictors of I tactics data. Initiate development of on-line, intelligent tacting design. Complete workload classification algorithm and systems, for both improved crew effectiveness and mission	numan performance by validating F-15E physical accommodation information sy l incorporate into initial multi-sensory a ion success rate.	crew workloa stem for crew daptive control	d/operational weapon system and personal interface for uninha	n system and equipment bited air			
- (U) \$ 3,418	Continue to develop system design technologies that in synchronization of operational performance data among problem facing multi-place air battle staff operations. S demonstrate ability to process and deploy critical inform	tegrate human factors including network intelligence analysts and command cen Simulate command center operations usination to maximize team performance.	t models to stream ters, and to ov ng human-cen	eamline the sharing a ercome the data over tered data interface a	nd load nd			
– (U) \$ 4,056	Continue to develop integrated human performance models technologies for airborne and ground control stations: d	tels and analysis tools to advance effection emonstrate with analytical experiments	ve/rapid/afford	lable crew system de	sign			
– (U) \$ 5,000	Continue to develop visual display technology including sight/display, design alternatives for lightweight helmet matrix organic light-emitting-diode for helmet display. verify visual performance models for windscreen optica	g integrated display and information pro sight/display using eye line-of-sight cu Perform ejection risk assessment for pa l parameters.	cessing standa eing, and demo noramic night	rds for targeting helr onstrate monochrome vision goggles, and o	net e active- develop and			
– (U) \$ 2,648	Continue development and flight demonstration of reco workload. Explore active noise reduction and active vil Air Force personnel. Develop technology to assess and operations.	nfigurable aircraft audio interface system oration reduction concepts for mitigation reduce adverse impacts of aircraft noise	n for enhanced n of noise and v and sonic book	performance and reavibration hazards for ms produced by Air I	duced aircrews and Force			
– (U) \$ 5,151	Develop advanced restraint system technologies using d operations, crashes, and emergency escape. Develop cr	lefined injury criteria to ensure safety of iteria for human performance in a high	all aircrew du sustained accel	ring aircraft and othe eration environment	er vehicle			
- (U) \$ 3,195	Continue to provide human systems technology support Combat Air Vehicle (UCAV) program.	to the joint Air Force/Defense Advance	d Research Pro	jects Agency Uninha	abited			
- (U) \$ 1,500 - (U) \$29,724	Continue international cooperative effort with Australia Total	for Virtual Air Commanders.						
Project 7184	Page	15 of 21 Pages	Exhibit	R-2A (PE 060220	2F)			
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RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Human Effectiveness A	PROJECT Applied Research 7184
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Not .	Applicable.	
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0602702F, Command, Control, and Communications.</li> <li>(U) PE 0603205F, Aerospace Vehicle Technology.</li> <li>(U) PE 0603227F, Personnel, Training and Simulation Technology.</li> <li>(U) PE 0603231F, Crew Systems and Personnel Protection Technology.</li> <li>(U) PE 0603245F, Flight Vehicle Technology Integration.</li> <li>(U) PE 0604227F, Distributed Mission Training (DMT).</li> <li>(U) PE 0604703F, Aeromedical/Casualty Care Systems Development.</li> <li>(U) PE 0604706F, Life Support Systems.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	armonize efforts and eliminate duplication.	
Project 7184 Page	16 of 21 Pages E	xhibit R-2A (PE 0602202F)
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RDT&E BUDGET	ITEM JUS	TIFICAT	TON SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 2 - Applied Research			PE N <b>06</b>	UMBER AND	TITLE <b>Iuman E</b> f	fectiven	ess Appl	ied Rese	arch	PROJECT <b>7755</b>
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cos
7755 Aircrew Physiology Technology	4,086	0	0	0	0	0	0	0	TBD	TE
<ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$ 883 Completed develo</li> <li>(U) \$2,823 Completed develo</li> <li>(U) \$ 380 Conducted and co</li> <li>(U) <u>FY 1999</u>: Not Applicable.</li> </ul> </li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> <li>(U) <u>FY 2001</u>: Not Applicable.</li> </ul>	ppment of and eroppment of metho oppment of metho ompleted expand	valuation for ods to identif led physical	aircrew perfo	ion enhancer diate physiol pattery and fi	ment technol ogical impai ire fighter ph	logies for bo rments arisi hysical fitnes	on fight saf	night air com	bat. bat. ormance air	craft.

RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February	<sup>,</sup> 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602202F Human Effectiveness Ap	oplied Research	PROJECT <b>7755</b>
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Chang within the Science and Technology (S&T) Program.	ges to this program since the previous President's	Budget are due to higher	priorities
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603231F, Crew Systems and Personnel Protection Technology.</li> <li>(U) PE 0604703F, Aeromedical/Casualty Care Systems Development.</li> <li>(U) PE 0604706F, Life Support Systems.</li> <li>(U) This project has been coordinated through the Reliance process to have a structure of the structure o</li></ul>	armonize efforts and eliminate duplication.		
(U) D. <u>Acquisition Strategy:</u> Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 7755 Page	18 of 21 Pages Ex	hibit R-2A (PE 0602202	2F)

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RDT&E BUDGET I	<b>FEM JUS</b>	TIFICAT		HEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 2 - Applied Research			PE N 06	PE NUMBER AND TITLE PROJE 0602202F Human Effectiveness Applied Research 7757						
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
7757 Directed Energy Bioeffects	13,959	12,147	8,568	8 10,624	10,917	11,077	10,857	11,246	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Description</u>. This project challed biological effects of electromagnetic radiation use radio frequency and microwave radiation, lasers, planning and countermeasures in combat, and not technical consultative support to other DoD progrematic (U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$ 3,533</li> <li>Conducted laser op safety for high-enerentiation of the progrematic communic technical communication of the progrematic communi</li></ul></li></ul>	tical bioeffects gy laser system equency radiat cations system ased risk man screening tool ogy to reduce a g a joint study e analysis.	anonal use of ing from, Air unitions, and ations for sp and counter s research to ms and laser ion (RFR) bi ns, and radar agement pro for toxic exp adverse impa with the Na	enable cou system safe ioeffects res by initiatin cess for Ain posure haza acts of aircra vy to mode	ntermeasures ety standards search to enal ng RFR cance r Force opera aft noise and l noise propa	for optical l for optical l oble safe expl r promotion for al fuels a t applicable sonic booms gation over	ifies and mi ressing area war, and pe and threats. nazards/threats oitation of le study and p and weapon to a wide ran by demonst water, and d	tigates the b s such as saf eacekeeping ats by initiat ethal and non promulgating system fire s nge of deplo trating minia emonstrating	iological effe ety, risk asse operations. ing probabili n-lethal direct NATO RFF suppression a yment locati turized affor g radar track	astic risk app astic risk app eted energy v Standardiz agents. Den ons. dable sonic ing storage	proach to weapons, cation honstrated boom
Project 7757			Page 19 o	of 21 Pages			Exhibi	t R-2A (PE	0602202F	)

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RDT	<b>E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhi	bit)	<b>February 1999</b>				
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602202F Human Eff	ectiveness Appli	ed Research	PROJECT <b>7757</b>			
(U) <u>FY 1999 (\$ in Th</u>	ousands):							
– (U) \$ 4,209	Conduct laser optical bioeffects research to enable con- high energy laser safety and low energy systems for emerging optical threats	ountermeasures for optical haza non-lethal use, and refining biol	rds/threats by initiating logical effects models to	development of guid assess combat vulne	lelines for erability to			
– (U) \$ 5,578	Conduct bioeffects research to enable safe exploitation and radar by transitioning tri-Service High-Power M	on of lethal and non-lethal direction of lethal and non-lethal direction of the second s	eted energy weapons, ad ds Study results to DoD	vanced communication and developing/prov	ons systems, viding data			
– (U) \$ 2,070	Develop and evaluate robust force protection bio-tec and predict adverse human health and mission perfo	hnology tools for Air Expedition rmance impacts.	nary Force commanders	to assess chemical e	exposures			
- (U) \$ 94 - (U) \$ 196	Evaluate Photorefractive Keratectomy (PRK) as surg Identified as a source for SBIR.	gical method to reduce need for	glasses or contact lense	s for aircrew.				
- (U) \$12,147 (U) EX 2000 (\$ in Th	Total							
- (U) \$ 3,245	Conduct laser optical bioeffects research to enable co flashblindness bioeffects with and without laser eye p probability-based methods of laser hazard analysis, a requirements for test range certification	ountermeasures for optical haza protection, conducting high-ene nd proposing tri-Service recomm	rds/threats by evaluatin rgy laser reflection haza mendations for High-Er	g and exploiting lase ard analysis, develop hergy Laser system u	r glare and ing se policy and			
- (U) \$ 4,773	Conduct radio frequency bioeffects research to enabl providing updated DoD and exposure guidelines for Initiative for portable High Energy Microwave Activ	e safe exploitation of lethal and ultra-wideband radiation and st e Denial Technology.	non-lethal directed ene arting Air Expeditionar	rgy weapons and rad y Force Agile Comb	ar by at Support			
– (U) \$ 550	Continue to evaluate Photorefractive Keratectomy as analyze first year post operative data.	surgical method to reduce need	l for glasses or contact l	enses for aircrew. C	ollect and			
– (U) \$ 8,568	Total							
Project 7757	Page	20 of 21 Pages	Exhibit	R-2A (PE 0602202	2F)			
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RDT&E BUI	DGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602202F Human Effectiveness Ap	PROJECT plied Research 7757
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:</li> <li>(U) \$ 4,144 Conduct Complet guidance</li> <li>(U) \$ 5,980 Conduct continui completi</li> <li>(U) \$ 500 Continue second y</li> <li>(U) \$10,624 Total</li> </ul>	a laser optical bioeffects research to enable co the joint-Service personnel effects model to as e for high energy laser test program. Tradio frequency bioeffects research to enable ng Air Expeditionary Force Agile Combat Su ing recommendation for DOD standard for H e Photorefractive Keratectomy as surgical me year post operative data.	ountermeasures for optical hazards/threats by develo sess combat vulnerability to emerging optical threats e safe exploitation of lethal and non-lethal directed of apport Initiative for portable High Energy Microway ligh Power Microwave and ultra-wideband radiation ethod to reduce need for glasses or contact lenses for	ping non-lethal laser use guidelines. s and generate optical safety energy weapons and radar by re Active Denial Technology and weapons. c aircrew. Collect and analyze
<ul> <li>(U) B. <u>Project Change Summary - 1</u> within the Science and Technolog</li> <li>(U) C. <u>Other Program Funding Sum</u></li> <li>(U) <u>Related Activities</u>: <ul> <li>(U) <u>PE 0602720A</u>, Environm</li> <li>(U) <u>PE 0602777A</u>, Systems</li> <li>(U) <u>PE 0603231F</u>, Crew Sy</li> <li>(U) <u>PE 0604706F</u>, Life Sup</li> <li>(U) This project has been compared</li> </ul> </li> </ul>	Description of Significant Changes: Change y (S&T) Program. mmary: mental Quality Technology. Health Hazard Prevention Technology. stems and Personnel Protection Technology. port Systems. pordinated through the Reliance process to ha	es to this program since the previous President's Bu armonize efforts and eliminate duplication.	dget are due to higher priorities
(U) D. <u>Acquisition Strategy</u> : Not A (U) E. <u>Schedule Profile</u> : Not Appli	applicable.		
Project 7757	Page	21 of 21 Pages Exh	bit R-2A (PE 0602202F)

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PE TITLE: Aerospace Propulsion

RDT&E BUDGET I	<b>TEM JUSTIFICATION SHEET (R-2 Exhibit)</b>								DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research	TITLE Aerospac	e Propul	sion								
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
Total Program Element (PE) Cost	58,054	68,329	62,012	66,607	70,453	74,783	71,197	72,225	Continuing	Continuing	
3012 Advanced Propulsion Technology	1,683	1,941	0	0	0	0	0	0	0	C	
3048 Fuels and Lubrication	10,629	11,569	8,415	9,036	9,392	14,181	14,629	15,037	Continuing	Continuing	
3066 Turbine Engine Technology	31,682	36,078	41,421	42,055	39,867	36,710	32,179	32,396	Continuing	Continuing	
3145 Aerospace Power Technology	14,060	18,741	12,176	15,516	21,194	23,892	24,389	24,792	Continuing	Continuing	
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0	

Note: As of FY 2000, all high-speed propulsion efforts under Project 3012, Advanced Propulsion Technology, are terminated. The decrease in Project 3048, Fuels and Lubrication, beginning in FY 2000 reflects deemphasis on high thermal stability fuels and engine technologies. The decrease in Project 3066, Turbine Engine Technology, beginning in FY 2002 reflects deemphasis on turbine engine technologies. The increase in Project 3145, Aerospace Power Technology, beginning in FY 2003 reflects increased emphasis on power components for space applications.

(U) A. <u>Mission Description</u>: This Applied Research program develops airbreathing propulsion and aerospace power technologies. The prime areas of focus are turbine engines, dual-mode ramjets, combined cycle engines, fuels, lubricants, and aerospace power technologies. Technology advances in turbine engine propulsion and lubrication systems are part of the Integrated High Performance Turbine Engine Technology (IHPTET) program and will increase engine performance, increase reliability, reduce specific fuel consumption, and lower cost of ownership. Dual-mode ramjet and combined cycle engines will increase weapon lethality and effectiveness against time-critical targets via high-speed propulsion systems. Fuels efforts will reduce system cost, maintenance, and the usage of hazardous cleaning materials while increasing aircraft performance and life through development of thermally stable and high heat sink fuels. High heat sink fuels from coal-derived resources will be investigated. Power system technologies are focused to eliminate troublesome, centralized hydraulic systems by replacement with highly reliable electric systems. Power conditioning, thermal management, and power source improvements will significantly enhance reliability, reduce weight, and lower life cycle costs.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

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Exhibit R-2 (PE 0602203F)

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RDT&E BUDGET ITEM JUS	STIFICATIC	ON SHEET (	(R-2 Exhib	February 1	999	
2 - Applied Research		0602203F	Aerospace	Propulsion		
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :						
	EV 1008	EV 1000	EV 2000	EV 2001	Total	
(U) Previous President's Budget/FY 1999 PB	57.261	<u>69.061</u>	70.539	73.303	Cont	
(U) Appropriated Value	60,577	69,561	,	,		
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-2,389	-1,232				
b. SBIR	-964					
c. Omnibus/Other Above Threshold Reprogrammings	-756					
d. Below Threshold Reprogrammings	1,586					
(U) Adjustments to Budget Year Since FY 1999 PB			-8,527	-6,696		
(U) Current Budget Submit/FY 2000 PB	58,054	68,329	62,012	66,607	Cont	

(U) (U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program. As of FY 2000, all high-speed propulsion efforts under Project 3012, Advanced Propulsion Technology, are terminated.

FY 1999: \$1,326 identified as a source for SBIR.

Page 2 of 12 Pages

Exhibit R-2 (PE 0602203F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										February 1999	
BUDGET ACTIVIT 2 - Applied	Research			PE N 06	UMBER AND	TITLE Aerospac	e Propul	sion	•	- - -	PROJECT 3012
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3012 Advanced Propulsion Technology         1,683         1,941         0 <td>0</td>									0		
increased averag support future m (U) FY 19 - (U) - (U) - (U) - (U) (U) FY 19 - (U) (U) FY 19 - (U) - (U) - (U) - (U) - (U) - (U)	ye velocity and lethality along with hissions such as rapid strike again (198 (\$ in Thousands): \$632 Investigated unique target loiter for hig (manned and unma \$343 Investigated, develo hypersonic missiles \$708 Investigated unique speed aerospace ve unmanned) and air \$1,683 Total (1999 (\$ in Thousands): \$712 Investigate unique target loiter for hig (manned and unma \$378 Investigate, develo missiles and air vel \$814 Investigate unique speed aerospace ve unmanned) and air \$37 Identified as a sour \$1,941 Total	h combined/ac ast time-critica concepts for con- speed aerosp nned) and airb oped, and explo- and air vehicle pulse detonate hicles. This ef preathing boos concepts for con- h-speed aerosp nned) and airb p, and exploit hicles to provide pulse detonate hicles. This ef breathing boos ce for SBIR.	lvanced-cycl l targets. No combining ac ace vehicles reathing boo bited Russian es to provide ton engine co fort supports ters.	e engines ar ote: This pro- lvanced prop . This effor osters. h hypersonic e greater ran oncepts to p s technology wanced prop s. This effor osters. ersonic tech nge and incr ncepts to pr s technolog	nd hydrocarb oject is termi pulsion cycle t supports teo c technology ge and incre- rovide the ca v transition for pulsion cycles rt supports te nology. This reased veloci ovide the cap y transition f	on fueled du nated in FY es which pro- chnology tra This effort ased velocity pability for to or next gener s which prov chnology tra s effort support by which enho bability for ta or next gener	al-mode cor 2000. vide the capa nsition for n supports teo which enha takeoff, acce ration recom ide the capa insition for r orts technolo ance weapo akeoff, accel ration recon	nbustion ran ability for ta ext generati chnology tra ance weapor eleration, cru- naissance/str bility for tak next generation n effectiven leration, cru- naissance/st	njets for high keoff, accele on reconnais nsition for no effectivenes uise, and targ tike vehicles ceoff, acceler ion reconnais n for next ge ess. ise, and targe rike vehicles	n-speed vehi eration, cruiss sance/strike ext generation ss. get loiter for (manned an ration, cruise ssance/strike eneration hypet loiter for h (manned ar	cles to ee, and vehicles on high- d e, and e vehicles personic high- nd
Project 3012				Page 3 of	12 Pages			Exhibi	it R-2A (PE	<u>0602203F)</u>	)

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602203F Aerospace Propulsion	PROJECT <b>3012</b>	
(U) <u>FY 2000</u> : Not Applicable.			
(U) <u>FY 2001</u> : Not Applicable.			
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Change within the Science and Technology (S&T) Program.	ges to this project since the previous President's	Budget are due to higher priorities	
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603216F, Aerospace Propulsion and Power Technology.</li> <li>(U) Program is reported to/coordinated by the Joint Army/Navy/NASA/A</li> <li>(U) This project has been coordinated through the Reliance process to has</li> </ul>	Air Force (JANNAF) executive committee. Armonize efforts and eliminate duplication.		
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 3012 Page	4 of 12 Pages E	xhibit R-2A (PE 0602203F)	

RDT	<b>&amp;E BUDGET ITE</b>		TIFICAT	ION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 2 - Applied Researc	ch			PE N 06	NUMBER AND	TITLE Aerospac	PROJECT 3048				
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3048 Fuels and Lubrication		10,629	11,569	8,415	5 9,036	9,392	14,181	14,629	15,037	Continuing	Continuing
(U) A. <u>Mission Description</u> and alternate fuels are devel temperatures.	n: Develops advanced ful loped and evaluated for A	uels, lubrica Air Force ae	ants, and con rospace appl	nponent tec ications. F	chnologies fo Juels and lub	r use in aircr icants must	aft, rockets, be thermally	and missile stable, cost	engines. Co effective, an	nventional production of the product	petroleum t higher
(U) FY 1998 (\$ in T	housands):										
- (U) \$6,136	Developed high therma systems. This technolo loads, higher engine te	al stability in the stability is for comperatures	hydrocarbon arrent and fu , and reduce	fuels to protect fuels to protect fuels to protect fuels to protect fuel fuel constants of the second secon	ovide higher It to reduce fu umption.	heat capacit	y and operat ouling/cokin	ting temperang, and prov	tures for airc ide cooling f	raft and mis or increased	sile avionics
– (U) \$1,793	Developed high perform with developing high pre- weight ratio and low sp	mance, low performance pecific fuel	emissions, i e, low maint consumption	robust com enance eng n.	bustor conception ines that ope	ots for advan rate efficient	ced turbine tly within ai	engines to re r pollution g	educe the risl guidelines and	and cost as d have high	ssociated thrust-to-
– (U) \$2,700	Developed lubricant te conventional and adva magnetic levitation and conventional approach	chnology to nced lubric d solid and es.	o permit efficients, and me vapor lubric	cient high-s chanical sy ation for ac	speed rotation stems extend lvanced engin	of turbine e led to their h nes with ope	engine comp nighest temp rating condi	onents. Thi berature limit tions that ex	s technology tations and a ceed the cap	includes pproaches, s abilities of	such as
- (U) \$10,629	Total										
(II) EV 1000 (\$ in Th	ouconda);										
- (U) \$4,227	Develop high thermal systems. This technolo loads, higher engine te	stability hy ogy is for comperatures	drocarbon fu urrent and fu and reduce	els to prov ture aircraf d fuel cons	ide higher he It to reduce fu umption.	at capacity a lel systems f	and operatin Fouling/cokin	g temperaturng, and prov	res for aircra ide cooling f	ft and missil or increased	e avionics
– (U) \$2,484	Develop high performa with developing high p weight ratio and low sp	ance, low en performance pecific fuel	nissions, rob e, low maint consumption	oust combu enance eng n.	stor concepts ines that ope	for advance rate efficient	d turbine en tly within ai	gines to redu r pollution g	uce the risk a guidelines and	nd cost asso d have high	ociated thrust-to-
– (U) \$4,633	Develop lubricant tech and advanced lubrican levitation and solid and approaches.	nology to p ts, and mec d vapor lub	ermit efficie hanical systerication for a	ent high-spe ems extend advanced ei	ed rotation o ed to their hi ngines with o	f turbine eng ghest temper perating con	gine compor rature limita ditions that	nents. This t ations and ap exceed the c	echnology in proaches, su capabilities o	cludes conv ch as magne f convention	rentional etic nal
– (U) \$225	Identified as a source f	or SBIR.									
Project 3048				Page 5 of	f 12 Pages			Exhibi	it R-2A (PE	0602203F)	

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RDT	DATE February 1999		
BUDGET ACTIVITY	_	PE NUMBER AND TITLE	PROJECT
2 - Applied Resear	rch	0602203F Aerospace Propulsio	on 3048
- (U) \$11,569	Total		
(U) FY 2000 (\$ in T	housands):		
- (U) \$2,993	Develop high thermal stability hydrocarbon fuels to aerospace systems. This technology is for current an	provide higher heat capacity, higher operating d future aircraft to reduce fuel systems foulin	g temperatures, and reduced signatures for g/coking, and provide cooling for
- (U) \$2,000	Develop high performance, low emissions, robust co associated with developing high performance, low m	mbustor concepts for advanced airbreathing e maintenance engines that operate efficiently w	ngines to reduce the risk and cost thin air pollution guidelines and have high
- (U) \$3,422	thrust-to-weight ratio and low specific fuel consumpt Develop lubricant technology to permit efficient high and advanced lubricants, and mechanical systems ex levitation and solid and vapor lubrication for advance	tion. n-speed rotation of turbine engine components tended to their highest temperature limitation ed engines with operating conditions that exc	<ul> <li>This technology includes conventional</li> <li>s and approaches, such as magnetic</li> <li>eed the capabilities of conventional</li> </ul>
- (U) \$8,415	approaches. Total		
(U) FY 2001 (\$ in T	housands):		
- (U) \$3,138	Develop high thermal stability hydrocarbon fuels to aerospace systems. This technology is for current an increased anionics loads, higher engine temperatures	provide higher heat capacity, higher operating d future aircraft to reduce fuel systems foulin	g temperatures, and reduced signatures for g/coking, and provide cooling for
- (U) \$2,200	Develop high performance, low emissions, robust co associated with developing high performance, low m thrust-to-weight ratio and low specific fuel consumption	mbustor concepts for advanced airbreathing e aaintenance engines that operate efficiently w tion.	ngines to reduce the risk and cost thin air pollution guidelines and have high
– (U) \$3,698	Develop lubricant technology to permit efficient high and advanced lubricants, and mechanical systems ex levitation and solid and vapor lubrication for advance approaches	n-speed rotation of turbine engine components tended to their highest temperature limitation ed engines with operating conditions that exc	s. This technology includes conventional s and approaches, such as magnetic eed the capabilities of conventional
– (U) \$9,036	Total		
Project 3048	Page	e 6 of 12 Pages	Exhibit R-2A (PE 0602203F)
		96	

RDT&E BUDGET ITEM JU	bit) DATE February 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602203F Aerospace	PROJECT 3048
(U) B. <u>Project Change Summary - Description of Signific</u> within the Science and Technology (S&T) Program.	cant Changes: Changes to this project since the pre-	vious President's Budget are due to higher priorities
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603216F, Aerospace Propulsion and Powe</li> <li>(U) This project has been coordinated through the I</li> </ul>	r Technology. Reliance process to harmonize efforts and eliminate	duplication.
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 1999			
BUDGET ACTIVITY       PE NUMBER AND TITLE         2 - Applied Research       0602203F Aerospace Propulsion									PROJEC <b>3066</b>		PROJECT <b>3066</b>
COST <i>(\$ 1</i>	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3066 Turbine Engine Technolo	ogy	31,682	36,078	41,421	42,055	39,867	36,710	32,179	32,396	Continuing	Continuing
weight, fuel consumption, an internal flow systems, contro (IHPTET) program. (U) <u>FY 1998 (\$ in The</u> – (U) \$3,050 – (U) \$31,682 (U) <u>FY 1999 (\$ in The</u> – (U) \$24,810 – (U) \$24,810 – (U) \$5,875 – (U) \$2,415 – (U) \$2,277 – (U) \$701 – (U) \$36,078	ousands): Developed core engine will provide aircraft en Developed turbine engine turbofan/turbojet engi performance, increase Total <u>ousands</u> ): Develop core engine co provide aircraft engine Develop turbine engine turbofan/turbojet engine performance, increase Develop turbine engine turbofan/turbojet engines in turbofan/turbojet engines bevelop components in engines with reduced of missiles. Develop components in transports. Identified as a source in Total	e componer ngines with gine components of fight d durability components es with high the component nes for fight d durability for expenda cost, reduce for turbosha	to experiment design. This ats for turbof higher perfor- nents (fans, I neters, attack a , reduced fue for turbofan are performants (fans, low neters, attack a , reduced fue ble engines f d fuel consu	can/turbojet sup can/turbojet oprmance, inc low pressure aircraft, bon el consumpti /turbojet eng nce, increaso v pressure tu aircraft, bon el consumpti for missile a mption, and o and small t	engines for f ereased durate turbines, er nbers, and tr ion, and low gines for fig ed durability urbines, engi nbers, and tr ion, and low and unmanne l increased sp urbofan eng	ighters, attac oility, reduce gine control ansports. Ther life cycle neters, attack , reduced fue ne controls, ansports. Ther life cycle d air vehicle becific thrust	aircraft, bon ek aircraft, b d fuel consu s, exhaust no ese comport cost. aircraft, bon el consumpti exhaust noz nese comport cost. application t, greatly exp ners, rotorcra	ombers, and imption, and ozzles, and in aents will pro- notes, and tra- tion, and low- zles, and intra- eents will pro- s. These con- panding the o- aft, special op	transport. T lower life cy ntegration te ovide aircraft ansports. Th er life cycle o egration tech ovide aircraft mponents will operating env perations airc	These componycle cost. chnology) for t engines with tese componycle cost. nology) for t engines with ll provide examples of co craft, and the	onents or th higher ents will th higher spendable ruise eater
Project 3066				Page 8 of	12 Pages			Exhibi	t R-2A (PE	0602203F)	

RDT8	February 1999			
BUDGET ACTIVITY 2 - Applied Researc	PROJECT <b>3066</b>			
(U) FY 2000 (\$ in Th	ousands):			
– (U) \$29,386	Develop core engine components for turbofan/turboj	et engines for fighters, attack air	craft, bombers, and tra	insports. These components will
– (U) \$6,958	Develop turbine engine components (fans, low press turbofan/turbojet engines for fighters, attack aircraft	ure turbines, engine controls, exh t, bombers, and transports. These umption, and lower life cycle cos	naust nozzles, and interest of the components will pro-	gration technology) for wide aircraft engines with higher
– (U) \$2,861	Develop components for expendable engines for mis engines with reduced cost, reduced fuel consumptior missiles.	sile and unmanned air vehicle ap a, and increased specific thrust, g	plications. These con reatly expanding the c	nponents will provide expendable operating envelopes of cruise
– (U) \$2,216	Develop components for turboshaft/turboprop and su transports.	nall turbofan engines for trainers	s, rotorcraft, special op	perations aircraft, and theater
- (U) \$41,421	Total			
(U) <b>FY 2001 (\$ in Th</b>	ousands).			
- (U) \$29,754	Develop core engine components for turbofan/turboj	et engines for fighters, attack airc	craft, bombers, and tra	nsports. These components will
– (U) \$7,045	provide aircraft engines with higher performance, inc Develop turbine engine components (fans, low press turbofan/turbojet engines for fighters, attack aircraft performance increased durability, reduced fuel const	reased durability, reduced fuel course turbines, engine controls, exh , bombers, and transports. These umption and lower life cycle cost	onsumption, and lowe aust nozzles, and inte components will pro	r life cycle cost. gration technology) for vide aircraft engines with higher
– (U) \$2,897	Develop components for expendable engines for missient engines with reduced cost, reduced fuel consumption missiles.	sile and unmanned air vehicle ap , and increased specific thrust, gr	plications. These con reatly expanding the o	ponents will provide expendable perating envelopes of cruise
- (U) \$2,359	Develop components for turboshaft/turboprop and su transports.	nall turbofan engines for trainers,	, rotorcraft, special op	erations aircraft, and theater
– (U) \$42,055	Total			
Project 3066	Paga	9 of 12 Pages	Exhibit	R-2A (PE 0602203E)
110,000,0000		99	EXHIBIT	

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602203F Aerospace Propulsio	PROJECT <b>3066</b>
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Not A	Applicable.	
(U) C. Other Program Funding Summary (\$ in Thousands):		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0603202F, Aircraft Propulsion Subsystem Integration.</li> <li>(U) PE 0603216F, Aerospace Propulsion and Power Technology.</li> <li>(U) PE 0603210N, Aircraft Propulsion.</li> <li>(U) PE 0603003A, Aviation Advanced Technology.</li> <li>(U) PE 0603003A, Aviation Advanced Technology.</li> <li>(U) This project has been coordinated through the Reliance process to I</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	narmonize efforts and eliminate duplication.	
Project 3066 Page	e 10 of 12 Pages	Exhibit R-2A (PE 0602203F)
	100	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research	ı			PE N <b>06</b>	UMBER AND	TITLE Aerospac	e Propul	sion		F	PROJECT <b>3145</b>
COST (\$ In	\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 EstimateFY 2005 EstimateCost to CompleteTotal Complete										Total Cost
3145 Aerospace Power Techno	ology	14,060	18,741	12,176	15,516	21,194	23,892	24,389	24,792	Continuing	Continuing
component and subsystem technologies. Power components are developed for aircraft and flight line equipment to increase reliability, maintainability, commonality, and supportability. This project supports an initiative which uses electrical power to replace hydraulic and pneumatic power and their costly logistics support. These electrical power technologies are necessary to meet the 10-20 year long-term storage requirements of Air Force uninhabited combat aerial vehicles (UCAVs). Electrical power generation technologies developed are enabling technologies for all future military directed energy (DE) weapon systems. This project supports development of very high output power systems that are suitable for applications such as Space Based Laser. Essentially, all power electronics (conversion) technology being developed here has dual-use opportunities. Spin-off application areas include all military system conversion development from conventional to electrically-based on-board subsystems.  (U) <u>FY 1998 (\$ in Thousands)</u> : $- (U) $12.047$ Developed power generation conversion and transmission components for aircraft systems. These components provide aircraft with a high											
- (U) \$1,505 - (U) \$508 - (U) \$14,060	<ul> <li>(U) \$12,047 Developed power generation, conversion, and transmission components for aircraft systems. These components provide aircraft with a high degree of self-sufficiency, improved reliability, maintainability, and supportability, all yielding a quicker aircraft turn-around time. In addition, ground support equipment requirements will be dramatically reduced.</li> <li>(U) \$1,505 Developed power sources for guidance, navigation, and control functions for missile systems, and for use in navigational aids, radios, and sensors for special operations forces. Power sources with higher power density, longer life, and increased reliability will provide missiles systems and special operations forces with greater reliability and reduced maintenance costs.</li> <li>(U) \$508 Developed special purpose power components for advanced surveillance and communications systems, as well as ground power applications.</li> </ul>							In os, and iissiles			
(U) <u>FY 1999 (\$ in Tho</u> - (U) \$16,153	<u>usands)</u> : Develop power gener	ation compo	onents for air	craft system	is. These co	mponents im	prove aircra	ft self-suffic	ciency, reliab	ility, mainta	inability,
<ul> <li>and supportability.</li> <li>(U) \$1,738</li> <li>Develop power source components for use in navigational aids, radios, and sensors for special operations forces. Power sources with higher power density, longer life, and increased reliability will provide special operations forces with greater reliability and reduced maintenance costs.</li> </ul>											
<ul> <li>- (U) \$487 Develop special purpose power components for advanced directed energy weapon systems, as well as ground power applications.</li> <li>- (U) \$363 Identified as a source for SBIR.</li> <li>- (U) \$18,741 Total</li> </ul>											
Project 3145				Page 11 of	f 12 Pages			Exhibi	t R-2A (PE	0602203F)	

RDT&E BUDGET ITEM J	Dit) DATE February 1999	
BUDGET ACTIVITY 2 - Applied Research	PROJECT 3145	
(U) FY 2000 (\$ in Thousands):		
- (U) \$4,501 Develop power generation co	mponents for aircraft and space systems. These compo-	nents improve aircraft and space systems self-
- (II) \$6 275 Develop advanced power ele	anaomity, and supportaomity.	ce and directed energy power systems
- (U) \$1,400 Develop power and thermal 1	nanagement system components to increase performance	e and reliability and reduce weight in space power
applications.		
– (U) \$12,176 Total		
(U) FY 2001 (\$ in Thousands):		
– (U) \$5736 Develop power generation co	mponents for aircraft and space systems. These compo	nents improve aircraft and space systems self-
sufficiency, reliability, maint	ainability, and supportability.	
- (U) \$7996 Develop advanced power elec	ctronics and energy storage components for aircraft, spa	ce, and directed energy power systems.
- (U) \$1,784 Develop power and thermal r	nanagement system components to increase performanc	e and reliability and reduce weight in space power
– (U) \$15,516 Total		
<ul> <li>(U) B. Project Change Summary - Description of Sign</li> <li>(U) C. Other Program Funding Summary:</li> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603216F, Aerospace Propulsion and Po</li> <li>(U) This project has been coordinated through the second secon</li></ul>	<b>ificant Changes:</b> Not Applicable. wer Technology. le Reliance process to harmonize efforts and eliminate c	luplication.
(U) D. Acquisition Strategy: Not Applicable.		
(U) E. Schedule Profile: Not Applicable.		
Project 3145	Page 12 of 12 Pages	Exhibit R-2A (PE 0602203F)

PE TITLE: Aerospace Sensors

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										February 1999	
BUDGET ACTIVITY 2 - Applied Research	BUDGET ACTIVITY     PE NUMBER AND TITLE       2 - Applied Research     0602204F Aerospace Sensors										
COST (\$ In Thousands)	FY 1998 Actual	FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 								Total Cost	
Total Program Element (PE) Cost	57,766	63,719	64,988	69,245	71,392	75,438	80,236	82,263	Continuing	Continuing	
2000 Electronic Countermeasures Technology	14,448	15,440	15,969	16,426	17,936	19,932	20,958	22,262	Continuing	Continuing	
2001 Electro-Optical Technology	6,011	463	495	597	997	1,698	2,598	2,005	Continuing	Continuing	
2002 Microwave Technology	9,167	9,039	9,387	10,505	9,976	10,194	10,465	10,754	Continuing	Continuing	
2003 Avionics System Design Technology	5,410	9,282	9,362	9,728	10,314	11,010	11,302	11,616	Continuing	Continuing	
6095 Sensor Fusion Technology	6,539	11,345	12,395	13,333	14,367	14,943	16,046	16,324	Continuing	Continuing	
6096 Microelectronics Technology	8,600	9,180	7,703	8,548	7,409	6,978	6,898	7,032	Continuing	Continuing	
7622 Radio Frequency Sensor Technology	7,591	8,970	9,677	10,108	10,393	10,683	11,969	12,270	Continuing	Continuing	
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C	

(U) A. <u>Mission Description</u>: This Applied Research program develops the technology base for Air Force aerospace sensors. Advances in aerospace sensors are required to increase combat effectiveness by providing "anytime, anywhere" surveillance, reconnaissance, precision targeting, and electronic warfare capabilities for ground, air, and space platforms. Advances in aerospace sensor technology will also reduce life cycle costs, facilitate affordable modernization of aging and future aerospace platforms, and provide protection against emerging hostile threat systems. Meeting these needs necessitates simultaneous advances in multiple, interrelated disciplines including: airborne and spaceborne sensors (e.g., infrared, radar, etc.); multi-function high-power electronic devices; target detection, classification, and recognition techniques; fire control; sensor fusion methods; communication and navigation subsystems; and electronic warfare technologies.

Page 1 of 24 Pages

Exhibit R-2 (PE 0602204F)

RDT&E BUDGET ITEM JUS	DATE February 1999							
BUDGET ACTIVITY		PE NUMBER AN	D TITLE					
2 - Applied Research 0602204F Aerospace Sensors								
(U) B. <u>Budget Activity Justification</u> : This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary sensor, electronics, and electronic combat technologies.								
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					Total			
	EV 1008	FV 1000	EV 2000	EV 2001				
(II) Previous President's Budget/FY 1999 PB	61 025	<u>65 5/9</u>	<u>67.461</u>	$\frac{112001}{72064}$	Cont			
(U) Appropriated Value	64 144	65 5/19	07,401	72,004	Cont			
(U) Adjustments to Appropriated Value	07,177	05,547			Cont			
a Congressional/General Reductions	-2 464	-1.830			Cont			
h SBIR	-739	1,050						
c Omnibus/Other Above Threshold Reprogrammings	-1 671							
d Below Threshold Reprogrammings	-1 504							
(U) Adjustments to Budget Year Since FY 1999 PB	1,001		-2.473	-2.819				
(U) Current Budget Submit/FY 2000 PB	57.766	63.719	64.988	69.245	Cont			
(U) Significant Program Changes: Changes to this program si	nce the previous F	President's Budge	et are due to high	er priorities within	n the Science and Technology (S&T)			

FY 1999: \$719 identified as a source for SBIR.

Page 2 of 24 Pages

Exhibit R-2 (PE 0602204F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									bruary 19	999
BUDGET ACTIVITYPE NUMBER AND TITLE2 - Applied Research0602204F Aerospace Sensors						P 2	ROJECT 2000			
COST (\$ In Thousands)	FY 1998 Actual	FY 1998FY 1999FY 2000FY 2001FY 2002FY 2003FY 2004ActualEstimateEstimateEstimateEstimateEstimate					FY 2005 Estimate	Cost to Complete	Total Cost	
2000 Electronic Countermeasures Technology	14,448	15,440	15,969	16,426	17,936	19,932	20,958	22,262	Continuing	Continuing

(U) A. <u>Mission Description</u>: This program determines the feasibility of active and passive electronic countermeasure technologies and explores, develops, expands, and refines the most promising and cost-effective technologies. The technologies pursued support passive sensing of the entire electromagnetic spectrum in order to provide signal collection, detection, recognition, analysis, identification, location, and countering of enemy electronic emissions whether intentional or unintentional. This project includes development of countermeasure concepts against radar, infrared (IR), and electro-optical threat weapon systems as well as against communication command and control networks. Various links and sensors of threat air defense systems are analyzed and a database of countermeasure technologies to provide increased capability for: 1) radar warning, radio frequency (RF) electronic warfare, and electronic intelligence applications; 2) IR detection for passive missile warning, IR signature exploitation, and IR countermeasures; 3) laser detection for threat warning and countermeasures; 4) passive and combined passive/active off-board expendables (chaff, decoys, etc.); and 5) hardware and software for associated processing and technology integration needs. These countermeasure capabilities are vital for survival of operational aerospace platforms facing advanced threats in future hostile environments.

#### (U) <u>FY 1998 (\$ in Thousands</u>):

- (U) \$3,255 Developed technologies for on-board and off-board (active IR decoys) countermeasures to counter IR-guided missiles and electro-optical threats, including evaluating techniques against imaging missile seekers, developing a shielded narrow band IR source, downselecting laser beamrider missile concepts, and developing cooperative on-board and off-board countermeasure concepts.
- (U) \$4,126
   Developed affordable RF jamming technology and concepts to degrade enemy radar, missile, and command and control systems, including testing countermeasures to monopulse tracking radars, evaluating digital RF memory architectures for defeating coherent doppler radars, developing digital jamming metrics, and examining countermeasures to covert featureless waveform communication links.
- (U) \$771 Developed off-board (expendable) RF countermeasure concepts, including designing active decoys to counter microwave and millimeter wave radars, developing methods to predict the effectiveness of advanced chaff, and developing and testing environmentally degradable and electromagnetically tailorable chaff designs.
- (U) \$1,542 Developed technology for generic software modules to enable low-cost block upgrades to electronic warfare receivers, including ground testing combined de-interleaving, correlation, and threat identification software and completing a preliminary design of advanced threat parameter normalization software.
- (U) \$3,854 Developed affordable RF receiver and antenna technology for use in operational and future aircraft, including testing a wideband digital receiver brassboard, developing wideband receiver specialized software, developing narrowband digital receiver technology, completing design of six-to-eight gigahertz conformal array, and transitioning software for design and evaluation of flush-mounted conformal arrays.

Project 2000	Page 3 of 24 Pages	Exhibit R-2A (PE 0602204F)
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RDT&	DATE February 1999							
BUDGET ACTIVITY 2 - Applied Researc	BUDGET ACTIVITYPE NUMBER AND TITLEPR2 - Applied Research0602204F Aerospace Sensors20							
<ul> <li>(U) \$900</li> <li>Developed missile and laser warning technology to accurately cue countermeasures, including developing laser warning discrimination techniques, evaluating infrared (IR) clutter rejection techniques, developing and evaluating multifrequency, non-mechanical filters, and developing a laser warning breadboard.</li> </ul>								
- (U) \$14,448 Total								
(U) FY 1999 (\$ in The	usands):							
- (U) \$4,150	Develop countermeasure technologies for on-board a including continuing to evaluate techniques against i demonstrating night vision device countermeasure co	nd off-board (active IR decoys) maging missile seekers, develo oncepts.	to counter IR-guided n ping cooperative jamme	nissiles and electro-optic threats, er and decoy concepts, and				
– (U) \$2,677	Develop affordable radio frequency (RF) jamming te systems, including completing covert featureless way techniques for degrading enemy modern communica	chnology and concepts to degra reform study, developing advan tion networks, and evaluating F	ade enemy radar, missil ced deception counterm RF countermeasure tech	e, and command and control (C2) neasures techniques, developing niques in the laboratory.				
- (U) \$305	Develop off-board (expendable) RF and combined IF effectiveness of advanced decoys.	R/RF countermeasure concepts,	including design tools	and analytic methods to predict				
- (U) \$2,095 Develop technology for generic software modules to enable low-cost block upgrades to electronic warfare receivers, including testing of combined de-interleaving correlation and threat identification software modules								
– (U) \$4,689	Develop affordable antenna technology for use in op developing new techniques for wideband to narrowb demonstrating dual-use conformal array technology.	erational and future aircraft, ind and cueing, and investigating th	cluding demonstrating f ne electromagnetic char	irst wideband digital receiver, acterization of and				
- (U) \$1,305	Develop missile and laser warning technology to acc development of laser warning techniques and evaluat	urately cue countermeasures an tion of IR clutter rejection techn	d improve survivability niques.	y. This includes continued				
- (U) \$219	Identified as a source for SBIR.	v	-					
- (U) \$15,440	Total							
(II) <b>FV 2000 (\$ in Th</b>	ande).							
- (U) \$3.524	Develop countermeasure technologies against IR-gui	ded missiles and electro-optic t	hreats, including contin	uing to evaluate techniques				
(0) \$0,021	against imaging missile seekers and demonstrating co	poperative jammer and decoy co	oncepts.					
– (U) \$3,007	Develop affordable RF jamming technology and cond	cepts that enhance aircraft survi	vability by degrading e	nemy radar, missile, and C2				
	systems, including completing covert evaluation of fe	eatureless waveform detection, o	optimizing advanced de	ceptive countermeasure				
(II) ¢401	techniques, and continuing to develop techniques for	degrading enemy modern com	munication networks.	or affordable survivability				
- (0) \$491	including demonstrating countermeasure effectivenes	s of advanced decoys against d	ual-mode missile seeke	rs.				
Project 2000	Page	e 4 of 24 Pages	Exhibit	R-2A (PE 0602204F)				
		106						

RDT	DATE February 1999			
BUDGET ACTIVITY 2 - Applied Researce	ch	PE NUMBER AND TITLE 0602204F Aero	space Sensors	PROJECT 2000
- (U) \$2,341	Develop technology for generic software modules to	enable low-cost block u	upgrades to electronic warfare ()	EW) receivers, including
– (U) \$3,045	Develop affordable RF receiver technology for use in digital receiver brasshoard, evaluating parrowbard re	operational and future	EW receivers, including contir developing wideband analog_t	using to demonstrate a wideband
– (U) \$2,058	Develop affordable antenna technology for use in op developing low-frequency direction-finding antennas demonstrating wideband phase shifters and transmit/	erational and future aer s, demonstrating advand receive module technol	ospace platform electronic rece ced pattern control of multimod	e/multifunction antennas, and
– (U) \$1,503	Develop aerospace missile and laser warning technol discrimination methods, assessing hyperspectral ima	ogies to accurately cue ging technology for mi	countermeasures, including de ssile warning, and demonstratir	vising laser warning g infrared clutter rejection
– (U) \$15,969	Total			
(U) <u>FY 2001 (\$ in Th</u> - (U) \$2,999	ousands): Develop countermeasure technologies against infrare	d-guided missiles and	electro-optic threats, including	continuing to evaluate techniques
– (U) \$3,776	against imaging missile seekers and demonstrating or Develop affordable RF jamming technology and con command and control systems, including developing	coperative jammer and cepts that enhance aircr a wide bandwidth micro a dagrada modern comm	decoy concepts. raft survivability by degrading e rowave tube for EW transmitter	nemy radar, missile, and s, testing optimized deception
- (U) \$1,145	Develop technology for generic software modules to identification software modules for next-generation s	enable low-cost block u	apgrades to EW receivers, incluing receivers	ding designing threat
– (U) \$3,258	Develop affordable RF receiver technology for use in a wideband all-digital receiver brassboard for space- utility of narrowband receivers technology for afford	a operational and future based applications that able space-based received	aerospace platform EW receive incorporates new hardware and ers, and demonstrating high-spe	ers. This includes demonstrating software elements, evaluating the
– (U) \$2,886	Develop affordable antenna technology for use in op continuing to demonstrate advanced pattern control of	erational and future aer	ospace platform electronic rece	ivers and apertures, including
- (U) \$2,362	Develop aerospace missile and laser warning technol spectral tracking algorithms, refining hyperspectral i	ogies to accurately cue maging techniques, and	countermeasures, including de	veloping advanced temporal and discrimination methods.
– (U) \$16,426	Total			
Project 2000	Data	o 5 of 24 Pages	Fyhihi	R-2A (PF 0602204F)
10,000 2000	T ugo	107		

RDT&E BUDGET ITEM JU	it) DATE February 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602204F Aerospace S	Sensors 2000
(U) B. <u>Project Change Summary - Description of Signif</u>	icant Changes: Not Applicable.	
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603270F, Electronic Combat Technology</li> <li>(U) This project has been coordinated through the</li> </ul>	y. e Reliance process to harmonize efforts and eliminate du	plication.
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 2000	Page 6 of 24 Pages	Exhibit R-2A (PE 0602204F)
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research			PE N <b>06</b>	UMBER AND	TITLE Aerospac	e Senso	rs		F	PROJECT 2001		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
1 Electro-Optical Technology 6,011 463 495 597 997 1,698 2,598 2,005 Continuing Con-								Continuing				
<ul> <li>(U) <u>FY 1998 (§ in Thousands)</u>:</li> <li>(U) <u>S1162</u> Developed advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>FY 1999 (§ in Thousands)</u>:</li> <li>(U) <u>S1463</u> Developed advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>FY 1999 (§ in Thousands)</u>:</li> <li>(U) <u>S1453</u> Developed advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>S4453</u> Developed advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>FY 1999 (§ in Thousands)</u>:</li> <li>(U) <u>FY 1999 (§ in Thousands)</u>:</li> <li>(U) <u>FY 2000 (§ in Thousands)</u>:</li> <li>(U) <u>S463</u> Total</li> <li>(U) <u>FY 2000 (§ in Thousands)</u>:</li> <li>(U) <u>S455</u> Develop advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>S463</u> Total</li> <li>(U) <u>S463</u> Total</li> <li>(U) <u>FY 2000 (§ in Thousands)</u>:</li> <li>(U) <u>S455</u> Develop advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>S463</u> Total</li> <li>(U) <u>S457</u> Develop advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>S457</u> Develop advanced electro-optical sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.</li> <li>(U) <u>S454</u> Total</li> <li>(U) <u>S455</u> Total</li> <li>(U) <u>S455</u> De</li></ul>												
Project 2001			Page 7 of	24 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0602204F)</u>			
			109	9								

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602204F Aerospace Sensors	PROJECT 2001
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:         <ul> <li>(U) \$597 Develop optical transmitter technology capable of seridentification, to include fabricating a single imaging</li> <li>(U) \$597 Total</li> </ul> </li> </ul>	nsing multiple target characteristics to provide g and non-imaging transmitter.	robust non-cooperative target
(U) B. <u>Project Change Summary - Description of Changes</u> : Changes to this proceed and Technology (S&T) Program.	roject since the previous President's Budget ar	e due to higher priorities within the
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0602702F, Command, Control, and Communications (C3).</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) PE 0602712E, Materials and Electronics Technology.</li> <li>(U) PE 0603739E, Advanced Electronics Technology.</li> <li>(U) This project has been coordinated through the Reliance process to have a sensitive of the sensitiv</li></ul>	armonize efforts and eliminate duplication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 2001 Page	e 8 of 24 Pages	Exhibit R-2A (PE 0602204F)
	110	

RDT	&E BUDGET ITE	EM JUS	TIFICAT	TION SH	EET (R-	-2A Exh	ibit)		DATE Fe	bruary 19	99
BUDGET ACTIVITYPE NUMBER AND TITLE2 - Applied Research0602204F Aerospace Sensors									PROJECT 2002		
COST <i>(</i> \$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2002 Microwave Technology	Microwave Technology         9,167         9,039         9,387         10,505         9,976         10,194         10,465						10,754	Continuing	Continuing		
<ul> <li>(U) A. <u>Mission Prescription</u>. This project rocuses on the generation, control, receiver, and processing of microwave and minimeter wave power. Develops technologies such as solid state and vacuum electronic power devices and amplifiers, low noise and signal control components, high-temperature electronics, multi-function monolithic integrated circuits, and high density packaging and interconnects. Develops techniques for integrating various combinations of these technologies to demonstrate significantly improved performance with smaller size, lower weight, lower cost, and higher reliability in military-specific applications. The requirements for device and component technology developments are based on Air Force and other DoD weapon systems needs in the areas of radar, communications, electronic warfare (EW), navigation, and smart weapons applications.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>S1,450</u></li> <li>Developed military essential mixed-mode (e.g., high-power/low-noise, microwave/digital, electronic/electro-optical, etc.) multi-function components for radar and EW receivers and for digital phased array radars. Application of this compact and more flexible sensor technology will improve warfighter situational awareness, enhance defense suppression, and improve precision weapon delivery.</li> <li>(U) \$1,780</li> <li>Developed high-power (1 to 100 watts), military unique, solid state microwave transmitters used in ground-based and airborne radar anglications. This technology will enable the warfighter to detect and track low radar cross-section targets at greater ranges, improve situational awareness, and enable development of compact affordable transmitters for smaller platforms such as advanced unmanned air vehicles.</li> <li>(U) \$1,417</li> <li>Developed military unique, every high-power (100 to 1,000 watts) vacuum electronics devices and components for EW, radar, and communications application</li></ul></li></ul>											
(U) <u>FY 1999 (\$ in Tl</u> - (U) \$2.316	Total <u>nousands)</u> : Develop compact. aff	ordable. mix	ed-mode. m	ulti-functior	n receiver an	d phased arr	ay compone	nts for radar	and EW. in	cluding desig	gning
(U) <u>FY 1999 (\$ in TI</u> - (U) \$2,316 - (U) \$2,506	Total nousands): Develop compact, affe miniature digital recei Develop high-power ( transmit amplifiers to power dissipation and	ordable, mix iver compon 1 to 100 wa improve rar reliability.	ed-mode, m ents and ref tts), military ge and kill j	ulti-functior ining advanc unique, soli probability o	n receiver an eed compone d state trans f precision g	d phased arr ent evaluatio mitters for r guided munit	ay compone n methods to adar and cor ions and adv	nts for radar o reduce nor nmunication vanced micro	and EW, in n-recurring e ns applicatio owave ampli	cluding designg in the set of the	gning osts. g proved

RDT8	DATE February 1999						
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602204F Aerospace	Sensors	PROJECT 2002			
- (U) \$2,833	Develop high yield process technologies to enable hi ground-based and airborne radar applications, include demonstrating integrated circuits and high power	igh-operating-temperature, milit ling evaluating candidate mater ternally matched transistors.	ary essential, solid stat	e microwave transmitters used in istor reliability and			
- (U) \$1,256	Develop military unique, very high-power (100 to 1, millimeter wave transmitters, including designing ac	000 watts) vacuum electronics d lvanced microwave tube compo	levices and components nents.	s for affordable microwave and			
- (U) \$128 - (U) \$9,039	Identified as a source for SBIR. Total						
(U) FY 2000 (\$ in Th	busands):						
– (U) \$4,510	Develop compact, affordable, mixed-mode, multi-fur including fabricating miniature digital receiver comp digital converters for space-based sensors and refinin	nction receiver and phased array onents, direct digital waveform g advanced component evaluati	components for radar transmitters, and very on methods.	and electronic warfare (EW), low power (<0.5W) analog-to-			
– (U) \$2,437	Develop high-efficiency radio frequency power ampl for space-based radar and compact, affordable, reliab improved power dissipation.	ifiers for military space-based sole transistors and devising fabri	ensors, including design cation techniques for n	ning a 10 GHz power amplifier nicrowave amplifiers that have			
– (U) \$332	Develop microwave technologies to enable high operating temperature, solid state microwave transmitters used in military ground-based and airborne radar applications, including robust high-speed, high-power III-nitride transistors.						
– (U) \$318	Demonstrate high-power, internally matched transist reliability and lower the life cycle cost of high-power	ors that will allow replacement	of S-band vacuum tube	e transmitters to increase the			
– (U) \$903	Develop aerospace surface protective coatings and pa improve reliability and lower the cost of components and interconnect processes for phased array antennas 6096.)	ackaging technologies for high-p that operate in harsh military e and EW transmitters. (In FY 2	performance, mixed and nvironments, including 2000, this work moved	alog/digital microwave circuits to developing advanced packaging from PE 0602204F, Project			
– (U) \$887	Develop military unique, very high-power (100 to 1,0 microwave and millimeter wave transmitters used in microwave tube components.	000 watts) vacuum electronics de EW, radar, and communication	evices and components as applications, includir	for compact, affordable ag fabricating of advanced			
– (U) \$9,387	Total						
(U) FY 2001 (\$ in Th	pusands):						
- (U) \$4,119	Develop compact, affordable mixed-mode multi-func demonstrating miniature airborne digital receiver cor analog-to-digital converters for space-based sensors,	ction receiver and phased array on nponents, fabricating direct digition and demonstrating and refining	components for radar a ital waveform transmitt advanced component o	nd electronic warfare, including ers and very low power (<0.5W) evaluation methods.			
Project 2002	Page	10 of 24 Pages	Exhibit	R-2A (PE 0602204F)			
		112					

RDT	DATE February 1999		
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT
2 - Applied Researd	:h	0602204F Aerospace Sensors	2002
- (U) \$2,783	Develop high-efficiency radio frequency power ampl for space-based radar and demonstrating compact, af have improved power dissipation.	ifiers for military space-based sensors, including fab fordable, reliable transistors and fabrication techniq	ricating a 10 GHz power amplifier ues for microwave amplifiers that
– (U) \$756	Develop microwave technologies to enable high oper airborne radar applications, including robust high-sp	cating temperature, solid state microwave transmitter eed, high-power III-nitride transistors and high temp	s used in military ground-based and perature silicon-carbide amplifiers.
– (U) \$645	Develop and laboratory test aerospace surface protec microwave circuits to improve reliability and lower t advanced packaging and interconnect processes for p	tive coatings and packaging technologies for high per he cost of components that operate in harsh military phased array antennas and electronic warfare transm	rformance mixed analog/digital environments, including testing itters.
– (U) \$736	Demonstrate military-unique, very high-power (100 t microwave and millimeter wave transmitters used in advanced microwave tube components.	o 1,000W) vacuum electronics devices and compone electronic warfare, radar, and communications appl	ents for compact, affordable ications, including demonstrating
– (U) \$1,466	Develop space sensor component technology, includit technology.	ing direct digital synthesis for waveform generation	and miniaturized receiver
– (U) \$10,505	Total		
<ul> <li>(U) B. Project Change S</li> <li>(U) C. Other Program F</li> <li>(U) Related Activities <ul> <li>(U) PE 0603203F</li> <li>(U) PE 0603270F</li> <li>(U) PE 0603270F</li> <li>(U) This project F</li> </ul> </li> <li>(U) D. Acquisition Strate</li> <li>(U) E. Schedule Profile:</li> </ul>	ummary - Description of Significant Changes: Not A Yunding Summary: Advanced Aerospace Sensors. E Electronic Combat Technology. has been coordinated through the Reliance process to have gey: Not Applicable. Not Applicable.	Applicable. armonize efforts and eliminate duplication.	
Project 2002	Page	11 of 24 Pages Exhi	bit R-2A (PE 0602204F)

BUDGET ACTIVITY <b>2 - Applied Research</b> COST (\$ In 7 2003 Avionics System Design Te (U) A. <u>Mission Description</u> : targets, digital processing, soft system needs. Develops new c ground-based targets in the pre- technology development is bei reduce life cycle costs, and inc (U) <u>FY 1998 (\$ in Thous</u>	Thousands) echnology : Develops advanced tware tools and technic concepts and demonst esence of severe weat ing conducted in digit crease avionics missio	FY 1998 Actual 5,410 aerospace se ques, and sys rates the feas her. These s al processing	FY 1999 Estimate 9,282 ensor and avistems archite sibility of pa	PE NI 060 FY 2000 Estimate 9,362 ionics techno ectures. Dev assive and ac	UMBER AND D2204F / FY 2001 Estimate 9,728 plogy for ele velops new o	FY 2002 Estimate 10,314	e Sensor FY 2003 Estimate 11,010	S FY 2004 Estimate 11,302	FY 2005 Estimate 11,616	P 2 Cost to Complete Continuing	ROJECT 1003 Total Cost Continuing
COST (\$ In 7 2003 Avionics System Design Te (U) A. <u>Mission Description</u> : targets, digital processing, soft system needs. Develops new c ground-based targets in the pre technology development is bei reduce life cycle costs, and inc (U) <u>FY 1998 (\$ in Thous</u>	Thousands) echnology : Develops advanced tware tools and technic concepts and demonst esence of severe weat ing conducted in digit crease avionics missio	FY 1998 Actual 5,410 aerospace se ques, and sys rates the feas her. These s al processing	FY 1999 Estimate 9,282 ensor and avistems archite sibility of pa	FY 2000 Estimate 9,362 ionics techno ectures. Dev assive and ac	FY 2001 Estimate 9,728 blogy for ele velops new o	FY 2002 Estimate 10,314 ctro-optical	FY 2003 Estimate 11,010	FY 2004 Estimate 11,302	FY 2005 Estimate 11,616	Cost to Complete Continuing	Total Cost Continuing
<ul> <li>2003 Avionics System Design Te</li> <li>(U) A. <u>Mission Description</u>: targets, digital processing, soft system needs. Develops new c ground-based targets in the pre- technology development is bei reduce life cycle costs, and inc</li> <li>(U) <u>FY 1998 (\$ in Thous</u>)</li> </ul>	echnology Develops advanced tware tools and technic concepts and demonst esence of severe weat ing conducted in digit crease avionics mission peands):	5,410 aerospace se ques, and sys rates the feas her. These s al processing	9,282 ensor and avi stems archite sibility of pa eensors are c	9,362 ionics techno ectures. Dev assive and ac	9,728 blogy for ele velops new c	10,314 ctro-optical	11,010	11,302	11,616	Continuing	Continuing
(U) A. <u>Mission Description</u> : targets, digital processing, soft system needs. Develops new of ground-based targets in the pre- technology development is bei reduce life cycle costs, and inc (U) <u>FY 1998 (\$ in Thous</u> )	: Develops advanced tware tools and technic concepts and demonst esence of severe weat ing conducted in digit crease avionics missio	aerospace se ques, and sys rates the feas her. These s al processing	ensor and avi stems archite sibility of pa sensors are c	ionics techno ectures. Dev assive and ac	ology for ele velops new c	ctro-optical	(FO) dectect				
<ul> <li>(U) A. <u>Mission Description</u>: Develops advanced aerospace sensor and avionics technology for electro-optical (EO) dectection, track, and identification of difficult targets, digital processing, software tools and techniques, and systems architectures. Develops new concepts, demonstrates feasibility, and advances technology for avionics system needs. Develops new concepts and demonstrates the feasibility of passive and active hyperspectral imaging sensors and algorithms for detection of airborne and ground-based targets in the presence of severe weather. These sensors are critical to future air and space-based surveillance and targeting capabilities. Additional technology development is being conducted in digital processing hardware, sensor integration, and real-time distributed software to improve weapon system performance, reduce life cycle costs, and increase avionics mission readiness.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) \$1,632</li> <li>Developed advanced machine intelligence technologies to provide a capability for enhanced management of critical on-board sensors and detection/recognition of targets.</li> <li>(U) \$2,712</li> <li>Developed advanced integration technology and evaluate the feasibility of integrating commercial-off-the-shelf components for affordable avionics modernization.</li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>:                 <ul> <li>(U) <u>FY 1999 (\$ in Thousands</u>):</li> <li>(U) \$2,5410</li> <li>Total</li> <li>(U) <u>S2,547</u></li></ul></li></ul></li></ul>											
<ul> <li>developing capability for performing in-flight self-checking of mission critical weapons and information systems software, and continuing to develop new techniques for rapidly incorporating new functions and hardware into scaleable systems.</li> <li>- (U) \$3,829</li> <li>Develop advanced machine intelligence technologies to provide a capability for enhanced management of critical on-board sensors and detection/recognition of targets, including demonstrating enhanced, real-time embedded avionics database management system, demonstrating advanced multi-target, multi-source identification capability, demonstrating an advanced tactical surveillance sensor manager, and developing and applying efficient target recognition and combat information fusion techniques.</li> <li>- (U) \$2,775</li> <li>Develop and demonstrate avionics integration technologies that allow rapid re-allocation of avionics hardware to meet changing operational requirements.</li> </ul>											
Project 2003	environments.	J		Page 12 of	24 Pages		· ·	Exhibit	t R-2A (PE	0602204F)	

RDT8	oit)	DATE February 1999					
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602204F Aerospace	Sensors	PROJECT 2003			
- (U) \$131 - (U) \$9,282	Identified as a source for SBIR. Total						
(U) <u>FY 2000 (\$ in Th</u>	ousands):						
– (U) \$2,298	Develop software engineering technologies to promo and space platform software, including continuing to software, developing and applying capability for perf software, and continuing to develop new techniques is systems.	te assured performance and affo demonstrate automated means t forming in-flight self-checking o for rapidly incorporating new ha	ordability of complex ex- to ensure correctness of of mission critical weap ardware/software functi	sisting and next-generation air cockpit display and console ons and information systems ons into scaleable, plug-and-play			
– (U) \$2,566	Develop technologies to find and fix deep hide target targeting, including developing aerospace infrared hy target models.	ts in day and night from high alt perspectral sensor components	titude and/or space in ti and fusion algorithms,	me to support precision and continue validating sensor			
– (U) \$1,119	Develop technology for non-cooperative identification and atmospheric phenomenology effects on sensor per and developing coherent image processing/extraction	n of airborne and ground-based erformance, generating multi-din a algorithms.	platforms, including in mensional/multi-functio	vestigating target background onal sensor platform concepts,			
– (U) \$1,839	<ul> <li>Develop electro-optical technology to enable passive or active targeting of difficult targets, including investigating ways of mitigating atmospheric phenomenology effects on extreme range aerospace sensors, developing turbulence compensation techniques for precision targeting, target signatures and phenomenology models, and selecting multifunction sensor target characteristics. (Prior to FY 2000, this work was performed under PE 0602702E. Project 4600.)</li> </ul>						
– (U) \$451	Develop military-unique optical transmission compo optical communication subsystem.	nents to enable information dom	ninance, including fabri	cating laboratory high-speed			
– (U) \$1,089	Develop innovative techniques and components to target difficult objects in degraded atmospheric conditions, including fabricating components for active multispectral imaging, assessing active imaging systems for their ability to penetrate weather and obscurants, and designing improved capabilities into existing systems						
– (U) \$9,362	Total						
(U) <u>FY 2001 (\$ in The</u> – (U) \$1,979	busands): Develop software engineering technologies to promo and space platform software, including continuing to weapons and information systems software, and cont functions into scaleable, plug-and-play systems.	te assured performance and affo develop and apply capability fo inuing to develop new technique	ordability of complex ex or performing in-flight s es for rapidly incorpora	xisting and next-generation air self-checking of mission critical ting new hardware/software			
Project 2003	Page	13 of 24 Pages	Exhibit	R-2A (PE 0602204F)			
		115					

RDT	ibit) DATE Fe	bruary 1999		
BUDGET ACTIVITY 2 - Applied Researc	:h	PE NUMBER AND TITLE 0602204F Aerospac	e Sensors	PROJECT <b>2003</b>
<ul> <li>2 - Applied Research</li> <li>- (U) \$2,308</li> <li>- (U) \$1,005</li> <li>- (U) \$1,005</li> <li>- (U) \$2,800</li> <li>- (U) \$419</li> <li>- (U) \$1,217</li> <li>- (U) \$9,728</li> <li>(U) B. Project Change Structure</li> <li>(U) C. Other Program F</li> <li>(U) Related Activities</li> <li>- (U) PE 0603253F</li> <li>- (U) PE 0602301F</li> <li>- (U) This project I</li> <li>(U) D. Acquisition Strate</li> <li>(U) E. Schedule Profile:</li> </ul>	<b>b b ch</b> Develop technologies to find and fix deep hide targe targeting, including fabricating aerospace infrared hyperformance. Develop technology for non-cooperative identification testing coherent image processing/extraction algorith Develop electro-optical technology to enable passive phenomenology effects on extreme range aerospace signatures and phenomenology models, and validatin Develop military-unique optical transmission comport the-shelf technologies integrated with military-unique Develop innovative techniques and components to ta demonstrating concepts based on high precision range. Total <b>cmmary - Description of Significant Changes:</b> Not A <b>unding Summary: c c</b> , Advanced Sensor Integration. <b>c</b> , Intelligence System Program. has been coordinated through the Reliance process to here <b>ray:</b> Not Applicable. Not Applicable.	0602204F Aerospace ts in day and night from high yperspectral sensor componen on of airborne and ground-base muss, and flight-demonstrating or active targeting of difficul sensors, generating turbulence ing multifunction sensor target nents to enable information de e components. rrget difficult objects in degrad ge gating and image processin .pplicable.	e Sensors	2003 ort precision hms, and analyzing ag-range sensors, ting atmospheric on targeting, target seful commercial-off- g analyzing and
Project 2003	Page	14 of 24 Pages	Exhibit R-2A (PE	0602204F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										DATE February 1999		
BUDGET ACTIVITY 2 - Applied Resear	ch			PE N <b>06</b>	UMBER AND	TITLE Aerospac	e Sensoi	rs		F	PROJECT 6 <b>095</b>	
COST <i>(</i> \$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
6095 Sensor Fusion Technol	35 Sensor Fusion Technology 6,539 11,345 12,395 13,333 14,367 14,943 16,046 16,324 Continuir							Continuing	Continuin			
situation awareness, automa concepts for fire control that opportunity) to enable new (U) <u>FY 1998 (\$ in Th</u> - (U) \$1,351 - (U) \$2,416 - (U) \$554 - (U) \$1,220 - (U) \$1,220 - (U) \$998 - (U) \$6,539 (U) <u>FY 1999 (\$ in Th</u>	atic target recognition (A at aid in precisely locatin covert tactics for success <u>nousands</u> ): Developed and evaluat increase detection ran Demonstrated rapid e Applied emerging op information fusion sy Developed low-cost t and increase mission Developed advanced Total	ATR), integra ng, identifyin sful accompl ated multi-se nges, allow h evaluation of en software a vstems for rea echniques us effectiveness ATR technic	ted fire con g, and targe ishments of ensor manag igh-confider multi-senso architecture luced target ing on-board s. ques, include	trol, and bor ting airbornd air-to-air an ement techn nce target id r system con standards ar ing errors ar d sensors for ing extractin	nb damage a e and surface d air-to-surf ologies to op entification, neepts to sup nd practices nd enhanced r cooperative ng radar "sig	assessment. e targets (win ace strike sco ptimize search and enhanch port all-aspecto to the develo situation aw e air-to-groun nature finger	This project th emphasis enarios. th technique e surface stri ect fire contr pment and e areness. nd identificat prints" and	determines on reduced s, increase a ike applicati- ol, target tra evaluation of tion of friend evaluating t	the feasibilit signature tar ir combat sit ons. icking, and si f real-time, o dly forces to hermal invar	y of technol gets and targ uational awa ituation awa n-board, ada reduce fratr iance featur	ogies and gets of areness, reness. aptive icide es.	
- (U) \$1,335 $- (U) $5,062$ $- (U) $2,772$ $- (U) $1,216$ $- (U) $800$ $- (U) $160$	Develop, evaluate, an identification algorith Develop, evaluate, an and identification alg Develop, evaluate, an hostile ground forces. Develop and demonst Develop precision tin Identified as a source	ad demonstra nms to drama ad demonstra orithms to da ad demonstra trate ATR er ne, position, for SBIR.	te air-to-air tically impr te air-to-gro ramatically i te feasibility tabling techi and velocity	single and r ove air comb pund single a improve reco v of single ar hologies for v sensors to g	nultisensor t bat capabilit and multi-sen onnaissance, ad multi-sen long-range, generate a co	racking, sen y. nsor tracking surveillance sor ATR alg high-altitude ommon preci	sor manager (, sensor man e, and strike prithms to dr air and space sion reference	nent, fire co nagement, fi operations. ramatically i ce vehicles. ce and enabl	ntrol, situation ire control, si improve capa le platforms t	tuation awarenes tuation awa ability to rec to share sens	ss, and reness, cognize sor data.	
- (U) \$11,345	Total											

RDT8	bit)	February 1999							
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602204F Aerospace	e Sensors	PROJECT 6095					
(II) <b>FY 2000 (\$ in Th</b>									
- (U) \$3,773	Develop, evaluate, and demonstrate single and multis performing a ground station emulation, simulating re resource allocation.	sensor lethality algorithms to d al-time information into the co	ramatically improve air ockpit (RTIC) targeting,	combat capability, including and developing adaptive					
- (U) \$3,573	Develop, evaluate, and demonstrate air-to-ground single and multi-sensor radar target signature models to support automatic target recognition (ATR) in strike operations, including investigating computational electromagnetics (CEM) techniques, generating geometric target models, and characterizing clutter.								
- (U) \$1,712	Develop, evaluate, and demonstrate feasibility of multi-sensor ATR algorithms for on- and off-board sensor-to-shooter image and data fusion to rapidly attack time-critical targets, including completing the evaluation of a sensor-to-shooter algorithm, devising multi-sensor performance metrics, and evaluating multisensor ATR algorithms.								
– (U) \$2,281	Develop and demonstrate enabling ATR technologies for long-range, high-altitude air and space vehicles, including investigating physics- based and adaptive learning techniques.								
– (U) \$1,056	Develop precision time, position, and velocity sensors, leveraging on the Global Positioning System (GPS), and to enable multiple platforms to share sensor data with reduced jamming vulnerability and increased precision targeting accuracy, including conducting trade studies to determine optimal mix and density of digital devices, and developing detailed designs for advanced direct signal acquisition techniques for increased iam resistance of GPS user equipment								
– (U) \$12,395	Total								
(U) FY 2001 (\$ in The	pusands):								
- (U) \$4,142	Develop, evaluate, and demonstrate single and multi- performing a live-feed to ground station emulation, e methods.	sensor lethality algorithms to valuating RTIC targeting sche	dramatically improve air mes, and optimizing ada	combat capability, including ptive resource allocation					
- (U) \$3,893	Develop, evaluate, and demonstrate air-to-ground sin including generating geometric target models and inc	gle and multi-sensor radar targ	get signature models to s arget recognition.	upport ATR in strike operations,					
– (U) \$1,748	Develop, evaluate, and demonstrate feasibility of multiplication of the contract targets including communication of targets including communication o	ti-sensor ATR algorithms for o	on- and off-board sensor	-to-shooter image and data fusion g multi-sensor ATR algorithms					
- (U) \$2,912	Develop and demonstrate enabling ATR technologies investigate physics-based and adaptive learning technologies	s for long-range, high-altitude	air and space vehicles, in	ncluding continuing to					
– (U) \$638	investigate physics-based and adaptive learning techniques. Develop technologies for reduced jamming vulnerability and increased precision targeting and strike accuracy of GPS, including completing detailed designs of advanced direct signal acquisition techniques for increased jam resistance of GPS user equipment and testing signal acquisition techniques.								
– (U) \$13,333	Total								
Project 6095	Page	16 of 24 Pages	Exhibit	R-2A (PE 0602204F)					
		118							
RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999								
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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602204F Aerospace Sensors	PROJECT 6095							
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Not A	Applicable.								
<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) <u>Related Activities</u>: <ul> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0602602F, Conventional Munitions.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) PE 0603226E, Experimental Evaluation of Major Innovative Techn</li> <li>(U) PE 0603762E, Sensor and Guidance Technology.</li> </ul> </li> <li>(U) This project has been coordinated through the Reliance process to here.</li> </ul>	ologies.								
<ul> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> </ul>									
(U) E. <u>Schedule Profile</u> : Not Applicable.									
Project 6095 Page	2 17 of 24 Pages	Exhibit R-2A (PE 0602204F)							

RDT	&E BUDGET IT	EM JUS	TIFICAT	ION SH	IEET (R·	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 2 - Applied Resear	ch			PE N <b>06</b>	PE NUMBER AND TITLE 0602204F Aerospace Sensors				PROJECT 6096		
COST <i>(</i> \$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
6096 Microelectronics Techn	ology	8,600	9,180	7,703	8,548	7,409	6,978	6,898	7,032	Continuing	Continuinç
2* Applied research         DOD2/OFF         Actograde Sensors         DOD3 <u>COST (\$ In Thousands)</u> <u>FY 1998</u> <u>FY 2004</u> <u>FY 2004</u> <u>FY 2004</u> <u>FY 2004</u> <u>FY 2004</u> <u>FY 2004</u> FY 2004                 FY 2004                FY 2004               FY 2004                   FY 2004                      FY 2004											
	in radar, EW, and ot	ner sensors.									

RDT	<b>&amp; E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exh	ibit)	February 1999						
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602204F Aerospac	e Sensors	PROJECT 6096						
- (U) \$2,609	Develop surface protective coatings and packaging to reliability and lower component cost for space senso	echnologies for high performa r components, including devel	nce, mixed analog/digital oping advanced packagin	microwave circuits to improve g and interconnect processes for $E_0602204E_{\text{Project}} 2002$ )						
- (U) \$2,528	Develop advanced design tools to reduce the cost and refining tools for next-generation "systems-on-a-chi	d time required to create comp	blex Air Force electronic s	systems, including assessing and						
- (U) \$805	Develop next generation design representations and a implementing the Air Force's "system of systems" v design language tools for developing complex milita	Develop next generation design representations and system-level modeling and simulation capability to support the complexity in implementing the Air Force's "system of systems" vision, including developing extensions to industry standard hardware description and design language tools for developing complex military information systems.								
- (U) \$131	Identified as a source for SBIR.									
- (U) \$9,180	Total									
(U) FY 2000 (\$ in T)- (U) \$2,487- (U) \$1,771- (U) \$775- (U) \$2,270- (U) \$400- (U) \$7,703	housands): Develop advanced high-speed device technologies to (RF) components and analog-to-digital converters fo Develop advanced design tools to reduce the cost and analog and digital systems, including demonstrating Develop next-generation design representations and complexity in implementing the Air Force's "system advanced techniques for analyzing life cycle cost/per Develop RF photonics technologies to demonstrate c photonic interconnect architectures for high perform PE 0602702F, Project 4600.) Develop, as part of an international cooperative effor assembly technologies needed for next-generation ai Total	e enable affordable, compact sp or high dynamic range, high se d time required to create comp tools for reconfigurable comp system-level modeling and co of systems" vision, including formance trade offs. compact, affordable, wide band ance digital receivers and proo rt, the three-dimensional mult rcraft and space-based radars.	bace-based sensors, includ nsitivity micro-receivers. lex Air Force electronic s uters and for describing h llaborative engineering ca specifying required repre dwidth, high data rate sen cessors. (In FY 1999, this ilayer microwave packagi	ding designing radio frequency systems, for example mixed hardware behavior. apability to support the esentations and developing sors, to include designing s work was performed in ang and interconnect multichip						
(U) <u>FY 2001 (\$ in T</u> - (U) \$3,397 - (U) \$1,812	<ul> <li><u>2001 (\$ in Thousands</u>):</li> <li>U) \$3,397 Develop high-speed device technologies to enable affordable, compact space-based sensors, including designing and fabricating low power, radiation tolerant analog-to-digital converters for high dynamic range, high sensitivity micro-receivers.</li> <li>U) \$1,812 Develop advanced design tools to reduce the cost and time required to create complex Air Force electronic systems, for example mixed analog and digital systems, including continuing to demonstrate tools for reconfigurable computing.</li> </ul>									
Project 6096	Page	19 of 24 Pages	Exhibit	R-2A (PE 0602204F)						
		121								

	repruary 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602204F Aerospace	PROJECT Sensors 6096
<ul> <li>(U) \$760 Develop next-generation design representation complexity in implementing the Air Force's demonstrating advanced techniques for anal Develop radio frequency photonics technological fabricating photonic interconnect component</li> <li>(U) \$2,579 Develop radio frequency photonics technological fabricating photonic interconnect component</li> <li>(U) \$8,548 Total</li> </ul>	ions and system-level modeling and collal s "system of systems" vision, including in lyzing life cycle cost/performance trade of ogies to demonstrate compact, affordable, nts for high performance digital receivers	borative engineering capability to support the aplementing required representations and ifs. wide bandwidth, high data rate sensors, including and processors.
(U) B. <u>Project Change Summary - Description of Significant Changes</u> within the Science and Technology (S&T) Program	<b><u>s</u>:</b> Changes to this project since the previo	ous President's Budget are due to higher priorities
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) PE 0602702F, Command, Control and Communications.</li> <li>(U) PE 0602705A, Electronics and Electronic Devices.</li> <li>(U) PE 0602234N, Materials, Electronics and Computers.</li> <li>(U) PE 0602712E, Materials and Electronics.</li> <li>(U) PE 0603739E, Manufacturing Technology.</li> <li>(U) This project has been coordinated through the Reliance prod</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	cess to harmonize efforts and eliminate du	uplication.
Project 6096	Page 20 of 24 Pages	Exhibit R-2A (PE 0602204F)

BUDGET ACTIVITY       PERUJECT       PERUJECT       PERUJECT       PERUJECT         2 - Applied Research       0602204F Acrospace Sensors       PT 2004       FY 2004       <	RDT	&E BUDGET ITI	EM JUS	TIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
COST (\$ In Thousands)         FY 1998 Actual         FY 1999 Estimate         FY 2001 Estimate         FY 2001 Estimate         FY 2004 Estimate         FY 2004 Estima	BUDGET ACTIVITY 2 - Applied Researc	ch			PE N <b>06</b>	UMBER AND	TITLE Aerospac	e Sensor	S		F	PROJECT 7622
Test       8.370       9.677       10.108       10.393       10.683       11.969       12.270       Continuing       Continuing         (U) A. <u>Mission Description</u> :       Determines feasibility of technology for reliable, all-weather, reconnaissance and precision strike radio frequency (RF) sensors and anountlage measures, severe clutter, and/or heavy jamming. This project also develops technology to satisfy the growing need to transmit data between aerospace vehicles with difficult to detect signatures due to reduced radar cross sections, concealment and camouflage measures, severe clutter, and/or heavy jamming. This project also develops technology to satisfy the growing need to transmit data between aerospace vehicles with difficult to detection, including electronic protection, multidimensional image processing, and adaptive algorithms, to improve performance and reduce life cycle costs. <ul> <li>(U) <u>FV 1998 (S in Thousands)</u>:</li> <li>(U) \$2.905</li> <li>Developed advanced microwave sensor technology for air-to-ground targeting and attack with robust performance in adverse weather, severe jamming, matural clutter, or concalment by foliage or camoullage.</li> <li>(U) \$1.794</li> <li>Developed advanced microwave sensor technologies, such as electronic protection, multi-dimensional image processing, and adaptive algorithms, for high-performance, lower file cycle cost air-to-air datar and target detection, including testing integrated RF techniques, developing adaptive algorithms for interference and lobe cancellation, and continuing to develop radar engineering tools to evaluate targeting in the strate and target detection, including testing integrated RF techniques, developing adaptive algorithms for interference and lobe cancellation, and continuing to develop radar engineering tools to evaluate tar</li></ul>	COST (\$ )	(\$ In Thousands) FY 1998 Actual FY 1999 FY 1999 FY 2000 FY 2000 FY 2001 FY 2002 FY 2003 FY 2003 FY 2004 FY 2005 Cost to Complete								Total Cost		
<ul> <li>(1) A. <u>Mission Description</u>: Determines feasibility of technology for reliable, all-weather, reconnaissance and precision strike radio frequency (RF) sensors and information transfer systems. Emphasis is on acquisition of surface and airborne targets with difficult to detect signatures due to reduced radar cross sections, concealment and camouflage measures, severe cluter, and/or heavy jamming. This project also develops technology to satisfy the growing need to transmit data between aerospace vehicles with high integrity, low probability of detection, and high jam resistance. Assured low probability of detections are required to reduce aircraft physical and electromagnetic vulnerability and provide major improvements in strike effectiveness by eliminating the requirement for "no communications" operations.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>52,802</u></li> <li>Developed advanced microwave sensors for air-to-ground targeting and attack with robust performance in adverse weather, severe jamming, natural clutter, or concealment by foliage or camouflage.</li> <li>(U) <u>51,794</u></li> <li>Developed technology for information transmission between airborne vehicles and cooperating assets with high fidelity, low probability of detection, and high jam resistance. Assure effectiveness.</li> <li>(U) <u>51,794</u></li> <li>Develop advanced microwave sensor technologies, such as electronic protection, multi-dimensional image processing, and adaptive algorithms, for high-performance, lower life cycle cost air-to-air radar and target detection, including testing integrated RF techniques, developing adaptive algorithms for interference and lobe cancellation, and continuing to develop radar engineering tools to evaluate targeting errors.</li> <li>(U) <u>51,435</u></li> <li>Develop advanced nitrowave sensors for air-to-ground targeting and atack with robust performance in adverse weather, severe jamming,</li></ul></li></ul>	7622 Radio Frequency Senso	or Technology	7,591	8,970	9,677	10,108	3 10,393 10,683 11,969 12,270 Continuing Continu					Continuing
Project 7622 Page 21 of 24 Pages Exhibit R-2A (PE 0602204F)	(U) A. <u>Mission Description</u> information transfer system: and camouflage measures, since with high integrity, physical and electromagnetic (U) <u>FY 1998 (\$ in Th</u> – (U) \$2,995 – (U) \$2,802 – (U) \$1,794 – (U) \$1,794 – (U) \$7,591 (U) <u>FY 1999 (\$ in Th</u> – (U) \$3,742 – (U) \$3,666 – (U) \$1,435 – (U) \$1,435	<ul> <li><b>bn</b>: Determines feasibilities. Emphasis is on acquisevere clutter, and/or head, low probability of determines of the end o</li></ul>	ity of techno sition of sur avy jamming ction, and hi yide major in microwave a cocessing, an airborne sen airborne sen cealment by y for inform im resistance algorithms for thorne senso iccowave ser performance algorithms for thorne senso iccealment by g to develop for informati im resistance nary design a for SBIR.	logy for relia face and airt face and airt face and airt face and airt sensor techn d adaptive a asors for air-t foliage or c ation transme to improve hsor technolo , lower life c or interference rs for air-to- foliage or c analytical to on transmiss e to improve for a non-lin	able, all-wea porne targets of also deve- tance. Assu s in strike eff ology for ain algorithms, to to-ground ta amouflage. ission betwee strike effect ogies, such a cycle cost ain ce and lobe of ground targe amouflage, to ols to prediction strike effect ear adaptive	ather, reconn s with difficu lops technolo red low prob fectiveness b r-to-air radar o improve pe rgeting and a een airborne iveness. as electronic r-to-air radar cancellation, eting and att including de ct SAR perfo a airborne ve tiveness, inc	aissance and ilt to detect s ogy to satisfy pability of de oy eliminatin and target d erformance a attack with r vehicles and protection, n and target c and continu ack with rob veloping impormance. hicles and co luding integre	precision st ignatures du y the growin tection com g the require etection, inc nd reduce li obust perform cooperating nulti-dimens letection, inc ing to devel- ust performa proved targe poperating as rating a com educe interfe	rike radio fr the to reduced g need to transmunications ement for "n duding elect fe cycle cost mance in ad assets with ional image cluding testin op radar eng ance in adve ting scenes for sets with high munication a erence.	equency (RF I radar cross insmit data b are required o communic ronic protect ts. verse weather high fidelity processing, ng integrated tineering too rse weather, for synthetic gh fidelity, le asset manage	F) sensors an sections, co etween aero to reduce a ations" oper ion, multi- er, severe jan , low probab l RF techniq ls to evaluat severe jamm aperture rac ow probabili ement syster	d ncealment space ircraft ations. nming, bility of bility of e ues, e ning, lars ity of n and
	Project 7622				Page 21 of	<sup>4</sup> 24 Pages			Exhibi	t R-2A (PE	0602204F)	

RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibi	t)	DATE February 1999					
BUDGET ACTIVITY 2 - Applied Researd	ch	PE NUMBER AND TITLE 0602204F Aerospace S	Sensors	PROJECT <b>7622</b>					
(U) <u>FY 2000 (\$ in Thousa</u>	nds):								
– (U) \$568	Develop aerospace microwave sensor technologies for protection, targeting, attack, and electronic warfare, advanced radar performance/cost analysis tools	or air-to-air radar and target detect including designing electromagne	tion that supports sur- etic interference mitig	veillance, reconnaissance, gation techniques and validating					
– (U) \$1,759	Develop adaptive microwave processing algorithms targets, including designing techniques to mitigate c	for detecting and locating advance lutter and jamming on airborne m	ed cruise missiles and onostatic and bistatic	slow airborne and ground radars.					
– (U) \$1,577	Develop advanced aerospace sensors for air-to-grour maneuvering tactical aircraft under hostile environm airborne and space surveillance sensors.	nd targeting and attack, providing ent, including performing an inde	synthetic aperture rac pendent assessment o	lar (SAR) targeting solutions for of various current and future					
– (U) \$743	Develop technology for detecting and attacking conc waveforms and targeting algorithms.	ealed targets, including developin	g innovative foliage-	and ground-penetrating radar					
– (U) \$1,199	Develop technology for information transmission between airborne vehicles and cooperating assets with high fidelity, low probability of detection, and high jam resistance to improve strike effectiveness, including completing a dual-use, integrated communication/navigation system demonstrator, developing a design for a non-linear adaptive interference limiter, and continuing propagation characterization studies and experiments								
– (U) \$491	Develop technology to accurately determine algorith surveillance and combat scenarios, including testing conducted under PE 0602702F, Project 4506.)	m and sensor performance from ai bistatic adjuncts on unmanned aer	irborne and space-bas rial vehicles. (Prior t	ed platforms in realistic airborne o FY 2000, this effort was					
– (U) \$2,139	Develop advanced electromagnetic aperture technolo an antenna element/aperture design for a digital bear sparse distributed satellite arrays, and demonstrating conducted under PE 0602702F, Project 4600.)	egy, including demonstrating the fe n-formed bistatic radar multibeam a three-dimensional optically exc	easibility of a space-b a antenna, evaluating ited antenna array. (	based radar subarray; completing advanced antenna concepts for Prior to FY 2000, this effort was					
– (U) \$1,201	Develop electromagnetic technologies for advanced s within severe clutter from airborne or space-based su Project 4600.)	surveillance systems applications f rveillance platforms. (Prior to FY	or the detection of lo 2000, this effort wa	w-observable airborne targets s conducted under PE 0602702F,					
– (U) \$9,677	Total								
(U) <u>FY 2001 (\$ in Th</u>	iousands):								
– (U) \$1,377	Develop aerospace microwave sensor technologies for	or air-to-air radar and target detect	tion that supports sur	veillance, reconnaissance,					
- (U) \$1,142	Develop adaptive microwave processing algorithms including laboratory testing techniques to mitigate cl	for detecting and locating advance lutter and jamming in airborne mo	enc interference miti ed cruise missiles and poostatic and bistatic	slow airborne and ground targets, radars.					
Project 7622	Page	22 of 24 Pages	Exhibit	R-2A (PE 0602204F)					
		124							

RD	<b>F&amp;E BUDGET ITEM JUSTIFICATIO</b>	N SHEET (R-2A E)	(hibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Resea	rch	PE NUMBER AND TITLE 0602204F Aerosp	ace Sensors	PROJECT <b>7622</b>
- (U) \$1,129	Develop advanced aerospace sensors for targeting performing an independent assessment of surveill	and attack, including develop	ing a high fidelity space-bas	sed radar evaluation tool for
- (U) \$1,325	Develop technology for detecting and attacking co waveforms and targeting algorithms, devising tech communications.	niques to prevent discovery b	aluating innovative foliage- y the enemy, and assessing	and ground-penetrating radar potential for embedded
– (U) \$1,379	Develop technology for information transmission detection, and high jam resistance to improve stril limiter and continuing wide-band propagation cha	between airborne vehicles and ke effectiveness, including con aracterization experiments.	cooperating assets with hig npleting the design of a non	h fidelity, low probability of -linear adaptive interference
- (U) \$893	Develop technology to accurately determine algor surveillance and combat scenarios, including dem adjunct unmanned aerial vehicles (UAV). airborne	ithm and sensor performance onstrating performance on air e foliage penetration assets. ar	from airborne and space-bas borne surveillance and fight ad space-based radar platfor	sed platforms in realistic airborne er platforms such as bistatic ms.
– (U) \$2,058	Develop advanced electromagnetic aperture techn multibeam antenna, demonstrating switched multi and demonstrating a broadband antenna horn arra	ology, including demonstratin -function phased array employ y for a UAV foliage penetrati	g algorithms for a digital be ying micro-machined electro on radar.	eam-formed bistatic radar omechanical system technology,
– (U) \$805	Develop electromagnetic technologies for advance within severe clutter from airborne or space-based section measurement capability.	ed surveillance systems applica l surveillance platforms, inclue	ations for the detection of lo ding continuing to build a la	w-observable airborne targets boratory bistatic radar cross
– (U) \$10,10	8 Total			
Project 7622	Pa	ige 23 of 24 Pages	Exhibit	R-2A (PE 0602204F)
		125		

RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602204F Aerospace Sensors	PROJECT <b>7622</b>		
(U) B. Project Change Summary - Description of Significant Changes: Not A	pplicable.			
(U) C. Other Program Funding Summary:				
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0603253F, Advanced Avionics Integration.</li> <li>(U) PE 0602782A, Command, Control and Communications (C3) Techn</li> <li>(U) PE 0602232N, Navy C3 Technology.</li> <li>(U) PE 0603792N, Advanced Technology Transition.</li> <li>(U) This project has been coordinated through the Reliance process to have a sensor of the sensor of the</li></ul>	ology. rmonize efforts and eliminate duplication.			
(U) D. <u>Acquisition Strategy</u> : Not Applicable.				
(U) E. <u>Schedule Profile</u> : Not Applicable.				
Project 7622 Page	24 of 24 Pages	Exhibit R-2A (PE 0602204F)		
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PE TITLE: Hypersonic Technology Program

BUDGET ACTIVITY         PE NUMEER AND TITLE         PROJECT           2 - Applied Research         0002269F         Hypersonic Technology Program         1025           1025         Market Stande         FY 1998         FY 1998         FY 2000         FY 2001         FY 2002         FY 2004         FY 2		RDT	<b>&amp;E BUDGET IT</b>	EM JUS	STIFICA	TION SI	HEET (F	R-2 Exhi	bit)		DATE Fe	bruary 1	999
COST (\$ In Thousands)         FY 1999         FY 1999         FY 2000         FY 2001         FY 2001 </th <th>BUDGET ACTIVIT 2 - Applied</th> <th>ry <b>Resear</b></th> <th>ch</th> <th></th> <th></th> <th>PE N 060</th> <th>UMBER AND</th> <th>TITLE Hyperson</th> <th>ic Techn</th> <th>ology Pr</th> <th>ogram</th> <th>- - -</th> <th>PROJECT</th>	BUDGET ACTIVIT 2 - Applied	ry <b>Resear</b>	ch			PE N 060	UMBER AND	TITLE Hyperson	ic Techn	ology Pr	ogram	- - -	PROJECT
1025         Hypersonic Technology         9,115         16,586         0        <		COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Quantity of RDT&E Aridies       0<	1025 Hypersoni	c Technology	/	9,115	16,586	0	0	0	0	0	0	0	0
Note: In FY 2000, this program is terminated.         (U) A. Mission Description: This Applied Research program develops advanced hypersonic technologies and will provide revolutionary technology options to satisfy future Air Force needs such as future hypersonic weapons and space launch concepts. This program will focus on hydrocarbon fueled hypersonic vehicle technologies and edmonstrate their feasibility. Technologies developed under this program will be dual-use and applicable to both DoD and National Aeronautics and Space Administration (NASA) requirements. Planned efforts include analyses, hypersonic materials/structures, airbreathing propulsion, hydrocarbon fuels, and integrated technology test demonstrations.         (U) FY 1998 (S in Thousands):       – (U) \$7,908       Designed, developed, and tested propulsion components, structures, and integrated propulsion designs to demonstrate performance and durability of advanced hypersonic propulsion concepts.         – (U) \$471       Designed, developed, and tested advanced high-temperature, high-strength materials and structures for durability and affordability in hypersonic applications.         – (U) \$284       Developed and estended computational technologies for supersonic combustion flow paths, validated these technologies, and applied them to predict internal flows and performance of scramjet engines for accurate prediction of system performance.         – (U) \$122       Conducted feasibility studies, design trades, and simulations to integrate hypersonic applications that will improve warfighting capability and satisfy the requirements of Global Reach/Global Power.         – (U) \$115       Total	Quantity o	f RDT&E Art	icles	0	0	0	0	0	0	0	0	0	0
	Project 1025					Page 1 of	5 Pages			EXNID	οπ K-2 (PE (	JOUZZ69F)	

BUDGET ACTIVITY         PE NUMBER AND TITLE         PROJECT           2 - Applied Research         0602269F Hypersonic Technology Program         1025   (U) FY 1999 (5 in Thousands): <ul> <li>(U) S14,127</li> <li>Design, develop, and test propulsion comeponents, structures, and integrated propulsion designs to demonstrate performance and durability of advanced hypersonic propulsion concepts.</li> <li>(U) S10,03</li> <li>Design, develop and test advanced high-temperature, high-strength materials and structures for durability in hypersonic applications.</li> <li>(U) S392</li> <li>Develop technologies for instrumentation and test in realistic hypersonic combustion flow paths, validate these technologies, and apply them to predict internal flows and performance of straingic engines for accurate prodiction of system performance.</li> <li>(U) S147</li> <li>Conduct feasibility studies, design trades, and simulations to integrate hypersonic technologies into advanced vehicle designs for hypersonic applications that will improve warfighting capability and satisfy the requirements of Global Reach/Global Power.</li> <li>(U) S465</li> <li>Total</li> <li>(U) FY 2000: Not Applicable</li> <li>(U) EV 2000: Not Applicable</li> <li>(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.</li> </ul>	RDT	N SHEET (R-2 Exhibit)	DATE February 1999	
<ul> <li>(1) <u>FY 1999 (\$ in Thousands):</u> <ul> <li>(U) \$14,127</li> <li>Design, develop, and test propulsion concepts.</li> <li>(U) \$14,127</li> <li>Design, develop, and test advanced high-temperature, high-strength materials and structures for durability in hypersonic applications.</li> <li>(U) \$392</li> <li>Develop technologies for instrumentation and test in realistic hypersonic combustion flow paths, validate these technologies.</li> <li>(U) \$392</li> <li>Develop and test advanced high-temperature, high-strength materials and structures for durability in hypersonic applications.</li> <li>(U) \$392</li> <li>Develop and test advanced high-temperature, high-strength materials and structures for durability in hypersonic applications.</li> <li>(U) \$392</li> <li>Develop and test advanced high-temperature, high-strength materials and structures for durability in hypersonic applications.</li> <li>(U) \$392</li> <li>Develop and test advanced high-temperature, high-strength materials and structures for durability in hypersonic applications.</li> <li>(U) \$392</li> <li>Develop and test advanced high-temperature, high-strength materials and structures for durability in hypersonic applications.</li> <li>(U) \$465</li> <li>Identified as a source for SBIR</li> <li>(U) <u>FY 2000</u>: Not Applicable</li> <li>(U) <u>FY 2001</u>: Not Applicable</li> <li>(U) <u>FY 2002</u>: Not Applicable</li> </ul> </li> <li>(U) <u>FY 2002</u>: Not Applicable</li> <li>(U) <u>FY 2002</u>: Not Applicable</li> <li>(U) <u>FY 2004</u>: Not Applicable</li> </ul> <li>(D) <u>FW 2004</u>: Not Applicable</li> <li>(D) <u>FW 2005</u>: Not Applicable</li> <li>(D) <u>FW 2005</u>: Not Applicable</li>	BUDGET ACTIVITY 2 - Applied Researd	ch	PE NUMBER AND TITLE 0602269F Hypersonic Technology Pr	ogram 1025
Project 1025         Page 2 of 3 Pages         Exhibit R-2 (PE 0602269F)	<ul> <li>(U) <u>FY 1999 (\$ in TH</u> <ul> <li>(U) \$14,127</li> <li>(U) \$14,063</li> <li>(U) \$392</li> <li>(U) \$392</li> <li>(U) \$147</li> <li>(U) \$147</li> <li>(U) \$465</li> <li>(U) <u>FY 2000</u>: Not A</li> <li>(U) <u>FY 2001</u>: Not A</li> </ul> </li> <li>(U) <u>FY 2001</u>: Not A</li> <li>(U) <u>B. Budget Activity Jr</u> <ul> <li>utility of evolutionary and n</li> </ul> </li> </ul>	<u>nousands</u> ): Design, develop, and test propulsion components, st of advanced hypersonic propulsion concepts. Design, develop, and test advanced high-temperatur Develop technologies for instrumentation and test in Develop and extend computational technologies for predict internal flows and performance of scramjet e Conduct feasibility studies, design trades, and simula applications that will improve warfighting capability Identified as a source for SBIR Total pplicable <u>ustification</u> : This program is in Budget Activity 2, Apprevolutionary technologies.	ructures, and integrated propulsion designs to demons e, high-strength materials and structures for durability realistic hypersonic conditions to enable appropriate s supersonic combustion flow paths, validate these techr ngines for accurate prediction of system performance. ations to integrate hypersonic technologies into advance and satisfy the requirements of Global Reach/Global plied Research, since it develops and determines the te	trate performance and durability in hypersonic applications. system testing. nologies, and apply them to red vehicle designs for hypersonic Power.
	Project 1025	Pag	e 2 of 3 Pages Exhib	it R-2 (PE 0602269F)

RDT&E BUDGET ITEM JUS	TIFICATIO	ON SHEET	(R-2 Exhib	it)	DATE February	/ 1999
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AN 0602269F	ID TITLE Hypersonic	c Technology	Program	PROJECT 1025
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :		·			Total	
<ul> <li>(U) Previous President's Budget/FY 1999 PB</li> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value <ul> <li>a. Congressional/General Reductions</li> <li>b. SBIR</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> </ul> </li> </ul>	<u>FY 1998</u> 9,305 9,840 -326 -216 -519	<u>FY 1999</u> 16,649 16,649 -63	<u>FY 2000</u> 16,577	<u>FY 2001</u> 16,396	Cont	
<ul> <li>d. Below Threshold Reprogrammings</li> <li>e. Rescissions</li> <li>(U) Adjustments to Budget Years Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> </ul>	336 9,115	16,586	-16,577 0	-16,396 0		
<ul> <li>(U) (U) Significant Program Changes: In FY 2000, this program FY 1999: \$465 indentified as a source for SBIR.</li> <li>(U) D. <u>Other Program Funding Summary</u>:</li> </ul>	am is terminated	due to higher pri	orities within the	e Science and Tech	nology (S& I ) Program.	
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602201F, Flight Dynamics.</li> <li>(U) PE 0602203F, Aerospace Propulsion</li> <li>(U) PE 0603112F, Advanced Materials for Weapon Symptotic constraints of the relation of the second secon</li></ul>	ystems. liance process to	harmonize effort	s and eliminate o	luplication.		
(U) E. <u>Acquisition Strategy</u> : Not Applicable.						
(U) F. <u>Schedule Profile</u> : Not Applicable.						
Project 1025	Po	age 3 of 3 Pages		Ex	hibit R-2 (PE 0602269	9F)
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PE TITLE: Phillips Laboratory Exploratory Development

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									February 1999	
BUDGET ACTIVITY       PE NUMBER AND TITLE         2 - Applied Research       0602601F Phillips Laboratory Exploratory         Development										
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	113,000	125,585	115,313	110,811	116,109	131,858	144,557	149,674	Continuing	Continuing
1010 Geophysics and Weather Technology	19,848	23,885	8,120	9,133	7,960	8,641	15,437	17,028	Continuing	Continuing
1011 Rocket Propulsion Technology	28,199	34,824	31,835	20,817	24,820	36,105	41,916	40,541	Continuing	Continuing
3326 Lasers and Imaging Technology	16,873	18,662	17,193	17,211	16,177	19,161	19,600	19,561	Continuing	Continuing
5797 Advanced Weapons and Survivability Technology	13,602	14,239	16,183	16,752	17,304	17,723	17,375	17,870	Continuing	Continuing
8809 Space and Missile Technology	34,478	33,975	41,982	46,898	49,848	50,228	50,229	54,674	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C

Note: In FY 2000, spectral sensing (intelligent satellite systems and hyperspectral technology) efforts currently in Project 3326 move into Project 8809.

(U) A. <u>Mission Statement</u>: This is the Applied Research program for space technology, rocket propulsion, and directed energy for the Air Force Research Laboratory. In geophysics, this PE develops technologies to understand, mitigate, and exploit effects of weather and geophysics environments on the design and operation of Air Force systems. This includes defining, modeling, and developing techniques to predict the phenomena of solar and space environments. In rocket propulsion, this PE develops technologies to demonstrate the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) goals for boost and orbit transfer, satellite maneuvering, and tactical/ballistic missile rocket propulsion. In lasers, this PE examines the technical feasibility of moderate to high power lasers, associated optical components, and long-range optical imaging concepts required for Air Force missions. Technologies researched include high power laser devices, mid-infrared semiconductor laser devices, semiconductor diode laser arrays, optical components, advanced beam control and atmospheric compensation technologies, techniques for laser target vulnerability assessments, and nonlinear optics processes and techniques. Advanced weapons examines high power microwave and other unconventional weapon concepts using innovative technologies such as compact toroids. This also provides for vulnerability assessments of representative U.S. strategic and tactical systems to directed energy weapon technology assessment for spaceic Air Force missions, and directed energy weapon lethality assessments against foreign targets. In space and missiles, this PE develops the following technologies: spacecraft platform (e.g., spacecraft software); ballistic missile/launch vehicle-specific (e.g., astrodynamics and guidance, navigation, and control avionics); and integrated experiments of advanced technologies for transition to planned systems (e.g., payload/platform/launch vehicle

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Exhibit R-2 (PE 0602601F)

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RDT&E BUDGET ITEM JUS	STIFICATIC	N SHEET	(R-2 Exhib	it)	February 1999
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AN 0602601F Developm	D TITLE Phillips Lal ent	boratory Exp	loratory
merging). Note: In FY 1999, Congress added \$9.0 million for technology program.	the High-frequer	ncy Active Auror	al Research Prog	ram and \$4.0 milli	on for the Terabit fiber optic
(U) <b>B.</b> <u>Budget Activity Justification</u> : This program in Budgutility of evolutionary and revolutionary technologies.	et Activity 2, App	plied Research, si	nce it develops a	and determines the	technical feasibility and military
(U) C. Program Change Summary (\$ in Thousands):					
	FV 1008	FV 1000	EV 2000	EV 2001	Total
(U) Previous President's Budget/FY 1999 PB	118 266	116 139	131.078	138 457	Cont
(U) Appropriated Value	127.259	129.139	101,070	100,107	Com
(U) Adjustments to Appropriated Value	,	,			
a. Congressional/General Reductions	-7,390	-3,554			
b. SBIR	-1,765				
c. Omnibus/Other Above Threshold Reprogrammings	-3,811				
d. Below Threshold Reprogrammings	-1,293				
(U) Adjustments to Budget Year Since FY 1999 PB	112 000	125 505	-15,765	-27,646	
(U) Current Budget Submit/FY 2000 PB	113,000	125,585	115,313	110,811	Cont
U) Significant Program Changes: Changes to this PE since the Program.	e previous Presid	ent's Budget are	due to higher pri	orities within the S	Science and Technology (S&T)
FY 1999: \$2,632 identified for a source for SBIR.					
				_	/

Page 2 of 18 Pages

Exhibit R-2 (PE 0602601F)

RDT	&E BUDGET ITE	EM JUS	TIFICAT	ION SH	HEET (R	-2A Exh	ibit)		February 1999		
BUDGET ACTIVITY <b>2 - Applied Resea</b>	PE N 06 De	PE NUMBER AND TITLEPROJEC0602601FPhillips Laboratory Exploratory1010Development1010									
COST (	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost			
1010 Geophysics and Weat	Geophysics and Weather Technology     19,848     23,885				9,133	7,960	8,641	15,437	17,028	Continuing	Continuin
<ul> <li>(U) IM<u></u></li></ul>	<ul> <li>This project actors is to not for realistic space systems and uninterrupted systems and defensive operate the systems and defensive operate the systems and the space explored preveloped infrared by missiles and other targulaser systems. Developed techniques disturbances on the operate of the systems and the structures. Total</li> </ul>	m design, m em perform ions. software, ar periment to ackground c gets from sp and system peration of c oral Researc	ance. Finall ance. Finall d decision a track solar e lutter codes a ace. Conduc s, both groun communication ch Program (	ids to speci ruptions, w and missile cted atmosp nd-based ar ons, surveil HAARP) f	ify the impact ses technologi which disrupt of and aircraft to pheric turbule and space-base llance, naviga acility in Ala	technologie es that allow t of space rad communicat target identif ence measure d, to measure tion, and otl ska and initi	diation on the ions and cau ication code ements and p e, specify, a ner space sys- ated develop	e design and unity to mitig e design and use satellite a es to improve performance and predict th stems. Incre- pment of tech	the environr gate or explo l operation of anomalies an e the detection analysis require effects of it eased the cap hniques for it	f DoD space it the aerosp d tracking e on of theater uired by ope onospheric ability of the maging unde	e systems. rrors. ballistic erational e High- erground
(U) <u>FY 1999 (\$ in T</u>	<u>`housands)</u> :										
– (U) \$4,099	Complete and validate and transition to Air F	e hardware, Force Space	software, an Command a	d decision and other us	aids, includin sers for impro	g the Improvoved specific	ved Solar Op ation of space	otical Observ ce environm	vation Netwo	ork (ISOON) s.	) system,
- (U) \$4,939 - (U) \$5,557	Develop techniques for including hyperspectr dust and to optimize t Develop systems such	or detecting al sensors. he performa as the space	and tracking Develop inst nce of opera e-based Com	tow-signation truments and tional laser tional laser	ture ballistic ad techniques weapon syst ns/Navigation	and cruise m to detect the ems. Outage For	issiles and c eater ballistic ecasting Sys	optimizing n c missiles th tem (C/NOF	ew surveillar rough clouds FS), sensors.	nce sensor d s, haze, smol and decision	esign, ke, and n aids to
Project 1010	measure, specify, and	predict the e	effects of ion	ospheric di Page 3 o	sturbances or f 18 Pages	n the operation	on of DoD s	pace system: Exhibi	s. t R-2A (PE	0602601F)	
				13	3						

RDT	<b>&amp;E BUDGET ITEM JUSTIFICATIO</b>	N SHEET (R-2A Ex	hibit)	<sup>™</sup> February 1999
BUDGET ACTIVITY 2 - Applied Resear	ch	PE NUMBER AND TITLE 0602601F Phillips Development	Laboratory Explorator	PROJECT Ty 1010
- (U) \$8,791	Expand the infrastructure at the High Frequency A control center and installation of radio and optical underground structures.	ctive Auroral Research Progr diagnostic instruments. Use	am's (HAARP) Alaska facility the HAARP facility to assess n	through construction of a ew concepts for imaging
- (U) \$499	Identified as a source for SBIR.			
- (U) \$23,885	Total			
(U) <u>FY 2000 (\$ in T</u>	nousands):			
– (U) \$2,960	Develop techniques and systems to monitor and pro- analysis and initial design of a space experiment to	edict environmental condition demonstrate control of radiat	s hazardous to DoD operationation belt particle levels.	space systems. Complete
- (U) \$2,515	Design real-time predictive background clutter cod systems. Validate atmospheric turbulence effects of earliest boost phase to enhance counterforce operat	e and develop data-based mod on operational laser systems and ions and force protection	lels to support design and opera ad conduct experiment to detec	tion of global surveillance t theater ballistic missiles at
- (U) \$2.645	Fabricate and test instrumentation for the Commun	nications/Navigation Outage F	orecasting System (C/NOFS).	
- (U) \$8,120	Total	<u>.</u>		
(U) FY 2001 (\$ in T!	nousands):			
- (U) \$3,672	Develop systems to predict space environmental hardisruptions of operational space systems.	azards, including solar disturb	ances and the earth's radiation	belts, and the resultant
- (U) \$2,772	Develop real-time infrared background clutter code weapons, and countermeasures systems, including earliest boost-phase detection of theater ballistic m	e, target detection techniques, detection of low-observable ta issiles.	and decision aids for application argets. Confirm utility of hyper	n to space surveillance, laser spectral imaging sensors for
– (U) \$2,689	Develop artificial intelligence techniques, forecasti including communications/navigation outage forec	ng tools, and sensors for impr asting and space-based radar	oved ionospheric specification demonstrations.	and forecasting support,
- (U) \$9,133	Total			
Drainat 1010	D.		Evhibit D (	

RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exp Development	PROJECT Ioratory 1010
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Chang the Science and Technology (S&T) Program.	ges to this PE since the previous President's Budg	et are due to higher priorities within
(U) C. <u>Other Program Funding Summary</u> :		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0305160F, Defense Meteorological Satellite Program.</li> <li>(U) PE 0601102F, Defense Research Sciences.</li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0603410F, Space Systems Environmental Interactions Technolo</li> <li>(U) PE 0305111F, Weather Systems</li> <li>(U) PE 0603707F, Weather Systems Advanced Development.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul>	gy. armonize efforts and eliminate duplication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 1010 Page	e 5 of 18 Pages Ex	hibit R-2A (PE 0602601F)
	135	

RDT&	E BUDGET ITE	EM JUS	<b>FIFICAT</b>	ION SH	IEET (R-	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 2 - Applied Research	TIVITY       PE NUMBER AND TITLE         ied Research       0602601F Phillips Laboratory Explorat         Development       Development				atory	tory 1011					
COST (\$ In	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
1011 Rocket Propulsion Techno	ology	28,199	34,824	31,835	20,817	24,820	36,105	41,916	40,541	Continuing	Continuin
of interest are those which wi sub-systems while reducing m improved designs, and impro initiative; a joint Department needs. (U) <u>FY 1998 (\$ in Tho</u> - (U) \$3,442 - (U) \$13,790 - (U) \$3,601 - (U) \$3,601 - (U) \$6,000 - (U) \$1,366 - (U) \$1,366 - (U) \$28,199 (U) <u>FY 1999 (\$ in Tho</u> - (U) \$3,756 - (U) \$2,928 - (U) \$3,629 - (U) \$13,509	ill improve reliability, o material, manufacturing wed manufacturing tech of Defense, National A <u>busands</u> ): Developed propellants Developed advanced I Initiated technologies Developed solar electr communication satelli Total <u>busands</u> ): Develop propellants w chemical propellant fo Develop advanced con Develop advanced ma Develop propulsion con	perability, s , and suppor miques. All veronautics a s with a high component boost and orl for long-tern ric and solar ites and satel with a high-en- prmulation a mbustion tec terial technology	urvivability t costs. Tec efforts in th and Space A -energy den technology bit transfer j n sustainme thermal pro lite constell hergy densit nd perform hnology for ligg chnology for	, affordabili chnology wi is project and dministratic sity for increan for reliable, propellants or strategore pulsion technologies ations. y for increan propellant to improved point htweight coor r reliable, sa r laupched to	ty, environm ty, environm ll be develop re part of the on (NASA), a eased payloa safe, and low which are en- tic systems w hnologies for sed payload of esting. This erformance a mponents an fe, and low-o	ental compa ed to reduce Integrated F and industry d capability w-cost boost vironmentall which also ap r stationkeep capability an propellant w and reliabilit d material p cost boost an	tibility, and the weight ligh Payoff effort to foc and lower c and orbit tra by safe durin ply to the da ing, repositi d lower cos vill be used i y of engines roperty enha	performance and cost of c Rocket Prop cus rocket pr cost space lau ansfer system g manufactu evelopment of ioning, and c t space launce in heavylift v used in heav ancement.	e of future sp components u ulsion Techr opulsion tech inch systems ns. ure, storage, u of the next g orbit transfer ch systems. I vehicles. vylift vehicle Develop so	pace and mis using new m hology (IHP) hnology on n wee, and disp eneration bo appropriate Develop adv es. lid and hybr	sile launch naterials, RPT) national possal. poster. for large vanced
– (U) \$7,000	Develop technologies	tor long-terr	n sustainme	ent of strateg	gic systems w	hich also ap	ply to the de	evelopment (	of the next g	eneration bo	oster.

BUDGET ACTIVITY         PEQUE           2 - Applied Research         Mo20501F Phillips Laboratory Exploratory         1011           - (U) \$3,278         Develop solar electric and solar thermal propulsion technologies for stationkeeping, repositioning, and orbit transfer appropriate for larg communication satellites and satellite constellations.         1011           - (U) \$32,278         Develop solar electric and solar thermal propulsion technologies for stationkeeping, repositioning, and orbit transfer appropriate for larg communication satellites and satellite constellations.         1011           - (U) \$32,42         Heurlifed as a source for SBIR.         - (U) \$34,824         Total           (U) FY 2000 (5 in Thousands):         - (U \$4,269         Develop propulation component technology for reliable, safe, and low-cost boost and orbit transfer systems. Develop advanced chemical propellant formulation and perform propellant testing.         - (U) \$4,114         Develop advanced material technology for reliable, safe, and low-cost boost and orbit transfer systems.         - (U) \$4,114         Develop advanced insulation and case materials for high combustion temperature propellants, plus complete analytical tools for prediction of propellant file.         - (U) \$3,200         Develop propellant file.         - (U) \$3,335         Total           (U) \$11,347         Develop propellant file.         - (U) \$3,355         Total         - (U) \$3,325         Develop repellant file.         - (U) \$3,325         Develop propellant file.         - (U) \$3,325         Develop propo	RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE February 1999
<ul> <li>(U) \$3,278 Develop solar electric and solar thermal propulsion technologies for stationkeeping, repositioning, and orbit transfer appropriate for larg communication satellites and satellite constellations.</li> <li>(U) \$724 If dentified as a source for SBIR.</li> <li>(U) \$724 Total</li> <li>(U) \$272000 (S in Thousands):         <ul> <li>(U) \$12,000 (S in Thousands):</li> <li>(U) \$14,347 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems. Develop advanced chemical propellant formulation and perform propellant testing.</li> <li>(U) \$14,347 Develop propulsion component technology for improved performance and reliability of liquid engines used in heavylift vehicles.</li> <li>(U) \$2,000 Complete development of insulation and case materials for high combustion temperature propellants, plus complete analytical tools for prediction of propellant life.</li> <li>(U) \$3,845 Develop structure d in stall thermal propulsion technologies for stationkeeping, repositioning, and orbit transfer appropriate for large communication satellites and satellite constellations.</li> <li>(U) \$3,845 Develop solar electric and solar thermal propulsion technologies for stationkeeping, repositioning, and orbit transfer appropriate for large communication satellites and satellite constellations.</li> <li>(U) \$3,845 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>(U) \$3,183 Total</li> </ul> </li> <li>(U) \$3,183 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>(U) \$1,093 Continue to develop advanced combustion technology for reliable, safe, and low-cost boost and orbit transfer systems.</li> <li>(U) \$1,093 Continue to develop advanced combustion technology for improved performanc</li></ul>	BUDGET ACTIVITY 2 - Applied Resear	ch	PE NUMBER AND TITLE 0602601F Phillips Laboratory Expl Development	oratory 1011
<ul> <li>(U) <u>FY 2000 (\$ in Thousands):</u> <ul> <li>(U) <u>54,269</u> Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems. Develop advanced chemical propellant formulation and perform propellant testing.</li> <li>(U) <u>514,347</u> Develop propulsion component technology for reliable, safe, and low-cost boost and orbit transfer systems.</li> <li>(U) <u>53,260</u> Develop advanced material technology for lightweight components and material property enhancement.</li> <li>(U) <u>52,000</u> Complete development of insulation and case materials for high combustion temperature propellants, plus complete analytical tools for prediction of propellant life.</li> <li>(U) <u>53,845</u> Develop solar electric and solar thermal propulsion technologies for stationkceping, repositioning, and orbit transfer appropriate for large communication satellites and satellite constellations.</li> <li>(U) <u>51,000</u> Continue to develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>(U) <u>51,001</u> Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>(U) <u>51,001</u> Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>(U) <u>51,001</u> Develop propellants with a high-energy density for improved performance and reliability.</li> <li>(U) <u>51,001</u> Develop propellants with a high-energy density for improved performance and reliability.</li> <li>(U) <u>51,093</u> Continue to develop advanced combustion technology for improved performance and reliability.</li> <li>(U) <u>51,091</u> Develop advanced ablative components using hybrid polymers for use in current and future launch systems.</li> <li>(U) <u>520,817</u> Total</li> </ul> </li> </ul>	- (U) \$3,278 - (U) \$724 - (U) \$34,824	Develop solar electric and solar thermal propulsion communication satellites and satellite constellations Identified as a source for SBIR. Total	technologies for stationkeeping, repositioning, and s.	orbit transfer appropriate for large
<ul> <li>- (U \$4,29 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems. Develop advanced chemical propellant formulation and perform propellant testing.</li> <li>- (U) \$14,347 Develop propulsion component technology for reliable, safe, and low-cost boost and orbit transfer systems.</li> <li>- (U) \$4,114 Develop advanced material technology for lightweight components and material property enhancement.</li> <li>- (U) \$4,000 Complete development of insulation and case materials for high combustion temperature propellants, plus complete analytical tools for prediction of propellant life.</li> <li>- (U) \$3,845 Develop solar electric and solar thermal propulsion technologies for stationkeeping, repositioning, and orbit transfer appropriate for large communication satellites and satellite constellations.</li> <li>- (U) \$31,835 Total</li> <li>- (U) \$1,997 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>- (U) \$1,091 (§ in Thousands):</li> <li>- (U) \$1,093 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>- (U) \$1,091 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>- (U) \$1,091 Develop propellants with a high-energy density for increased payload capability and lower cost space launch systems.</li> <li>- (U) \$1,091 Develop advanced combustion technology for improved performance and reliability.</li> <li>- (U) \$1,093 Develop advanced combustion technology for improved performance and reliability.</li> <li>- (U) \$1,097 Develop advanced ablative components using hybrid polymers for use in current and future launch systems.</li> <li>- (U) \$20,817 Total</li> </ul>	(U) FY 2000 (\$ in T	housands):		
<ul> <li>(U) \$14,001 Develop propulsion component technology for reliable, safe, and low-cost boost and orbit transfer systems.</li> <li>(U) \$1,093 Continue to develop advanced combustion technology for improved performance and reliability.</li> <li>(U) \$1,797 Develop advanced ablative components using hybrid polymers for use in current and future launch systems.</li> <li>(U) \$20,817 Total</li> </ul>	- (U  \$4,269  - (U) \$14,347  - (U) \$3,260  - (U) \$4,114  - (U) \$2,000  - (U) \$3,845  - (U) \$31,835  (U) FY 2001 (\$ in T  - (U) \$3 926	Develop propellants with a high-energy density for in chemical propellant formulation and perform propell Develop propulsion component technology for reliabl Develop advanced combustion technology for lightweigh Complete development of insulation and case materia prediction of propellant life. Develop solar electric and solar thermal propulsion to communication satellites and satellite constellations. Total <u>housands</u> ): Develop propellants with a high-energy density for in	ncreased payload capability and lower cost space lat lant testing. le, safe, and low-cost boost and orbit transfer syster ved performance and reliability of liquid engines us ht components and material property enhancement. als for high combustion temperature propellants, pl echnologies for stationkeeping, repositioning, and o	anch systems. Develop advanced ns. ed in heavylift vehicles. us complete analytical tools for orbit transfer appropriate for large
Project 1011 Page 7 of 18 Pages Exhibit R-2A (PE 0602601E)	- (U) \$14,001 - (U) \$1,093 - (U) \$1,797 - (U) \$20,817	Develop propulsion component technology for reliabl Continue to develop advanced combustion technology Develop advanced ablative components using hybrid Total	le, safe, and low-cost boost and orbit transfer system y for improved performance and reliability. polymers for use in current and future launch syste	ns.
	Project 1011	Pag	e 7 of 18 Pages Ex	hibit R-2A (PE 0602601F)

RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Exp Development	PROJECT Iloratory 1011
(U) B. Project Change Summary - Description of Significant Changes: Not .	Applicable.	
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology.</li> <li>(U) PE 0602303A, Missile Technology.</li> <li>(U) PE 0603302F, Space and Missile Launch Technology.</li> <li>(U) PE 0603311F, Ballistic Missile Technology.</li> <li>(U) PE 0603401F, Advanced Spacecraft Technology.</li> <li>(U) This project has been coordinated through the Reliance process to F</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	armonize efforts and eliminate duplication.	
Project 1011 Page	e 8 of 18 Pages Ex	xhibit R-2A (PE 0602601F)
	138	

	RD	T&E BUDGET IT	EM JUS	M JUSTIFICATION SHEET (R-2A Exhibit)								999
BUDGET ACTIVITY 2 - Applied Research						NUMBER AND 02601F Evelopme	™LE Phillips L nt	aborator	y Explora	PROJECT <b>3326</b>		
	COST	(\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3326 Lasers and	Fechnology	16,873	18,662	17,19	3 17,211	16,177	19,161	19,600	19,561	Continuing	Continuing	
components, an application as il utility in aimpo semiconductor of assessments, an $(U) \frac{FY 19}{- (U)}$ $- (U)$ $+ (U)$ $+ (U)$ $+ (U)$	d long-ra luminato int selecti diode lase d nonline <u>98 (\$ in 7</u> \$898 \$1,666 \$1,485 \$4,600 \$1,610 \$3,801 \$2,813 516,873	nge optical imaging conce rs and imaging sources as ion, target maintenance, an er arrays, optical compone ear optics processes and teo <u>Thousands</u> ): Developed generic, high Developed long-range of object identification. Investigated and develop collection and processing and intelligence preparat Developed laser source a against infrared imaging Investigated and develop Developed high power s and infrared (IR) missile disrupt/jam countermeas Developed coherent lase Total	pts required well as adva ad damage as nts, advanced chniques are energy laser ptical imagir bed advanced g algorithms tion of the ba and targeted g seekers. bed nonlineas emiconducto g jamming, c jures against r diode array	for Air Forc nced optical ssessment. A d beam contri developed. technologie ag and non-in l laser radar for laser radar for laser radar tor laser radar attlefield. coupling tec r optics (NL4 r lasers/array hemical ager near-term the	e missions imagers fo Additionall rol and atm es for applie maging tec for space s lar (LADA hnology fo O) technolo ys at altern nt detection rreats. red perform	Technologi or target ident y, high powe ospheric com cations such a nnologies for urveillance an R) remote sen r next genera ogies to suppo ate waveleng a, illuminator	es researched ification and r laser device opensation te as illuminato increased re ad remote se asing of atmo- tion high-pay ort imaging a ths for applic s, efficient se power in app	d include ad l assessment es, mid-infra chnologies, rs and use in solution and nsing using ospheric pro yoff applicat and other applicat entions such emiconducto	vanced, shor Laser tech ared semicor techniques f h wavelength data fusion transceiver s perties, cher ions such as plications. as forward l or laser array quiring high	t-wavelengtl nologies wil iductor laser for laser targe n-specific mi to support n systems, and nical agents, damage/des ooking infra pumping m power levels	h laser devic l be studied devices, et vulnerabil litary missio nissions such advanced da and target e troy counter: red (FLIR) s odules, and s.	es for for their ity ons. n as space ata effluents, measures ystems
Project 3326					Page 9 o	f 18 Pages			Exhibi	t R-2A (PE	0602601F)	

RD	<b>T&amp;E BUDGET ITEM JUSTIFICATION</b>	ibit)	DATE February 1999	
BUDGET ACTIVITY 2 - Applied Resea	arch	PE NUMBER AND TITLE 0602601F Phillips L Development	aboratory Explora	PROJECT <b>3326</b>
(II) EV 1000 (\$;n	Theusanda)			
$(0) \frac{1}{1} \frac{1}{1999} \frac{3}{3} \frac{1}{10} \frac{1}{1} \frac{1}$	<u>Develop generic</u> high energy laser technologies for ann	lications such as illuminators	and use in wavelength-sn	ecific military missions
- (U) \$3,606	Develop long-range optical technologies for increased re- identification and ground target identification from space	esolution, characterization, and	d data fusion to support n	issions such as space object
– (U) \$1,486	Investigate and develop advanced laser transceiver syster ranging (LIDAR) remote sensing of atmospheric proper battlefield.	ems, and advanced data collect rties, chemical agents, and tar	tion and processing algor get effluents, and intellige	ithms for light detection and nce preparation of the
– (U) \$2,854	Develop laser source and target coupling technology for against infrared imaging seekers.	r next-generation high-payoff	applications such as dama	ge/destroy countermeasures
– (U) \$588	Investigate and develop nonlinear optics (NLO) technol	ogies to support imaging and	beam projection technolo	gies.
– (U) \$4,558	Develop high power semiconductor lasers/arrays at alter infrared (IR) missile jamming, chemical agent detection countermeasures against near-term threats.	rnate wavelengths for applicat n, illuminators, efficient semic	ions such as forward look conductor laser array pum	ing infrared (FLIR) systems and ping modules, and disrupt/jam
– (U) \$4,150	Develop spatially coherent lasers for tactical/unmanned which require higher power sources.	air vehicle and space applica	tions such as designation/	illumination and remote sensing
– (U) \$395	Identified as a source for SBIR.			
– (U) \$18,662	Total			
(II) <b>FY 2000 (\$ in</b>	Thousands)			
- (U) \$1,892	Develop long-range optical technologies (e.g., speckle h such as space object identification and status.	nolography) for increased reso	lution, characterization, a	nd data fusion for applications
– (U) \$645	Continue development of NLO technologies to support and modification for decreased complexity.	imaging and beam projection	applications. NLO allow	s non-mechanical beam clean-up
– (U) \$3,514	Develop high power chemical gas/solid state laser techn specific applications such as infrared countermeasures.	nologies for applications such	as directed energy weapo	ns, illuminators, and wavelength
– (U) \$1,806	Develop laser source beam control and target coupling t countermeasures against surface-to-air missiles (SAM)	echnology for next generation and air-to-air missiles (AAM	high payoff applications threats.	such as damage/destroy
– (U) \$2,614	Develop high power semiconductor lasers at alternate (e systems and IR missile warning/sensor jamming, chemi	e.g., longer) wavelengths for a fixed agent detection, and illum	pplications such as forwa inators.	rd looking infrared (FLIR)
– (U) \$6,722	Develop higher power, more efficient monolithic, solid as jamming near-term infrared guided missile threats.	state/semiconductor lasers for	tactical/unmanned air ve	hicle and space applications such
Project 3326	Page	10 of 18 Pages	Exhibit	R-2A (PE 0602601F)
		140		

R	DT&E BUDGET ITEM JUSTIFICATION	I SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Res	earch	PE NUMBER AND TITLE 0602601F Phillips Laboratory Explora Development	PROJECT 3326
- (U) \$17,193	Total		
$\begin{array}{c} (U) \ \underline{FY} \ \underline{2001} \ (\$) \\ - \ (U) \ \$1,925 \\ - \ (U) \ \$645 \\ - \ (U) \ \$3,655 \\ - \ (U) \ \$1,893 \\ - \ (U) \ \$1,893 \\ - \ (U) \ \$2,286 \\ - \ (U) \ \$6,807 \\ - \ (U) \ \$17,211 \end{array}$	in Thousands): Continue development of long-range imaging and non-imidentifying satellites. Continue development and begin large-scale field test of applications associated with large aperture lightweight op Develop high power chemical gas/solid-state laser technol specific applications such as infrared countermeasures. Develop laser source beam control and target coupling teal countermeasures against surface-to-air missiles (SAM) and Develop high power semiconductor lasers at alternate (e.g and infrared (IR) missile warning/sensor jamming, chemical power of the power, more efficient monolithic, solid states jamming near-term infrared guided missile threats. Total	haging optical technologies for increased resolution, ch nonlinear optics (NLO) technologies to support beam potics. logies for applications such as directed energy weapor chnology for next generation high payoff applications and air-to-air missiles (AAM) threats. g., higher) wavelengths for applications such as forwar ical agent detection, and illuminators. tate/semiconductor lasers for tactical/unmanned air veh	haracterization, and data fusion for projection and imaging hs, illuminators, and wavelength such as damage/destroy d looking infrared (FLIR) systems hicle and space applications such
<ul> <li>(U) C. <u>Other Progra</u></li> <li>(U) <u>Related A</u></li> <li>(U) PE 060</li> <li>(U) This pr</li> </ul> (U) D. <u>Acquisition S</u>	Activities: 2101N, Directed Energy Weapons. 2307A, Laser Weapon Technology. 3314A, High Energy Laser and Directed Energy Componen 3319F, Airborne Laser Demonstrator. 3605F, Advanced Weapons Technology. oject has been coordinated through the Reliance process to h trategy: Not Applicable.	ts. narmonize efforts and eliminate duplication.	
Project 3326	Page	E 11 of 18 Pages Exhibit	t R-2A (PE 0602601F)
		141	

		DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Laboratory Explora Development	itory
(U) E. <u>Schedule Profile</u> : Not Applicable.		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999	
BUDGET ACTIVITY       PE NUMBER AND TITLE         2 - Applied Research       0602601F Phillips Laboratory         Development							y Explora	atory	F	PROJECT 5797
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
5797 Advanced Weapons and Survivability Technology	13,602	14,239	16,18	16,752	17,304	17,723	17,375	17,870	Continuing	Continuing

(U) A. <u>Mission Statement</u>: High power microwave (HPM) and other unconventional weapon concepts using innovative technologies are explored in this project. Technologies that support a wide range of Air Force missions such as suppression of enemy air defenses, command and control warfare, and vehicle self-protection are developed. This project provides for vulnerability assessments of representative U.S. strategic and tactical systems to directed energy weapons, directed energy weapon technology assessment for specific Air Force missions, and directed energy weapon lethality assessments against foreign targets. In addition to directed energy weapon threats, this project conducts assessments of specific space environmental (natural and man-made) effects on space systems and develops hardening technologies and methodologies.

#### (U) FY 1998 (\$ in Thousands):

- (U) \$4,723 Developed generic advanced weapon technologies that support multiple Air Force applications such as command and control warfare and suppression of enemy air defenses.
- (U) \$1,884 Assessed effects/lethality of directed energy weapon technologies against representative air and ground military systems.
- (U) \$978 Developed HPM technologies that will support applications such as command and control warfare.
- (U) \$2,217 Developed HPM technologies that will support applications such as suppression of enemy air defenses and aircraft self-protection.
- (U) \$1,909 Developed HPM technologies, including susceptibility and effects experiments and modeling and database development, to support space control applications.
- (U) \$1,891 Assessed the vulnerability of various space assets to threats such as solar radiation and directed energy weapons.
- (U) \$13,602 Total

Project 5797

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Exhibit R-2A (PE 0602601F)

RDT	<b>[&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE Febru	Jary 1999
BUDGET ACTIVITY 2 - Applied Resea	rch	PE NUMBER AND TITLE 0602601F Phillips Labora Development	atory Exploratory	PROJECT <b>5797</b>
(U) <u>FY 1999 (\$ in 7</u>	Thousands):			
$\begin{array}{c} - (U)  \$5,799 \\ - (U)  \$3,439 \\ - (U)  \$1,397 \\ - (U)  \$1,583 \\ - (U)  \$1,723 \\ - (U)  \$298 \\ (U)  \$100000000000000000000000000000000000$	<ul> <li>Developed generic advanced weapon technologies the suppression of enemy air defenses.</li> <li>Assess effects/lethality of directed energy weapon technologies high power microwave (HPM) technologies</li> <li>Develop HPM technologies that will support applicate Assess the vulnerability of various space assets to the Identified as a source for SBIR.</li> </ul>	at support multiple Air Force applica chnologies against representative air a that will support applications such as ions such as suppression of enemy air reats such as solar radiation, space det	tions such as command and contro nd ground military systems. command and control warfare. defenses. pris, and directed energy weapons	) warfare and
- (U) \$14,239	Total			
$\begin{array}{c} (U) & \$1,498 \\ - & (U) & \$1,977 \\ - & (U) & \$1,787 \\ - & (U) & \$2,646 \\ - & (U) & \$5,727 \\ - & (U) & \$5,727 \\ - & (U) & \$571 \\ - & (U) & \$1,977 \\ - & (U) & \$16,183 \end{array}$	Investigate technologies for developing innovative H warfare and suppression of enemy air defenses. Assess effects/lethality of directed energy weapon te Develop HPM technologies that will support applica Investigate HPM technologies best suited to support Investigate HPM technologies best suited to support power available on future aircraft. Investigate best means for Active Denial Technology Assess the vulnerability of various space assets to ra Total	IPM sources to support multiple Air F echnologies against representative air ations such as command and control w applications such as suppression of er offensive and defensive advanced tac y to support Agile Combat Support ag diation threats such as solar radiation	Force applications such as comma and ground military systems. varfare. nemy air defenses. tical applications made possible b oplications. and directed energy weapons.	nd and control ased on increased
Project 5797	Page	e 13 of 18 Pages	Exhibit R-2A (PE 060	)2601F)
		144		

RDT&	<b>&amp; E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Researc	h	PE NUMBER AND TITLE 0602601F Phillips Laboratory Explo Development	ratory 5797
<ul> <li>(U) <u>FY 2001 (\$ in The</u> - (U) \$1,574</li> <li>(U) \$1,868</li> <li>(U) \$1,957</li> <li>(U) \$2,899</li> <li>(U) \$6,498</li> <li>(U) \$1,956</li> <li>(U) \$16,752</li> </ul> (U) B. <u>Project Change Su</u> <ul> <li>(U) C. <u>Other Program Fu</u></li> <li>(U) <u>Related Activities</u></li> <li>(U) <u>PE 06021204</u></li> <li>(U) PE 0602111N</li> <li>(U) PE 0602202F</li> <li>(U) PE 0602605F</li> <li>(U) This project 1</li> </ul> (U) D. <u>Acquisition Strate</u> <ul> <li>(U) E. <u>Schedule Profile</u>: The strate of the strate of</li></ul>	Dusands): Investigate technologies for developing innovative hi command and control warfare and suppression of end Assess effects/lethality of directed energy weapon tech Develop HPM technologies that will support applicat Investigate HPM technologies best suited to support a power available on future aircraft. Assess the vulnerability of various space assets to rac Total <b>mmary - Description of Significant Changes:</b> Not A <b>unding Summary:</b> A, Electronic Survivability and Fuzing Technology. J, Anti-Air/Anti-Surface Warfare Technology. J, Advanced Weapons Technology. as been coordinated through the Reliance process to h <b>gy:</b> Not Applicable. Not Applicable.	gh power microwave (HPM) sources to support mul emy air defenses. chnologies against representative air and ground mil- tions such as command and control warfare. applications such as suppression of enemy air defens offensive and defensive advanced tactical application diation threats such as solar radiation and directed er applicable.	tiple Air Force applications such as tary systems. es. as made possible based on increased ergy weapons.
Project 5797	Page	<u>14 of 18 Pages</u> Exhi	bit R-2A (PE 0602601F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							DATE Fe	DATE February 1999			
BUDGET ACTIVITY       PE NUMBER AND TITLE         2 - Applied Research       0602601F Phillips Laboratory Exploratory         Development								F	PROJECT 8809		
COST (\$ /	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
8809 Space and Missile Tech	nology	34,478	33,975	41,982	46,898	49,848	50,228	50,229	54,674	Continuing	Continuing
body       Starto       Starto									hermal odeling and cosatellite ciency hal ector levices, re-based egrated		
Project 8809				Page 15 of	f 18 Pages			Exhibi	t R-2A (PE	0602601F)	)

RDT8	<b>E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A EXHIBIT)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Researd	ch	PE NUMBER AND TITLE 0602601F Phillips Laboratory Explora Development	PROJECT 8809
(U) <u>FY 1999 (\$ in T</u>	housands):	-	
- (U) \$4,669	Develop technologies for space platform subsystems power cells, lightweight batteries, and innovative po	such as cryocoolers, space vehicle thermal management wer generation and storage concepts.	nt, compact, high efficiency solar
– (U) \$4,589	bevelop technologies for space platform structures s structures, and lightweight composite satellite and la	such as spacecraft structural controls for vibration supp aunch vehicle structures.	ression, multifunctional
– (U) \$1,889	Develop technologies for space-based payload subsy and antenna architectures for Space-based Radar.	stems such as advanced infrared sensors, advanced har	dened focal plane detector arrays,
– (U) \$3,661	Develop technologies for space-based payload comp micro-electo-mechanical systems (MEMS) devices,	onents such as low power, high performance, radiation and advanced electronics packaging.	hardened electronic devices,
– (U) \$1,831	Develop technologies for satellite control, autonomo systems.	bus satellite operations, and modeling and simulation fo	r space-based surveillance
- (U) \$1,402	Develop satellite protection technologies such as spa	ace environmental effects mitigation and space debris p	rediction.
- (U) \$9,548	Develop ground and small satellite integration techn	ologies for space and near-space experiments.	
- (U) \$1,763	Develop microsatellite technologies and integrated n and collaborative microsatellite constellations.	nicrosatellite technology concepts for applications such	as near-earth object inspection
– (U) \$3,907	Conduct Phase III of the Terabit fiber optic technolo	gy program.	
– (U) \$716	Identified as a source for SBIR.		
- (U) \$33,975	Total		
(U) <u>FY 2000 (\$ in T</u>	housands):		
– (U) \$5,581	Develop technologies for space platform subsystems power cells, lightweight batteries, and innovative po	such as cryocoolers, space vehicle thermal managemer wer generation and storage concepts.	t, compact, high efficiency solar
– (U) \$5,787	Develop technologies for space platform structures s structures, and lightweight composite satellite and la	uch as spacecraft structural controls for vibration suppr sunch vehicle structures.	ession, multifunctional
- (U) \$2,395	Develop technologies for space-based payload subsy and antenna architectures for Space-Based Radar.	stems such as advanced infrared sensors, advanced hard	lened focal plane detector arrays,
– (U) \$1,904	Develop hyperspectral imaging data exploitation met	thodologies for military remote sensing applications.	
- (U) \$4,426	Develop technologies for space-based payload compo MEMS devices, and advanced electronics packaging	onents such as low power, high performance, radiation	hardened electronic devices,
Project 8809	Page	16 of 18 Pages Exhibit	R-2A (PE 0602601F)

RDT8	<b>E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A EXHIB	IT)	February 1999
BUDGET ACTIVITY 2 - Applied Resear	ch	PE NUMBER AND TITLE 0602601F Phillips Lab Development	oratory Exploratory	PROJECT 8809
- (U) \$1,831 - (U) \$3,275 - (U) \$12,961 - (U) \$3,822 - (U) \$41,982	Develop technologies for satellite control, autonomor systems. Develop satellite protection technologies such as spa Develop ground and small satellite integration techno Develop microsatellite technologies and integrated m and collaborative microsatellite constellations. Total	us satellite operations, and model ace debris prediction and threat was ologies for space and near-space on nicrosatellite technology concepts	ing and simulation for space arning/attack reporting. experiments. for applications such as nea	e-based surveillance ar-earth object inspection
$\begin{array}{l} \text{(U)} \ \underline{\text{FY 2001 (\$ in TH}} \\ - \ (\text{U}) \ \$5,919 \\ \\ - \ (\text{U}) \ \$5,562 \\ \\ - \ (\text{U}) \ \$3,434 \\ \\ - \ (\text{U}) \ \$1,938 \\ - \ (\text{U}) \ \$1,938 \\ - \ (\text{U}) \ \$5,815 \\ \\ - \ (\text{U}) \ \$1,713 \\ \\ - \ (\text{U}) \ \$1,713 \\ \\ - \ (\text{U}) \ \$1,218 \\ - \ (\text{U}) \ \$9,968 \\ \\ - \ (\text{U}) \ \$46,898 \end{array}$	<ul> <li><u>nousands</u>):</li> <li>Develop technologies for space platform subsystems power cells, lightweight batteries, and innovative power cells, lightweight batteries, and innovative power cells, lightweight composite satellite and late the composite structures, and lightweight composite satellite and late the composite technologies for space-based payload subsystem and antenna architectures for Space-Based Radar. Develop hyperspectral imaging data exploitation met Develop technologies for space-based payload composite micro-electo-mechanical systems (MEMS) devices, at Develop technologies for satellite control, autonomous systems.</li> <li>Develop satellite protection technologies such as three Develop microsatellite technologies and integrated mand collaborative microsatellite constellations. Total</li> </ul>	such as cryocoolers, space vehicl wer generation and storage conce- uch as spacecraft structural contro- unch vehicle structures. stems such as advanced infrared s thodologies for military remote se onents such as low power, high pe and advanced electronics packagin us satellite operations, and model eat warning/attack reporting. ologies for space and near-space of hicrosatellite technology concepts	e thermal management, com pts. ols for vibration suppression sensors, advanced hardened ensing applications. erformance, radiation harden ng. ing and simulation for space experiments.	npact, high efficiency solar n, multifunctional focal plane detector arrays, ned electronic devices, e-based surveillance ar-earth object inspection
Project 8809	Page	<u>17 of 18 Pages</u> 148	Exhibit R-2A	A (PE 0602601F)

RDT&E BUDGET ITEM JU	BIT) DATE February	1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602601F Phillips Lal Development	poratory Exploratory	PROJECT 8809
(U) B. <u>Project Change Summary - Description of Signif</u>	<b>ïcant Changes:</b> Not Applicable.		
(U) C. <u>Other Program Funding Summary</u> :			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> </ul>			
<ul> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0603302F, Space and Missile Rocket Pro</li> </ul>	pulsion.		
<ul> <li>(U) PE 0603311F, Ballistic Missile Technology.</li> <li>(U) PE 0603401F, Advanced Spacecraft Technol</li> </ul>	ogy.		
<ul> <li>(U) PE 0603410F, Space Systems Environmenta</li> <li>(U) This project has been coordinated through the</li> </ul>	l Interactions. e Reliance process to harmonize efforts and eliminate c	luplication.	
(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 8809	Page 18 of 18 Pages	Exhibit R-2A (PE 060260	1F)

PE TITLE: Conventional Munitions

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							February 1999			
BUDGET ACTIVITY       PE NUMBER AND TITLE         2 - Applied Research       0602602F Conventional Munitions										
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	36,687	40,386	42,20	5 46,840	47,804	50,030	51,662	53,247	Continuing	Continuing
2068 Advanced Guidance Technology	15,173	16,465	14,40	3 18,089	18,718	20,245	20,562	19,314	Continuing	Continuing
2502 Ordnance Technology	21,514	23,921	27,80	2 28,751	29,086	29,785	31,100	33,933	Continuing	Continuing
Quantity of RDT&E Articles	0	0		0 0	0	0	0	0	0	C

(U) A. <u>Mission Description</u>: This Applied Research program investigates, develops and establishes the technical feasibility and military utility of advanced guidance and ordnance technologies for conventional munitions. The program includes development of: (1) advanced guidance technologies, including seekers, navigation and control, signal and image processing/algorithms, and simulation assessments for low-cost precision adverse-weather autonomous seekers; and (2) conventional ordnance technologies, including warheads, fuzes, explosives, munition integration, and lethality and vulnerability assessments. Payoff from this program is increased warhead penetration effectiveness, enhanced blast and fragmentation weapons, precision fuze control for increased probability of target kill, and precision terminal guidance for improved weapon effectiveness, and the capability to increase weapon standoff range while operating in adverse weather conditions.

(U) B. <u>Budget Activity Justification</u>: This Program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

Page 1 of 8 Pages

RDT&E BUDGET ITEM JUS	DATE February 1999				
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE		
2 - Applied Research		0602602F	Convention	nal Munitions	
		·			
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					
					Total
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost
(U) Previous President's Budget/FY 1999 PB	38,505	41,529	42,826	45,556	Cont
(U) Appropriated Value	40,772	41,529			
(U) Adjustments to Appropriated Value					
a. Congressional/General Reductions	-1,780	-1,143			
b. SBIR	-517				
c. Omnibus/Other Above Threshold Reprogrammings	-1,356				
d. Below Threshold Reprogrammings	-432				
(U) Adjustments to Budget Year Since FY 1999 PB			-621	1,284	
(U) Current Budget Submit/FY 2000 PB	36,687	40,386	42,205	46,840	Cont
(U) Significant Program Changes: Not Applicable.					
FY 1999: \$658 identified as a source for SBIR.					
	Pa	ige 2 of 8 Pages		Exh	ibit R-2 (PE 0602602F)

BUDGET ACTIVITY         FE NUMBER AND TITLE         PROJECT           2 Applied Research         0002602F Conventional Munitions         2068           COST (§ In Trausands)         FY 1998         FY 1998         FY 2000         FY 2001         FY 2004	RDT	&E BUDGET IT	EM JUS	TIFICAT	ION SH	EET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
COST (\$ In Thousands)       FY 1998       FY 1999       FY 2001       FY 2001       FY 2003       FY 2003       FY 2004       FY 2004       Cost to       Total Con-         2068       Advanced Guidance Technology       15,173       16,465       14,403       18,089       18,718       20,245       20,562       19,314       Continuing       Continuing         (U) A. Mission Description:       This Applied Research project investigates, develops, and evaluates conventional munition advanced guidance technologies to establish technical feasibility and military utility. This project includes development of advanced guidance, including terminal seekers, navigation and control, signal and image processing/algorithms, and assessments for digital six degree-of-freedom simulations. Project payoffs include: adverse-weather and "launch and leave" precision guidance rapatility increased number of kills per sortic: increased acrospace vehicle survivability; improved reliability and affordability; reduced test costs; shorter development representation of the set standoff launch ranges, reduced pilot workload, and improved aerospace vehicle survivability.         - (U) \$4,236       Investigated and developed advanced component technologies for current and future munitions that will decrease pilot workload and increase survivability.         - (U) \$2,230       Investigated and developed advanced optical and digital processors and advanced target detection/classification/dentification algorithms for autonomous seekers that will grow de the basis for smart autonomous weapons that will decrease pilot workload and increase survivability.         - (U) \$2,276	BUDGET ACTIVITY 2 - Applied Resear	ch			PE NI <b>06(</b>	UMBER AND D2602F(	TITLE Conventie	onal Mun	itions		F	PROJECT
2010       Advanced Guidance Technology       15,173       16,465       14,403       18,019       18,718       20,245       20,582       19,314       Continuing       Contabability       Contresission and controls isp	COST (\$	S In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This Applied Research project investigates, develops, and evaluates conventional munition advanced guidance technologies to establish technical feasibility and military utility. This project includes development of advanced guidance, including terminal seekers, navigation and control, signal and image processing/algorithms, and assessments for digital six degree-of-freedom simulations. Project payoffs include: adverse-weather and "launch and leave" precision guidance rapability; increased number of kills per sortic; increased acrospace vehicle survivability; improved reliability and affordability; reduced test costs; shorter development programs; and improved survivability and effectiveness of conventional weapons.</li> <li>(U) <u>PY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>S4,326</u></li> <li>Investigated and developed advanced component technology for low-cost precision adverse-weather autonomous seekers that will allow increased standorf launch ranges, reduced pilot workload, and improved aerospace vehicle survivability.</li> <li>(U) <u>S6,322</u></li> <li>Investigated and developed advanced navigation and control technologies for current and future munitions that will decrease pilot workload and increase survivability.</li> <li>(U) <u>S2,339</u></li> <li>Investigated and developed detailed six degree of freedom and hardware-in-the-loop simulations and models for the analysis of guided munitions and their components to enable requirement studies, design iteration/evaluation, and experiment risk reduced.</li> <li>(U) <u>S15,173</u></li> <li>(U) <u>S15,173</u></li> </ul> </li> <li>Divert <u>D08</u></li> </ul>	2068 Advanced Guidance Te	echnology	15,173	16,465	14,403	18,089	18,718	20,245	20,562	19,314	Continuing	Continuin
	2068       Advanced Guidance Technology       15,173       16,465       14,403       18,089       18,718       20,245       20,562       19,314       Continuing       Continuing         (U) A. <u>Mission Description</u> : This Applied Research project investigates, development of advanced guidance, including terminal seekers, navigation and control, signal and image processing/algorithms, and assessments for digital six degree-of-freedom simulations. Project payoffs includie: adverse-weather and "launch and leave" precision guidance capability: increased number of kills per sortic; increased aerospace vehicle survivability; improved reliability and affordability; reduced test costs; shorter development programs; and improved survivability and effectiveness of conventional weapons.       (U) FY 1998 (S in Thousands): <ul> <li>(U) SP 1998 (S in Thousands):</li> <li>(U) \$4,236</li> <li>Investigated and developed advanced pilot workload, and improved aerospace vehicle survivability.</li> <li>(U) \$6,322</li> <li>Investigated and developed advanced optical and digital processors and advanced target detection/classification/identification algorithms for autonomous seekers that will provide the basis for smart autonomous weapons that will decrease pilot workload and increase survivability.</li> <li>(U) \$2,276</li> <li>Investigated and developed detailed six degree of freedom and hardware-in-the-loop simulations and models for the analysis of guided munitions and their components to enable requirement studies, design iteration/evaluation, and experiment risk reduction. These advanced simulations will shorten development time, reduce development cost, and provide more effective munitions that will reduce cost per kill.</li> <li>(U) \$15,173</li> <li>To</li></ul>											

RDT	&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT
2 - Applied Resear	ch	0602602F Conventional Munitions	2068
(U) FY 1999 (\$ in Thousa	unds):		
– (U) \$3,988	Investigate and develop advanced component technol- standoff launch ranges, reduced pilot workload, and in	ogy for low-cost precision adverse-weather autono mproved aerospace vehicle survivability.	mous seekers that will allow increased
– (U) \$8,338	Investigate and develop advanced navigation and con increase survivability.	trol technologies for current and future munitions	that will decrease pilot workload and
– (U) \$1,786	Investigate and develop advanced optical and digital autonomous seekers that will provide the basis for sm	processors and advanced target detection/classifica art autonomous weapons that will decrease pilot w	tion/identification algorithms for orkload and increase survivability.
– (U) \$2,085	Investigate and develop detailed six degree of freedor and their components to enable requirement studies, o will shorten development time, reduce development c	n and hardware-in-the-loop simulations and model design iteration/evaluation, and experiment risk re ost, and provide more effective munitions that will	s for the analysis of guided munitions duction. These advanced simulations reduce cost per kill.
– (U) \$268	Identified as a source for SBIR.	-	-
– (U) \$16,465	Total		
(U) <u>FY 2000 (\$ in T</u>	nousands):		
– (U) \$4,467	Investigate and develop advanced component techno standoff launch ranges, reduced pilot workload, and	logy for low-cost precision adverse-weather auton improved aerospace vehicle survivability.	omous seekers that will allow increased
– (U) \$5,611	Investigate and develop advanced navigation and co increase survivability.	ntrol technologies for current and future munitions	s that will decrease pilot workload and
– (U) \$2,586	Investigate and develop advanced optical and digital autonomous seekers that will provide the basis for s	processors and advanced target detection/classific nart autonomous weapons that will decrease pilot	cation/identification algorithms for workload and increase survivability.
– (U) \$1,739	Investigate and develop detailed six degree of freedo and their components to enable requirement studies, will shorten development time, reduce development	om and hardware-in-the-loop simulations and mode design iteration/evaluation, and experiment risk r cost, and provide more effective munitions that wi	els for the analysis of guided munitions eduction. These advanced simulations ll reduce cost per kill.
- (U) \$14,403	Total		
Project 2068	Pag	e 4 of 8 Pages Ex	hibit R-2A (PE 0602602F)

RDT&E F	UDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 1999									
		PROJECT									
2 - Applied Research	0602602F Conventional Munitions	2068									
<ul> <li>(U) <u>FY 2001 (\$ in Thousan</u> <ul> <li>(U) \$5,099</li> <li>Invastar</li> <li>(U) \$7,586</li> <li>Invastar</li> <li>(U) \$2,578</li> <li>Invastar</li> <li>(U) \$2,578</li> <li>Invastar</li> <li>(U) \$2,826</li> <li>Invastar</li> <li>(U) \$2,826</li> <li>Invastar</li> <li>(U) \$2,826</li> <li>Invastar</li> <li>(U) \$2,826</li> <li>Invastar</li> <li>(U) \$18,089</li> <li>Tot</li> </ul> </li> <li>(U) B. <u>Project Change Summa</u> <ul> <li>(U) B. <u>Project Change Summa</u></li> </ul> </li> <li>(U) B. <u>Project Change Summa</u></li> <li>(U) C. <u>Other Program Fundin</u> <ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0603601F, Con</li> <li>(U) PE 0604314F, Adv</li> <li>(U) PE 0604940D, Cer</li> <li>(U) PE 0604604F, Sub</li> <li>(U) This project has be</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy:</u> N</li> <li>(U) E. <u>Schedule Profile</u>: Not A</li> </ul>	<ul> <li>(b):</li> <li>stigate and develop advanced component technology for low-cost precision adverse-weather autonomo doff launch ranges, reduced pilot workload, and improved aerospace vehicle survivability.</li> <li>stigate and develop advanced navigation and control technologies for current and future munitions that ease survivability.</li> <li>stigate and develop advanced optical and digital processors and advanced target detection/classificatio nomous seekers that will provide the basis for smart autonomous weapons that will decrease pilot work stigate and develop detailed six degree of freedom and hardware-in-the-loop simulations and models f their components to enable requirement studies, design iteration/evaluation, and experiment risk reduce shorten development time, reduce development cost, and provide more effective munitions that will reduce a shorten development time, reduce development cost, and provide more effective munitions that will reduce a development cost.</li> <li>y. Description of Significant Changes: Not Applicable.</li> <li><u>Summary:</u></li> <li>rentional Weapons Technology.</li> <li>anced Medium Range Air-to-Air Missile.</li> <li>tral Test and Evaluation Improvement Program.</li> <li>nunitions Development.</li> <li>en coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> <li>(ot Applicable.</li> </ul>	hus seekers that will allow increased at will decrease pilot workload and in/identification algorithms for kload and increase survivability. For the analysis of guided munitions pition. These advanced simulations aduce cost per kill.									
Project 2068	Page 5 of 8 Pages Exhibit	I K-ZA (PE U6U26U2F)									
RDT8	<b>E BUDGET ITE</b>	EM JUS	TIFICAT	ION SH	EET (R·	-2A Exh	ibit)		DATE Fe	bruary 1	999
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BUDGET ACTIVITY 2 - Applied Researd	:h			PE NI 060	PE NUMBER AND TITLE 0602602F Conventional Munitions					PROJECT 2502	
COST (\$ )	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2502 Ordnance Technology		21,514	23,921	27,802	28,751	29,086	29,785	31,100	33,933	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Descriptic</u> arm devices, fuzes, explosivand planned conventional wimproved storage capability dispensing; selectable multimore thoroughly tested weat</li> <li>(U) <u>FY 1998 (\$ in Th</u> - (U) \$5,607</li> <li>(U) \$3,060</li> <li>(U) \$3,820</li> <li>(U) \$3,467</li> <li>(U) \$5,560</li> <li>(U) \$21,514</li> </ul>	2502 Ornance recompagy       21,514       23,921       27,802       28,751       29,086       29,785       31,100       33,933       Continuing       Continu									safe and of current include: nature; and and s to ent time vanced cost and thality mproving ality that	
Project 2502				Page 6 of	8 Pages			Exhibi	t R-2A (PE	0602602F)	

RDT	DATE February 1999		
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT
2 - Applied Resear	ch	0602602F Conventional Munitions	2502
(II) <b>FY 1999 (\$ in T</b>	housands).		
- (U) \$6,698	Investigate and develop high fidelity analytical tools in lethality and vulnerability. Quantify and characterize t information into advanced analytical methods for predi providing more effective munitions to the Air Force.	cluding computational mechanics model for calcu he coupling of destructive energy into the target, cting weapon effectiveness. These tools will redu	lating weapons effects and assessing and the means to translate that ce development time and cost while
- (U) \$2,178	Investigate and develop new affordable explosives that munitions that will provide more effective munitions to	provide higher performance and lower sensitivity the Air Force and reduce cost per kill.	for development of advanced
- (U) \$3,282	Investigate and develop fuze, and safe and arm technol supportability, safety, and performance for the Air Ford	ogy for advanced munitions that will reduce cost a	and provide increased weapons
- (U) \$4,695	Investigate and develop advanced control and carriage future air-to-ground and agile air-to-air missiles that w survivability and decreasing pilot workload.	technologies for integrated ordnance packages wi ill provide increased accuracy, lethality, and load	th enhanced lethality for current and out while improving aircrew
- (U) \$6,678	Investigate and develop advanced warhead development allow reduced sortie rates and lower cost per kill.	nt technologies and advanced kill mechanisms to	enhance munitions lethality that will
- (U) \$390	Identified as a source for SBIR.		
- (U) \$23,921	Total		
<ul> <li>(U) <u>FY 2000 (\$ in T</u> - (U) \$6,625</li> <li>- (U) \$2,452</li> <li>- (U) \$4,125</li> <li>- (U) \$8,603</li> <li>- (U) \$5,997</li> <li>- (U) \$27,802</li> </ul>	housands): Investigate and develop high fidelity analytical tools in lethality and vulnerability. Quantify and characterize to information into advanced analytical methods for predi- providing more effective munitions to the Air Force. Investigate and develop new affordable explosives that munitions that will provide more effective munitions to Investigate and developed fuze, and safe and arm techn supportability, safety, and performance for the Air Force Investigate and develop advanced control and carriage future air-to-ground and agile air-to-air missiles that w survivability and decreasing pilot workload. Investigate and develop advanced warhead development allow reduced sortie rates and lower cost per kill. Total	cluding computational mechanics model for calcul he coupling of destructive energy into the target, cting weapon effectiveness. These tools will redu- provide higher performance and lower sensitivity the Air Force and reduce cost per kill. tology for advanced munitions that will reduce cost e. technologies for integrated ordnance packages wi ill provide increased accuracy, lethality, and loaded ant technologies and advanced kill mechanisms to e	lating weapons effects and assessing and the means to translate that ce development time and cost while for development of advanced st and provide increased weapons th enhanced lethality for current and out while improving aircrew enhance munitions lethality that will
Project 2502	Page	e 7 of 8 Pages Ex	hibit R-2A (PE 0602602F)
		155	

RD	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)						
BUDGET ACTIVITY 2 - Applied Resea	rch	PE NUMBER AND TITLE 0602602F Convention	al Munitions	PROJECT 2502			
(U) FY 2001 (\$ in '	Thousands):						
– (U) \$6,755	Investigate and develop high fidelity analytical tools lethality and vulnerability. Quantify and characteriz information into advanced analytical methods for pre providing more effective munitions to the Air Force.	including computational mechani e the coupling of destructive ener dicting weapon effectiveness. Th	cs model for calculating weapons gy into the target, and the means these tools will reduce development	effects and assessing to translate that t time and cost while			
- (U) \$2,611	Investigate and develop new affordable explosives th munitions that will provide more effective munitions	at provide higher performance an to the Air Force and reduce cost	d lower sensitivity for developmer per kill.	nt of advanced			
- (U) \$4,757	Investigate and develop fuze, and safe and arm techn supportability, safety, and performance for the Air Fo	ology for advanced munitions that orce.	at will reduce cost and provide incr	reased weapons			
- (U) \$7,469	Investigate and develop advanced control and carriag future air-to-ground and agile air-to-air missiles that survivability and decreasing pilot workload	ge technologies for integrated ord will provide increased accuracy,	nance packages with enhanced let lethality, and loadout while impro	hality for current and oving aircrew			
- (U) \$7,159	Investigate and develop advanced warhead developm allow reduced sortie rates and lower cost per kill.	nent technologies and advanced k	ill mechanisms to enhance munition	ons lethality that will			
- (U) \$28,751	Total						
B. <u>Project Change Sun</u>	nmary - Description of Significant Changes: Not Appl	licable					
(U) C. Other Program	Funding Summary:						
<ul> <li>(U) <u>Related Activit</u></li> <li>(U) PE 060360</li> <li>(U) PE 060431</li> <li>(U) PE 060460</li> <li>(U) PE 060460</li> <li>(U) PE 060460</li> <li>(U) This project</li> </ul>	<u>ies</u> : <sup>1</sup> F, Conventional Weapons Technology. <sup>4</sup> F, Advanced Medium Range Air-to-Air Missile. <sup>1</sup> 2F, Armament Ordnance Development. <sup>4</sup> F, Submunitions Development. <sup>1</sup> Ct has been coordinated through the Reliance process to h	narmonize efforts and eliminate d	uplication.				
(U) D. <u>Acquisition Stra</u>	ategy: Not Applicable.						
(U) E. <u>Schedule Profil</u>	e: Not Applicable.						
Project 2502	Pag	ge 8 of 8 Pages	Exhibit R-2A(PE	0602602F)			
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PE TITLE: Command, Control, and Communication (C3)

RDT&E BUDGET I	February 1999									
BUDGET ACTIVITY       PE NUMBER AND TITLE         2 - Applied Research       0602702F Command,Control, and Communication         (C3)										
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	80,686	71,661	46,448	52,283	52,769	63,285	65,615	68,076	Continuing	Continuing
2338 Reliability Sciences Technology	8,191	0	0	0	0	0	0	0	0	Continuing
4506 Surveillance Technology	14,578	11,688	9,224	9,826	10,058	10,485	10,918	11,331	Continuing	Continuing
4519 Communications Technology	10,207	17,259	10,817	13,208	13,300	13,990	14,577	16,026	Continuing	Continuing
4594 Information Technology	14,302	9,549	14,235	14,699	15,331	15,568	15,827	15,941	Continuing	Continuing
4600 Electromagnetic Technology	18,866	13,518	0	0	0	0	0	0	Continuing	Continuing
5581 Command and Control (C2) Technology	14,542	19,647	12,172	14,550	14,080	23,242	24,293	24,778	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C

Note: Project 2338, Reliability Sciences Technology, was eliminated beginning in FY 1999 due to higher Air Force priorities. Project 4600, Electromagnetic Technology, will be eliminated beginning in FY 2000 due to higher Air Force priorities.

(U) A. <u>Mission Description</u>: This Applied Research program is the primary source of new concepts, feasibility demonstrations, and advanced technology for Air Force Command, Control, and Communications (C3). Current developments include: improving effectiveness and survivability through secure communications; improving surveillance range and detection capabilities against low-observable threats and enemy electronic countermeasures; and improving the timeliness and quality of data acquisition for decision making. The program addresses five technology areas: surveillance; communications; information; electromagnetics; and command and control. Note: In FY 1999, Congress added \$2.0 million for Protein-Based Memory and \$5.0 million for a Cyber Security program.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

Page 1 of 15 Pages

Exhibit R-2 (PE 0602702F)

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RDT&E BUDGET ITEM JUS	DATE February 19	99					
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602702F Command,Control, and Communication (C3)					
(U) C. Program Change Summary (\$ in Thousands):							
	EV 1008	EV 1000	EV 2000	EV 2001	Total		
(U) Provious President's Rudget/EV 1000 PR	<u>F 1 1998</u> 84 545	<u>F1 1999</u> 65 175	<u>F1 2000</u> 54 146	<u>F1 2001</u> 52 826	Cont		
(U) Appropriated Value	88 567	72 175	54,140	52,820	Cont		
(U) Adjustments to Appropriated Value	88,507	12,115					
a Congressional/General Reductions	-2.978	-514					
h. SBIR	-1.172	011					
c. Omnibus/Other Above Threshold Reprogrammings	-1.705						
d. Below Threshold Reprogrammings	-2.026						
(U) Adjustments to Budget Years Since FY 1999 PB	_,•_•		-7.698	-543			
(U) Current Budget Submit/FY 2000 PB	80,686	71,661	46,448	52,283	Cont		
(U) Significant Program Changes: Changes to this program si Program. FY 1999: \$847 identified as a source for SBIR.	nce the previous	President s Budg	get are due to hig	her priorities withi	n the Science and Technology	7 (S&1)	

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Exhibit R-2 (PE 0602702F)

BUDGET ACTIVITY         PROJECT           2 - Applied Research         0         0         0         2338           COST (\$ In Thousands)         FY 1998         FY 1999         FY 2001         FY 2002         FY 2003         FY 2003         Estimate         Cost (\$ In Thousands)         Total Cost           2338         Reliability Sciences Technology         8.191         0	RDT&E BUDGET ITE	EM JUS	TIFICAT	ION S	SHEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
COST (\$ In Thousands)         FY 1998 Actual         FY 1999 Estimate         FY 2001 Estimate         FY 2001 Estimate         FY 2003 Estimate         FY 2004 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2007 Estimate         FY 2007 Estimate         FY 2007 Estimate         FY 2007 Estima	BUDGET ACTIVITY 2 - Applied Research			PE 0 (	E NUMBER AND 0602702F( C3)	TITLE Command	d,Control	l, and Co	ommunica	ation	PROJECT 2338
233 Reliability Sciences Technology       8.191       0 <th>COST (\$ In Thousands)</th> <th>FY 1998 Actual</th> <th>FY 1999 Estimate</th> <th>FY 2000 Estimate</th> <th>0 FY 2001 e Estimate</th> <th>FY 2002 Estimate</th> <th>FY 2003 Estimate</th> <th>FY 2004 Estimate</th> <th>FY 2005 Estimate</th> <th>Cost to Complete</th> <th>Total Cost</th>	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	0 FY 2001 e Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: The Air Force requires technology which increases reliability and diagnostic capability for electronic devices and systems while assessing electromagnetic environmental performance. Payoffs are increased system availability and lower life cycle costs. This effort focuses on technology to identify and eliminate design and fabrication characteristics that result in poor reliability. It develops equipment and system reliability and diagnostic technology reliability assessment, diagnostic development and integration, design for reliability, and system design and operational assurance.</li> <li>(U) <u>FY 1998 (S in Thousands)</u>:         <ul> <li>(U) <u>S2,600</u></li> <li>Developed electronic reliability techniques to evaluate new devices in an operational environment and recommend corrective action.</li> <li>(U) <u>S2,881</u></li> <li>Developed reliability system design process enhancements for improved Command, Control, and Communications (C3) devices.</li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> </ul> </li> <li>Project 2338</li> </ul>	2338 Reliability Sciences Technology		0 0	0	0	0	0 0	C	Continuing		
Project 2558 Prages Prages Exhibit R=2R (FE 0002702F)	<ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) <u>S2,710</u> Developed electronic</li> <li>(U) \$2,881 Developed reliability</li> <li>(U) <u>FY 1999</u>: Not Applicable.</li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> <li>(U) <u>FY 2001</u>: Not Applicable.</li> </ul>	fs are increa result in po rational reac reliability, a reliability te s technologi system desia	sed system a or reliability. liness and su nd system de echniques to des and integr gn process er	Page 2	y and lower life lops equipment lity. Areas of e l operational as new devices in m into existing ents for improv	an operation tools and tec ed Comman	This effort reliability ar lude electron nal environm chniques to a d, Control, a	focuses on ad diagnosti nic technolog nent and reco address high and Commun	technology t c technology t c techniques gy reliability ommend corn h-priority use nications (C3	o identify an to be applie assessment rective actio er requireme 3) devices.	nd ed in , n. nts.
	Project 2338			Page 3	of 15 Pages			Exhibi	it R-2A (PE	0602702F	)

ET ACTIVITY Applied Research 3. <u>Project Change Summary - Description of Significant Changes</u> : Change the Science and Technology (S&T) Program.	PE NUMBER AND TITLE <b>0602702F Command,Control, ar</b> <b>(C3)</b> unges to this program since the previous President	PROJECT 2338
<b>B.</b> <u><b>Project Change Summary - Description of Significant Changes</b></u> : Chan the Science and Technology (S&T) Program.	nges to this program since the previous Presider	nt's Budget are due to higher priorities
<ul> <li>C. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0603617F, C3 Applications.</li> <li>(U) PE 0603726F, C3 Subsystem Integration.</li> <li>(U) PE 0603728F, Advanced Computing Technology.</li> <li>(U) PE 0603789F, C3 Advanced Development.</li> <li>(U) PE 0604609F, Reliability and Maintainability Technology Insertic</li> <li>(U) PE 0708026F, Producibility, Reliability, Availability, and Maintai</li> <li>(U) This project has been coordinated through the Reliance process to</li> </ul> </li> </ul>	n Program. nability. harmonize efforts and eliminate duplication.	
<ul> <li>Acquisition Strategy: Not Applicable.</li> <li>E. Schedule Profile: Not Applicable.</li> </ul>		
ect 2338 Pa	ge 4 of 15 Pages	Exhibit R-2A (PE 0602702F)

RD	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										999
BUDGET ACTIVITY 2 - Applied Resea	arch			PE N 060 (C3	UMBER AND <sup>•</sup> 02702F ( 3)	TITLE Command	l,Control	l, and Co	mmunica	ation	PROJECT <b>4506</b>
COST	(\$ In Thousands) FY 1998 FY 1999 FY 2000 FY 2001 FY 2002 FY 2003 FY 2004 FY 2005 Cost to Complete Total Stimate Stimat										Total Cost
4506 Surveillance Techno	4506 Surveillance Technology 14,578 11,688 9,224 9,826 10,058 10,485 10,918 11,331 Continuing C								Continuing		
(U) A. <u>Mission Descrip</u> systems. Major Applied Technologies being deve processors. (U) <u>FY 1998 (\$ in</u> - (U) \$6,110 - (U) \$5,120 - (U) \$2,753 - (U) \$2,753 - (U) \$2,753 - (U) \$14,578 (U) <u>FY 1999 (\$ in Thou</u> - (U) \$14,578 (U) <u>FY 1999 (\$ in Thou</u> - (U) \$1,467 - (U) \$2,880 - (U) \$1,467 - (U) \$2,880 - (U) \$1,467 - (U) \$2,880 - (U) \$1,467 - (U) \$1,467 $-$ (U) \$1,467 - (U) \$1,467 $-$ (U) \$1,467 - (U) \$1,475 $-$ (U) \$1,4755 $-$ (U) \$1,475	<ul> <li>n Thousands):</li> <li>Developed, tested, and small target detection in Developed, tested, and tested to platforms.</li> <li>Developed, tested, demintelligence machines f Designed, developed, a Total</li> <li>1sands):</li> <li>Develop and demonstrand space-based platform applica Develop, test, and den awareness. Implement Design architecture for Identified as a source for Total</li> </ul>	es advanced include: low assive bistati demonstrate n a complex echnologies a onstrated, ar for enhanced nd tested ult rate sensor p porms in hosti and concepts tions. nonstrate imp at measures of r an affordat for SBIR.	surveillance -observable c radar; spat d new high-s electromagn and concepts and assessed a target detec rahigh frequ erformance a le (jamming s for passive proved real-to of merit for a ole, scaleable	speed signal speed signal etic backgro for passive advanced mu tion and trace ency microv analysis and ) scenarios. surveillance ime multisp advanced dis , teraflop in	es to improve e; passive sur- te and time p processor pro- bund. surveillance iltispectral/n cking. wave electron software for e with empha bectral and m stributed fusi formation pr	e the perform rveillance; in processing tec e with empha nultisensor k nics and opti r synthetic ap asis on electro ultisensor fu on system er rocessor and	nance and re formation f echniques; so chnologies a asis on airbo nowledge-b cally contro perture radar conic suppor usion technic valuation. augment it	educe the cos usion; and ad ensor and da nd algorithm rne unmanne ased fusion t illed antenna r and moving t measures a ques for enha to support ra	st of Air Ford dvanced prod ta fusion; an as (space and ed aerial veh techniques an array for rad g target indic nd airborne anced air and upid fusion p	ce surveillar cessing tech d advanced l time) to en icle (UAV) nd artificial dar applicati cator from a wideband bi d space situa rocessing.	nce nologies. signal hance ions. irborne istatics for ational
Project 4506				Page 5 of	15 Pages			Exhibi	t R-2A (PE	0602702F)	)
				161	l						

			DATE February 1999				
BUDGET ACTIVITY 2 - Applied Reso	earch	PE NUMBER AND TITLE 0602702F Command,Control, and Communication (C3)					
(U) FY 2000 (\$ in Th	ousands):						
– (U) \$2,647	Continue to develop technologies and concepts for passiv waveform and antenna designs for operation in severe clu technologies and concepts.	e surveillance with emphasis on electronic support measure and jamming environments. Develop and evaluate	asures and advanced bistatic e space-based radar subsystem				
– (U) \$3,905	Demonstrate and assess operational algorithms processing data fusion, delivering an enhanced air and space situatio enhanced performance.	g massive global databases to produce improved real-ti- nal picture. Complete development and demonstrate f	me multispectral and multisensor fusion quality measures validating				
– (U) \$2,672	Complete design and implementation technologies for ful processing.	ly programmable, scaleable, affordable teraflop proces	sors for real-time fusion and				
– (U) \$9,224	Total						
(U) FY 2001 (\$ in Th	ousands):						
– (U) \$2,888	Continue to develop technologies and concepts for passiv	ve surveillance with emphasis on electronic support me	easures and bistatics for enhanced				
– (U) \$4.214	Develop, test, and demonstrate fused and unfused data in	Id jamming environments. Evaluate space-based radar iformation sharing strategies enhancing common inter-	subsystem concepts. faces to a consistent battlespace				
	knowledge.		1				
- (U) \$2,724 (L) \$9,826	Demonstrate fully programmable, scaleable, affordable to	eraflop processors and algorithms for real-time fusion	and processing.				
- (0)\$9,820	1000						
(U) B. Project Chang	ge Summary - Description of Significant Changes: Not Ap	pplicable.					
(U) C. Other Progra	<u>m Funding Summary</u> :						
(II) Related Act	ivities						
- (U) PE 0603	726F, C3 Subsystems Integration.						
– (U) PE 0603	789F, C3 Advanced Development.						
- (U) This proj	ject has been coordinated through the Reliance process to ha	armonize efforts and eliminate duplication.					
(U) D. Acquisition S	trategy: Not Applicable.						

RDT&E BUDGET ITEM J	t) DATE February 1999	
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602702F Command,C (C3)	ontrol, and Communication 4506
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 4506	Page 6 of 15 Pages	Exhibit R-2A (PE 0602702F)
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RDT8	<b>E BUDGET ITI</b>	EM JUS	TIFICAT	TION SH	EET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 2 - Applied Researc	h			PE N 060 (C3	UMBER AND <b> 12702F (</b> 3)	TITLE Command	l,Control	l, and Co	mmunica	tion 4	PROJECT <b>4519</b>
COST <i>(\$ 1</i> ,	COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 EstimateFY 2004 Estimate								FY 2005 Estimate	Cost to Complete	Total Cost
4519 Communications Technology 10,207 17,259 10,817 13,208 13,300 13,990						14,577	16,026	Continuing	Continuin		
(U) A. Mission Description: The Air Force requires technologies that enable worldwide communications. The rapid build-up of U.S presence abroad, via rapid application of air power, requires assured connectivity providing reliable, responsive, affordable transfer of information using all available communications media. This program provides the technologies for: multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques such as spread spectrum and adaptive null steering; lightweight antennas and phased array antennas; modular, programmable, low-cost radios; and Communications (C3) across the electromagnetic and optical spectrums. It includes technologies for advanced processors and devices, advanced network protocols, artificial intelligent communications management and control, advanced algorithms, and enabling processing technologies employing on-board programmable devices, processing technologies for improved security, survivability, timeliness, and reconstruction of communications networks between airborne and fiber optic networks that are commercially compatible.         - (U) \$2,222       Developed technologies for improved security, survivability, timeliness, advanced network protocols, advanced artificial intelligence algorithms, and enabling adaptive signal processing technologies essential for robust, survivable, spread spectrum communications.         - (U) \$2,222       Developed advanced adaptive electronic and photonic processors and controllers, advanced network protocols, advanced artificial intelligence algorithms, and enabling adaptive signal processing technologies essential for robust, survivable, spread spectrum communications.         - (U) \$2,222       Developed advanced adaptive electronic and photonic processors and controllers, advanced network protocols, advanced artificial intelligen									a. This chniques Control, ptocols, mable d irborne		

RDT	DATE February 1999							
BUDGET ACTIVITY 2 - Applied Resear	ch	PE NUMBER AND TITLE 0602702F Com (C3)	imand,Control, and Co	PROJECT mmunication 4519				
(U) FY 1999 (\$ in T	housands):							
- (U) \$3,414	Develop critical communications technologies (for in monolithic microwave integrated circuits to provide high frequency (SHF) spectrums. Analyze weight, or	magery and video) emp global connectivity to cost, and drag for unma	ploying programmable devices, places are space forces in the ultra-hig anned aerial vehicle (UAV) apple	processing technologies, and h frequency (UHF) and super- ications.				
– (U) \$4,576	Develop assurance of service and universal transacti reconstruction of communications networks.	on service technologies	s for improved security, survival	bility, timeliness, and				
– (U) \$3,188	\$3,188 Develop advanced communications signal processors, an advanced Smart Network protocol, advanced algorithms, and enabling processing technologies essential for survivable radio communications.							
– (U) \$5,877	Develop Defensive Information Warfare (DIW) tool to ensure information protection and security of sense	s and technologies (i.e. sitive and encrypted Ai	, pathology and forensics to deter r Force information systems.	ect and countermeasure break-ins)				
- (U) \$204 - (U) \$17,259	Identified as a source for SBIR. Total							
(U) FY 2000 (\$ in Thous	ands):							
- (U) \$3,700	Develop assurance of services and universal transact seamless, distributed communications network emplo	ion services technologi oying wireless and wire	es for improved security, survive ed links.	ability, and timeliness in a global,				
– (U) \$5,078	Develop critical communications and signal processi aerospace forces. Continue millimeter component de	ng technologies to provevelopment and the Sm	vide adaptive, covert, anti-jam, a nart Network Radio program.	nd global connectivity to				
– (U) \$2,039	Develop DIW tools (Net Visualization) and technolo Air Force communication and information systems.	ogies (attack indicators)	) to ensure information and datab	base protection and security for				
- (U) \$10,817	Total							
(U) FY 2001 (\$ in Thous	ands):							
– (U) \$4,400	Continue to develop assurance of service and universin a global, seamless, distributed communications ne	sal transaction service t twork and global distri	echnologies for improved securi buted information system.	ty, survivability, and timeliness				
– (U) \$6,112	Continue to develop critical communications technol commercial connectivity to aerospace forces. Develo	logies to provide adaption of stealth antennas and	ive, covert, anti-jam, and global subsystems and continue efforts	seamless military and s on Smart Network Radio.				
– (U) \$2,696	Develop DIW tools and technologies to ensure inform security for Air Force information systems (normal a	mation protection using and encrypted).	g preemptive indicators, damage	assessment, recovery, and				
- (U) \$13,208	Total							
Project 4519	Page	e 8 of 15 Pages	Exhibit	R-2A (PE 0602702F)				
		165						

RDT&E BUDGET ITEM JUSTIFICATIO	N SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602702F Command,Control, an (C3)	PROJECT d Communication 4519
<ul> <li>(U)B. <u>Project Change Summary - Description of Significant Changes:</u> Charwithin the Science and Technology (S&amp;T) Program.</li> <li>(U) C. <u>Other Program Funding Summary:</u> <ul> <li>(U) <u>Related Activities:</u></li> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0603726F, C3 Subsystem Integration.</li> <li>(U) PE 0603728F, Advanced Computing Technology.</li> <li>(U) PE 0603789F, C3 Advanced Development.</li> <li>(U) This project has been coordinated through the Reliance process to</li> </ul> </li> </ul>	nges to this program since the previous President' harmonize efforts and eliminate duplication.	s Budget are due to higher priorities
<ul> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>		
Project 4519 Pa	166	Exhibit R-2A (PE 0602702F)

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 2 - Applied Researd	ch			PE N 060 (C3	UMBER AND <sup>•</sup> 02702F ( 3)	TITLE Command	d,Contro	I, and Co	mmunica	ation 4	PROJECT <b>4594</b>	
COST <i>(</i> \$	: In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
4594 Information Technology	/	14,302	9,549	14,235	14,699	15,331	15,568	15,827	15,941	Continuing	Continuing	
disseminate timely information. This project improves Global Awareness at all levels enabling warfighters to understand relevant military situations on a consistent basis with the precision needed to accomplish their missions. Global Awareness is achieved by exploiting information provided by other government agencies. The information is fused to support Dynamic Planning and Execution via the Global Information Exchange distribution system. Knowledge, information, and data are archived in the Global Information Base for continued use and historical analysis. The information technologies required to achieve this capability are developed under this project in an affordable manner and include appropriate access mechanisms for our coalition partners.         (U) <u>FY 1998 (\$ in Thousands)</u> :       – (U) \$7,470       Developed processing technologies (including memories, sorting algorithms, and fusion and correlation displays) that improve information timeliness, reliability, and accessibility for applications such as non-cooperative combat target identification.         – (U) \$2,231       Developed information data handling techniques to automatically and expertly extract event data from multimedia databases for prediction and awareness purposes.         – (U) \$2,291       Developed protein-based optical memories for high-density, high-throughput mass storage systems of the future.         – (U) \$1,867       Developed protein-based optical memories for imagery and electromagnetic signals. Develop technology to transition the capability to tag targets in space and sort large volumes of communications in direct support of information superiority for global engagement.         – (U) \$3,824       Develop information exploitation capabilities for ommunications in direct support of information superiority for gl												
- (U) \$1,825 - (U) \$113 - (U) \$9,549	Develop advanced tech Identified as a source t Total	hnologies an for SBIR.	nd approach	es for the ac	quisition, an	alysis, and t	imely disser	nination of i	ntelligence i	nformation.		
Project 4594				Page 10 of	f 15 Pages			Exhibi	t R-2A (PE	0602702F)	)	

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RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	I SHEET (R-2A Exl	nibit)	DATE February	1999
BUDGET ACTIVITY 2 - Applied Researd	ch	PE NUMBER AND TITLE 0602702F Comman (C3)	d,Control, and Co	mmunication	PROJECT <b>4594</b>
(U) <u>FY 2000 (\$ in Thous</u> – (U) \$4,552 – (U) \$4,500 – (U) \$5,183	sands): Automate multisensor and multimedia technologies spectrum for precision location and identification. Develop innovative multisensor collaboration systen behavior for spaceborne systems in a fully distribute Develop Global Information Base technologies for g dynamic planning and execution operations.	to automatically detect and to n to fuse events in time and sp d fusion environment. dobal, theater, and local situa	rack targets using radiated pace, to locate and identify tion awareness providing t	signals across the en objects, and to proje timely and accurate in	tire ct future 1put to
- (U)\$14,235	Total				
(U) FY 2001 (\$ in Th	nousands):				
<ul> <li>- (U) \$4,800</li> <li>- (U) \$4,818</li> <li>- (U) \$5,081</li> <li>- (U)\$14,699</li> </ul>	Continue to develop multisensor, multimedia analyt and demonstrate improvements in decision-making information extraction capabilities for seamless inte Develop and evaluate innovative multisensor collab fully distributed environment. Develop, evaluate, and demonstrate Global Informati timely and accurate input to dynamic planning and Total	ical techniques to automatica execution resulting from the gration into the Global Inforr orative fusion technologies ac tion Base technology concept execution operations in respo	lly detect and track the pre- integration of these capabi- nation Base. Idressing surface, airborne s that employ multiple lev nse to dynamically changi	esence and location o ilities. Evaluate adva e, and spaceborne syst els of abstraction, pro ing requirements and	f targets, inced tems in a oviding guidance.
(U) B. <u>Project Change S</u>	ummary - Description of Significant Changes: Not A	Applicable.			
(U) C. <u>Other Program F</u> (U) <u>Related Activition</u> – (U) PE 06037261 – (U) PE 06037891 – (U) This project	unding Summary: es: F, C3 Subsystem Integration. F, C3 Advanced Development. has been coordinated through the Reliance process to h	armonize efforts and eliminat	e duplication.		
(U) D. <u>Acquisition Strat</u>	egy: Not Applicable.				
Project 4594	Разе	e 11 of 15 Pages	Exhibit	R-2A (PE 0602702	2F)
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		DATE February 1999
BUDGET ACTIVITY <b>2 - Applied Research</b>	PE NUMBER AND TITLE 0602702F Command,C (C3)	Control, and Communication
(U) E. <u>Schedule Profile</u> : Not Applicable.		

EUDGET ACTIVITY         PE NUMEER AND ITTLE         PEOJECT           2 - Applied Research         6002702F Command, Control, and Communication         4600 <u>COST (\$ In Trousands)</u> FY 1998         FY 1998         FY 2001         FY 2003         FY 2004         FY 2004         Cost to Compute         Control, and Communication         4600 <u>4600</u> Electromagnetic Technology         18,866         13,518         0	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 1999		
COST (\$ In Thousands)         FY 1998 Actual         FY 1999 Estimate         FY 2001 Estimate         FY 2001 Estimate         FY 2003 Estimate         FY 2004 Estimate         FY 2005 Estimate         FY 2004 Estimate         FY 2005 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2007 Estimate         FY 2007 Estimate         FY 2006 Estimate         FY 2006 Estima	BUDGET ACTIVITY       PE NUMBER AND TITLE         2 - Applied Research       0602702F Command,Control, and Communication (C3)								ation	PROJECT <b>4600</b>	
4600         Electromagnetic Technology         18,866         13,518         0	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This project consists of three subset technologies: electromagnetics; solid state sciences; and photonics. Future surveillance, communications, and imagery/information processing systems will require improved technology for the generation, control, processing, and radiation of electromagnetic and optical energy to reduce system cost, improve system sensitivity, and increase processing rates. Promising technologies for improving Command, Control, and Communications (C3) systems are electromagnetic propagation and scattering (from targets and clutter), and monolithic microwave and millimeter-wave integrated components and antennas. This project develops: a technology base for electronic and photonic devices and device materials for C3 systems; optical technology for electronic data processing and storage; real-time target recognition and high-speed fiber optic interconnects; and control techniques for large phased array antennas. It also characterizes phenomena for low-observable surveillance.</li> <li>(U) <u>FY 1998 (\$ in Thousands</u>): <ul> <li>(U) <u>\$4,016</u> Developed electromagnetic technologies, such as digital beamforming and phased array correction algorithms, for advanced surveillance and communications systems applications.</li> <li>(U) <u>\$4,016</u> Developed advanced materials and components capable of higher processing speeds at reduced power levels for telecommunications and survivable server applications.</li> <li>(U) <u>FY 1999 (\$ in Thousands</u>): <ul> <li>(U) <u>FY 1999 (\$ in Thousands</u>):</li> <li>(U) <u>S18,866</u> Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands</u>): <ul> <li>(U) <u>S18,748</u> Developed photonic sub-systems and new computer codes for advanced surveillance and communications applications.</li> <li>(U) <u>S1,817</u> Develop advanced electromagnetic materials and components capable of higher processing speeds for sensing and communications applications.</li> <li>(U) <u>S1,817</u> Develop photonic sub-systems and components capable of higher processing speeds for sensing an</li></ul></li></ul></li></ul>	4600 Electromagnetic Technology	18,866	13,518	0	0	0	0	0	0	Continuing	Continuing
$= (0)$ $\varphi_{100}$ further as a source for SDIN.	<ul> <li>(U) A. <u>Mission Description</u>: This project consists of three subset technologies: electromagnetics; solid state sciences; and photonics. Future surveillance, communications, and imagery/information processing systems will require improved technology for the generation, control, processing, and radiation of electromagnetic and optical energy to reduce system sensitivity, and increase processing ates. Promising technologies for improving Command, Control, and Communications (C3) systems are electromagnetic propagation and scattering (from targets and clutter), and monolithic microwave and millimeter-wave integrated components and antennas. This project develops: a technology base for electronic and photonic devices and device materials for C3 systems; optical technology for electronic data processing and storage; real-time target recognition and high-speed fiber optic interconnects; and control techniques for large phased array antennas. It also characterizes phenomena for low-observable surveillance.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>\$4,016</u></li> <li>Developed electromagnetic technologies, such as digital beamforming and phased array correction algorithms, for advanced surveillance and communications systems applications.</li> <li>(U) <u>\$4,016</u></li> <li>Developed advanced materials and components capable of higher processing speeds at reduced power levels for telecommunications and survivable server applications.</li> <li>(U) <u>\$8,840</u></li> <li>Developed photonic components and related materials for insertion into core Command, Control, and Communications (C3) programs to increase efficiencies and reduce costs.</li> <li>(U) <u>\$14,999 (\$ in Thousands)</u>:</li></ul></li></ul>										

BUDGET ACTIVITY F 2 - Applied Research	PE NUMBER AND TITLE 0602702F Command,Control, and Co	PROJECT
	(C3)	mmunication 4600
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>: Not Applicable.</li> <li>(U) <u>FY 2001 (\$ in Thousands)</u>: Not Applicable.</li> <li>(U) B. <u>Project Change Summary - Description of Significant Changes:</u> : Charwithin the Science and Technology (S&amp;T) Program.</li> <li>(U) C. <u>Other Program Funding Summary:</u> <ul> <li>(U) <u>Related Activities:</u></li> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0603617F, C3 Applications.</li> <li>(U) PE 0603726F, C3 Subsystem Integration.</li> <li>(U) PE 0603789F, C3 Advanced Development.</li> <li>(U) This project has been coordinated through the Reliance process to har</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> </ul>	nges to this program since the previous President's E monize efforts and eliminate duplication.	Budget are due to higher priorities
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 4600 Page 1	13 of 15 Pages Exhibit	t R-2A (PE 0602702F)

BUDGET ACTIVITY         PECUACT           2 - Applied Research         IPE NUMBER AND ITTLE         062702F Command,Control, and Communication         5581           cost (\$ In Thousands)         FY 1998 Actual         FY 1998 Estimate         FY 2001 Estimate         FY 2002 Estimate         FY 2003 Estimate         FY 2003 Estimate         FY 2004 Estimate         FY 2005 Estimate         FY 2004 Estimate         FY 2004 Estimate <t< th=""><th>RDT</th><th colspan="8">RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)</th><th colspan="3">DATE February 1999</th></t<>	RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 1999		
COST (\$ In Thousands)FY 1998 ActualFY 1998 EstimateFY 2001 EstimateFY 2001 EstimateFY 2003 EstimateFY 2004 EstimateFY 2004 EstimateF	BUDGET ACTIVITY 2 - Applied Researd	ch			PE N 060 (C3	UMBER AND <sup>•</sup> D2702F ( 3)	TITLE Command	l,Control	l, and Co	mmunica	ation	PROJECT <b>5581</b>
Image: Text state       11,542       12,172       14,550       14,080       23,242       24,243       24,778       Continuing         (U) A. Mission Description:       The Air Force requires Command and Control (C2) technologies which provide the next generation of information for real-time battle management. Technologies being developed in this project will increase capability, quality, and reliability while reducing the cost of computer resources in C2 systems. Work in this project focuses on developing advanced C2 computer software systems capable of providing vasi improvements in military decision makine. These include collaborative intelligent agent, planning, and scheduling technologies. The project site developed in this project will increase capability, quality, and reliability with reduced software technologies for real-time battle management and command and control including full-dialog manmachine interface.         - (U) \$4,562       Developed intelligent information technologies for real-time battle management and database technology using cluster techniques.         - (U) \$4,920       Developed intelligent information technologies to support modeling and analysis of evolvable software and parallel processing systems.         - (U) \$14,542       Total         (U) FY 1999 (S in Thousands):       - (U) \$14,542         - (U) \$14,542       Total         (U) \$14,542       Develop intelligent information technologies including preplan-to-react planning technology for noncontinuous planning and tools and techniques for collaborative intelligent systems.       - (U) \$6,139       Develop distributed computing and database technology including collab	COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
(U) A. <u>Mission Description</u> : The Air Force requires Command and Control (C2) technologies which provide the next generation of weapon systems with improved processing and presentation of information for real-time battle management. Technologies being developed in this project will increase capability, quality, and reliability while reducing the cost of computer resources in C2 systems. Work in this project focuses on dweloping advanced C2 computer software systems capable of providing vas improvements in military decision making. These include collaborative intelligent agent, planning, and scheduling technologies. The project develops technology for distributed systems, data bases, and fault tolerance mechanisms; and knowledge-based technologies, systems, and data bases.         (U) <u>FV 1998 (S in Thousands):</u> <ul> <li>(U) <u>S4,760</u></li> <li>Developed intelligent information technologies for real-time battle management and command and control including full-dialog manachine interface.</li> <li>(U) <u>S4,760</u></li> <li>Developed software technologies to support modeling and analysis of evolvable software and parallel processing systems.</li> <li>(U) <u>S4,720</u></li> <li>Developed enabling technologies including preplan-to-react planning technology for noncontinuous planning and tools and techniques for collaborative intelligent systems.</li> <li>(U) <u>S6,148</u></li> <li>Develop intelligent information technologies including preplan-to-react planning technology for increased capability, quality, and reliability with reduced support cost.</li> <li>(U) <u>S6,148</u></li> <li>Develop artificator: centered technology that provides easier-to-design and easier-to-maintain software for increased capability, quality, and reliability with reduced support cost.</li> <li>(U) <u>S6,148</u></li> <li>Develop attributed compu</li></ul>	[5581] Command and Control	Command and Control (C2) Technology 14,542 19,647 12,172 14,550 14,080 23,242 24,293 24,778 Continuing							Continuing			
Project 5581         Page 14 of 15 Pages         Exhibit R-2A (PE 0602702F)	<ul> <li>(U) A. <u>Mission Descriptio</u></li> <li>processing and presentation while reducing the cost of c improvements in military dd distributed systems, data ba</li> <li>(U) <u>FY 1998 (\$ in TI</u> - (U) \$4,862</li> <li>(U) \$4,760</li> <li>(U) \$4,760</li> <li>(U) \$4,920</li> <li>(U) \$14,542</li> <li>(U) <u>FY 1999 (\$ in Th</u> - (U) \$14,542</li> <li>(U) <u>FY 1999 (\$ in Th</u> - (U) \$7,128</li> <li>(U) \$6,139</li> <li>(U) \$6,148</li> <li>(U) \$232</li> <li>(U) \$19,647</li> </ul>	<ul> <li>m: The Air Force requires of information for real-computer resources in C2 ecision making. These isses, and fault tolerance results in the set isses, and fault tolerance. Developed intelligent in techniques for collable Develop architecture-and reliability with results in the set isses for the set is a source and reliability is a sourc</li></ul>	es Comman time battle n systems. W nclude colla nechanisms; information echnologies f echnology for formation te prative intell centered tec duced suppo omputing an cal storage r for SBIR.	d and Contro nanagement. Vork in this p borative inte and knowle a technologie to support m or distributed echnologies i igent system hnology that ort cost. d database t nultimedia d	of (C2) techr Technolog project focus elligent agen dge-based te es for real-th odeling and computing including pr s. provides ea echnology in latabase mar	iologies whi ies being de es on develo t, planning, a echnologies, me battle ma analysis of e and databas eplan-to-read usier-to-desig ncluding coll nagement sys	ch provide the veloped in the ping advance and scheduli systems, and unagement and evolvable sole e technology ct planning to gn and easier laborative we	ne next gene nis project w ed C2 comp ng technolog d data bases. nd command ftware and p v using cluste echnology fr -to-maintain orkspaces sh	ration of we rill increase of uter softwar gies. The pro- d and contro arallel proce er technique for noncontin n software for nared across	apon system capability, que systems ca oject develo l including fue essing system s. nuous planni or increased of a distributed	is with impr uality, and r pable of pro ps technolo ull-dialog m ns. ng and tools capability, q	oved reliability oviding vast gy for nan-
	Project 5581				Page 14 of	<sup>15</sup> Pages			Exhibi	t R-2A (PE	0602702F	)

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)						
BUDGET ACTIVITY 2 - Applied Researd	ch	PE NUMBER AND TITLE 0602702F Command,Control, (C3)	and Communication 5581				
(U) <u>FY 2000 (\$ in TI</u> – (U) \$5,816 – (U) \$1,046 – (U) \$5,310 – (U) \$12,172	housands): Develop intelligent information technologies includi Develop high performance knowledge base technolog Investigate, analyze, and develop intelligent informa information, access, and assurance mechanisms base Total	ng planning technology for coalition Comm gy for coordination and cooperative use of ac tion management and user interface systems d on C2 application parameters.	and and Control (C2). erospace C2 resources. s that tailor visualization strategies,				
(U) <u>FY 2001 (\$ in T</u> – (U) \$6,263 – (U) \$1,963 – (U) \$6,324 – (U) \$14,550	housands): Demonstrate intelligent information technologies for collaborative systems and agents. Continue to develop high performance knowledge ba Investigate, analyze, and develop reconfiguration me quality of service parameters. Total	real-time battle management and C2 for tir se technology for coordination and cooperat chanisms to adapt an intelligent informatior	me-critical air operations, including tive use of aerospace C2 resources. n system to varying crisis levels based on				
(U) <b>B.</b> <u>Project Change S</u> within the Science and Tec	Summary - Description of Significant Changes: Chan Chnology (S&T) Program.	ges to this program since the previous Presi	ident's Budget are due to higher priorities				
(U) C. <u>Other Program F</u>	Sunding Summary:						
(U) <u>Related Activitia</u> – (U) PE 06036171 – (U) PE 06037281 – (U) PE 06037891 – (U) PE 03034011 – (U) This project	es: F, C3 Applications. F, Advanced Computing Technology. F, C3 Advanced Development. F, Communications-Computer Systems (C-CS) Security has been coordinated through the Reliance process to ha	RDT&E. armonize efforts and eliminate duplication.					
(U) D. <u>Acquisition Strat</u>	egy: Not Applicable.						
(U) E. <u>Schedule Profile</u> :	Not Applicable.						
Project 5581	Page	15 of 15 Pages	Exhibit R-2A (PE 0602702F)				
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PE TITLE: Dual Use Science & Technology

RDT&E BUDGET	ITEM JU	STIFICA	TION S	HEET (R	R-2 Exhi	bit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 2 - Applied Research			PE N <b>06</b>	UMBER AND 02805F	TITLE Dual Use	Science	& Techn	ology	F Z	PROJECT <b>4770</b>
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
4770 Dual Use Science and Technology (S&T)	0	9,961	17,927	17,841	17,735	17,726	18,095	18,472	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0
advantageous to both the Air Force and industry. Technology (S&T) way of doing business. A ket to the development effort. Specific projects are of Section 804, Other Transactions Authority, as pa contracting practices. Dual use technology was p Program (TRP) (FY 1993-96) and then under the responsibility for DUAP from DARPA to the Ser Support Savings Initiative (COSSI), were split an FY 1999, Congress reduced this program by \$9.0 (U) <u>FY 1998</u> : Not Applicable. (U) <u>FY 1999 (\$ in Thousands)</u> : -(U) \$2,000 Develop air vehicl vehicles. Areas of -(U) \$2,556 Develop informati and awareness. Ar environment devel -(U) \$5,069 Develop space tech systems. Areas of -(U) \$336 Identified as a sou -(U) \$9,961 Total	One of the pr y component o letermined thro rt of the Dual Dual Use App vices Dual Use d transferred i million which the technologies research inclu on technologie reas of research opment. mologies that research inclu rce for SBIR.	ogram's goa f the program ough annual Use S&T pro- led by the De- plication Pro- e programs. nto Service ( n explains the that extend t de improving s that improv- n include inter- will reduce the de improved	Is is to incom n is the cost competitive ogram in ord offense Advar gram (DUA The two exists) 5.2 and 6.4 He perceived the perceived the life and i g flight cont we the capab elligent inform ne cost and i space vehic	rporate dual sharing requ solicitation( ler to educate need Researc P) (FY 1997 sting DUAP PEs, respecti increase in F rol, lightwei ility of both rmation syste le survivabil	use technolo nirement fron s). Another e the Air For ch Projects A -98). In FY efforts, Dua vely. This F Y 2000 and performance ght structure aerospace co ems, commu capability of ity, space ve	gy as part of n both indus goal is to uti ree S&T wor agency (DAF 7 1997, the d l Use S&T ( PE is the DU out. out.	f the standard try and labo ilize FY 199 kforce in no RPA), first u lecision was DU S&T) an S&T effort Force and co electronics, a control, and tems, inform rce and com l, and space-	d Air Force 3 ratory which 7 Defense A on-traditional nder the Tec made to beg nd Commerci for the Air F on the Air F on the Air F and vehicle s d commercial nation fusion umercial space based sensin	Science and affirms con uthorization or commerce hnology Rei in transferrin ial Operation Force. Note: vorce. Note: l communica , and collabor se vehicles an g.	nmitment Act cial nvestment ng ns and In r ations orative nd launch

Project 4770

Page 1 of 3 Pages

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RD	T&E BUDGET ITEM JUSTIFICATION	N SHEET (R-2 Exhibit)	DATE February 1999
BUDGET ACTIVITY 2 - Applied Resea	rch	PE NUMBER AND TITLE 0602805F Dual Use Science & Techne	PROJECT 4770
<ul> <li>(U) <u>FY 2000 (\$ in</u></li> <li>- (U) \$8,000</li> <li>- (U) \$5,000</li> <li>- (U) \$4,927</li> <li>- (U) \$17,927</li> </ul>	<u>Thousands</u> ): Develop air vehicle technologies that extend the life and Areas of research include improving flight control, light Develop information technologies that improve the capa awareness. Areas of research include intelligent inform environment development. Develop space technologies that will reduce the cost and systems. Areas of research include improved space vehi Total	I improve the performance of both Air Force and comp tweight structures, common electronics, and vehicle su ability of both aerospace command and control, and co ation systems, communication systems, information fu d improve the capability of both Air Force and comme icle survivability, space vehicle control, and space-bas	nercial fixed wing air vehicles. bsystems. mmercial communications and usion, and collaborative rcial space vehicles and launch ed sensing.
<ul> <li>(U) <u>FY 2001 (\$ in</u></li> <li>(U) \$8,500</li> <li>(U) \$4,500</li> <li>(U) \$4,841</li> <li>(U) \$17,841</li> </ul>	<u>Thousands</u> ): Develop air vehicle technologies that extend the life and Areas of research include improving flight control, light Develop information technologies that improve the capa awareness. Areas of research include intelligent inform environment development. Develop space technologies that will reduce the cost and systems. Areas of research include improved space vehi Total	I improve the performance of both Air Force and comp tweight structures, common electronics, and vehicle su ability of both aerospace command and control, and co ation systems, communication systems, information fu I improve the capability of both Air Force and comme icle survivability, space vehicle control, and space-bas	nercial fixed wing air vehicles. bsystems. mmercial communications and usion, and collaborative rcial space vehicles and launch ed sensing.
Project 4770	Pag	e 2 of 3 Pages Exhib	it R-2 (PE 0602805F)
		174	

RDT&E BUDGET ITEM JU	STIFICATIO	N SHEET	(R-2 Exhib	DATE Febru	DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AN 0602805F	ID TITLE Dual Use S	cience & Teo	chnology	PROJECT <b>4770</b>	
(U) B. <u>Budget Activity Justification</u> : This program is in Bu utility of evolutionary and revoultionary technologies.	dget Activity 2, A	oplied Research,	since it develops	s and determines t	he technical feasibilit	y and military	
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :							
	<b>FW</b> 1000	<b>TH</b> 1000			Total		
(II) Drawing Dravidart's Dudrat/EV 1000 DD	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u> 18 252	<u>FY 2001</u>	<u>Cost</u>		
(U) Previous President's Budget/FY 1999 PB (U) Appropriated Value	0	19,606	18,255	18,180	Cont		
(U) Adjustments to Appropriated Value	0	10,000			0		
a. Congressional/General Reductions		-39					
b. SBIR							
c. Omnibus/Other Above Threshold Reprogrammings							
d. Below Threshold Reprogrammings							
(U) Adjustments to Budget Year Since FY 1999 PB			-326	-339			
(U) Current Budget Submit/FY 2000 PB	0	9,961	17,927	17,841	Cont		
FY 1999: \$336 identified as a source for SBIR.							
(U) D. Project Change Summary - Description of Significa	nt Changes: Not	Applicable.					
(U) E. <u>Other Program Funding Summary</u> :							
(U) <u>Related Activities</u> :							
– (U) This project will be coordinated through the Rel	iance process to ha	rmonize efforts	and eliminate du	plication.			
(U) F. <u>Aquisition Strategy</u> : Not Applicable.							
(U) G. <u>Schedule Profile</u> : Not Applicable.							
Project 4770	ת	a 2 of 2 D		F	white D 2 (DE 060)		
Project 4770	Pa	ge 5 of 5 Pages				20036)	

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PE TITLE: Logistics Systems Technology

RDT&E BUDGET IT	TION S	)N SHEET (R-2 Exhibit)				February 1999				
BUDGET ACTIVITYPE NUMBER3 - Advanced Technology Development060310					TITLE Logistics	Systems	s Techno	logy	F	PROJECT 2745
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2745 Logistics Performance and Support Technology	14,115	9,069	10,786	14,015	15,603	15,566	16,270	12,876	Continuing	Continuing
Quantity of RDT&E Articles	0	0	C	0	0	0	0	0	0	0

NOTE: Beginning in FY 1999, three projects (Project 2745, Logistics for Contingency Operations and Weapons Systems Support; Project 2940, Technology for Design and Maintenance; and Project 2950, Improved Logistics and Maintenance Performance) were combined into a single project (Project 2745, Logistics Performance and Support Technology). The total project costs for Project 2745 reflect this consolidation.

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates cost-effective technologies to improve the design, performance, and support of current and future weapon systems. This effort also develops technology to incorporate human operator, maintenance, and support considerations into the weapon systems design process and to make engineering, product support, and maintenance data electronically available throughout weapon systems' life cycles. The program provides more realistic logistics planning and combat capability assessment tools, provides technologies to reduce deployment airlift and footprint requirements, improves logistics information command and control and asset visibility, provides critical logistics risk reduction technology, and helps control total weapon systems' life cycle costs.

Project 2745

Page 1 of 6 Pages

Exhibit R-2 (PE 0603106F)

RDT	DATE February 1999			
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603106F Logistics	Systems Technol	ogy 2745
(U) <u>FY 1998 (\$ in Thousa</u>	<u>nds)</u> :			
– (U) \$ 2,612	Developed and demonstrated technologies to enable, technologies to repair composite and low-observable electronic technical data, software, and algorithms to assessment performance data, and completed initial	/streamline aircraft maintenar e materials in battle and accide o support the automated assess field test of damage assessme	nce processes. Field tested ent damaged aircraft. Con sment of aircraft battle da ent using paper technical of	d, documented, and transitioned ntinued development of mage. Gathered baseline orders
– (U) \$ 4,462	Developed and demonstrated tools and technologies Developed, tested, documented, and transitioned tec operations. Transitioned specific planning tools to s and operations. Began development of deployable ca safe state and minimize requirements to return hazar reliable, reconfigurable, and easily deployable multi-	to maximize efficiency and efficienc	ffectiveness of Air Force of gistics contingency plann and airlift reduction, and erials generated in deploy S. Fully defined system co uppent	operational deployments. ing, deployments, and to support beddown planning ed operation to environmentally oncept for next generation highly
- (U) \$ 5,443	Developed and demonstrated analytical tools to impro- systems. Transitioned analytical tool suites to impro- interaction between depots and their customers at the	rove efficiency of Air Force d we the efficiency and affordal e operational wings.	epot maintenance operation bility of organic depot ma	ons and logistics information intenance processes and the
– (U) \$ 1,598	Completed, demonstrated, and transitioned analysis systems acquisition, repair, and modification. Comp tools using high fidelity human models and mainten	tools to ensure tight correlation pleted and transitioned advance ance task simulations to ensure	on between specific opera ced computer-based air ve re designed-in supportabil	tional user requirements and hicle maintainability assessment ity of fielded weapon systems
– (U) \$14,115	Total		and an and the approximation	
Project 2745	Pag	e 2 of 6 Pages	Exhibi	t R-2 (PE 0603106F)
		178		

RDT	DATE February 1999		
BUDGET ACTIVITY	ology Dovelopment	PE NUMBER AND TITLE	PROJECT
5 - Auvanceu Techi	lology Development	COUSTOOF LOGISTICS Systems rech	1010gy 2745
(U) <u>FY 1999 (\$ in Th</u>	<u>ousands)</u> :		
– (U) \$2,196	Develop, demonstrate, and transition technologies to electronic technical data, algorithms, and software to aircraft damage assessors.	enable/streamline aircraft maintenance processes l o support automated assessment of battle damaged	y continuing development of a nircraft. Field test with trained
– (U) \$4,668	Develop and demonstrate tools and technologies to n continuing to develop technologies for next generati and easily deployable. Continue to develop and field Begin development of technology to provide wing co	naximize efficiency and effectiveness of Air Force of on, multi-function, modular support equipment tha d test technologies to enhance rapid contingency pl ommanders/senior logisticians with advanced infor	perational deployments by are highly reliable, reconfigurable, unning, deployments, and operations. nation and management capabilities.
– (U) \$1,453	Develop and demonstrate analytical tools by defining maintenance operations and logistics information systematics	g artificial intelligence requirements to improve effi	ciency of Air Force depot
– (U) \$ 504	Investigate technologies to demonstrate the feasibilit Status System).	y of downloading aircraft status information anytir	ne during a flight (Passive Aircraft
– (U) \$ 248	Identified as a source for SBIR.		
– (U) \$9,069	Total		
(U) <u>FY 2000 (\$ in The</u> – (U) \$ 1,036 – (U) \$ 6,568 – (U) \$ 3,182 – (U) \$10,786	Develop and demonstrate technologies to enable/stree capability to provide technicians with more effective modern aircraft and advanced aircraft systems curren Develop and demonstrate tools and technologies to n continuing development of technology to provide wi capabilities, including rapid access to real-time resou tracking. Begin development of technology to provide including identification of deployment support requi processes. Demonstrate agile/lean deployment capal modular, multi-function support equipment for fligh Develop and demonstrate analytical tools by using in aspects and operational fidelity of large-scale synthe Total	amline aircraft maintenance processes by beginnin tools for isolating faults on the software intensive, ntly in development. naximize efficiency and effectiveness of Air Force on g commanders/senior logisticians with advanced arces status information, proactive problem identified e enhanced capability for units to manage logistics rements, management of waste, medical and non-n bility, reduced airlift requirements, and reduced on- tline maintenance. ntelligent software agents and realistic human beha- tic environments and wargames.	g development of diagnostics reconfigurable systems found on operational deployments by nformation and management cation, decision support, and process resources for deployed operations edical equipment, and deployment site footprint using highly-reliable, vior models to improve the logistics
Project 2745	Pag	e 3 of 6 Pages Ex	nibit R-2 (PE 0603106F)
		1/9	

RDT&I	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Techno	logy Development	PE NUMBER AND TITLE 0603106F Logistics Systems Techno	PROJECT 2745
(U) <u>FY 2001 (\$ in Thou</u>	sands):		
– (U) \$ 1,210	Develop and demonstrate technologies to enable/s capability to provide technicians with more effection modern aircraft and advanced aircraft systems cur	streamline aircraft maintenance processes by continuin ive tools for isolating faults on the software intensive, in trently in development	g development of diagnostics reconfigurable systems found on
– (U)\$7,438	Develop and demonstrate tools and technologies to continuing development of technology to provide including identification of deployment support red deployment processes. Continue development of t and management capabilities, including rapid acco support, and process tracking. Define requirement significantly streamline cargo handling and on-log	o maximize efficiency and effectiveness of Air Force of enhanced capability for units to manage logistics resou quirements, management of waste, medical and non-m echnology to provide wing commanders/senior logistic ess to real-time resources status information, proactive its for advanced material handling equipment and soft ad/off-load operations at aerial ports and at deployed h	perational deployments by arces for deployed operations dedical equipment, and cians with advanced information problem identification, decision ware tools which will occations
- (U) \$ 3,763	Continue development of advanced modeling and in large-scale synthetic environments and wargam the supportability of space-based assets and groun	simulation technologies to improve the operational fic es. Research and develop high leverage, high-payoff d support segments of space operations.	delity and logistics representation technology concepts to improve
– (U) \$ 1,604	Develop tools and methods that automatically ger from design, engineering, and supportability analy	herate maintenance information and the associated maintenance inform	intenance/repair manuals directly
– (U) \$14,015	Total		
Project 2745	Pag	e 4 of 6 Pages Exhib	it R-2 (PE 0603106F)
		180	

PE NUMBER AND TITLE       PROJEC         - Advanced Technology Development       0603106F Logistics Systems Technology       2745         1) B. Budget Activity Justification:       This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates cost-effective shologies to improve the design, performance, and support of current and future weapon systems.       Total         (f) C. Program Change Summary (\$ in Thousands):       Total         (f) Previous President's Budget/FY 1999 PB       14,502       FY 1999         (f) Appropriated Value       15,338       9,177         (f) Adjustments to Appropriated Value       -345       Cont         (g) Communication Component of the stop o	RDT&E BUDGET ITEM JUS	DATE Febr	DATE February 1999				
<ul> <li>b. Budget Activity Justification: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates cost-effective chologies to improve the design, performance, and support of current and future weapon systems.</li> <li>c. Program Change Summary (\$ in Thousands):         <ul> <li>FY 1998</li> <li>FY 1999</li> <li>FY 2000</li> <li>FY 2001</li> <li>Cost</li> <li>Cost</li> </ul> </li> <li>D Previous President's Budget/FY 1999 PB</li> <li>14,502</li> <li>8,677</li> <li>7,883</li> <li>10,381</li> <li>Cont</li> <li>Adjustments to Appropriated Value</li> <li>a. Congressional/General Reductions</li> <li>-502</li> <li>-108</li> <li>b. SBIR</li> <li>-345</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>-999</li> <li>d. Below Threshold Reprogrammings</li> <li>-277</li> <li>Adjustments to Budget Year Since FY 1999 PB</li> <li>2,903</li> <li>3,634</li> <li>O Current Budget Submit/FY 2000 PB</li> <li>14,115</li> <li>9,069</li> <li>10,786</li> <li>14,015</li> <li>Cont</li> </ul> <li>Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile sport for the Expeditionary Aerospace Forces initiative.</li> <li>'1999: \$248 identified as a source for SBIR.</li>	BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AN 0603106F	ND TITLE Logistics S	nology	PROJECT 2745		
<ul> <li>b) C. Program Change Summary (\$ in Thousands):</li> <li>b) Previous President's Budget/FY 1999 PB</li> <li>b) Appropriated Value</li> <li>b) Appropriated Value</li> <li>congressional/General Reductions</li> <li>congressional/General Reductions</li> <li>constant of the shold Reprogrammings</li> <li>d) Below Threshold Reprogrammings</li> <li>constant of the shold Reprogrammings</li> <li>constant of the shold Reprogrammings</li> <li>d) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile sport for the Expeditionary Aerospace Forces initiative.</li> <li>c) System of the SBIR.</li> </ul>	(U) <b>B.</b> <u>Budget Activity Justification</u> : This program is in Bud technologies to improve the design, performance, and support of	lget Activity 3, A f current and futu	dvanced Techno are weapon system	logy Developmer ms.	nt, since it develop	s and demonstrates	s cost-effective
Image: TotalTotal10Previous President's Budget/FY 1999 PB14,5028,6777,88310,381Cont11Appropriated Value15,3389,17710,381Cont12Adjustments to Appropriated Value-502-108-10813SBIR-345-345-345-34514Below Threshold Reprogrammings-277-29033,63415Adjustments to Budget Year Since FY 1999 PB14,1159,06910,78614,015Cont15Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile sport for the Expeditionary Aerospace Forces initiative.TotalTotal15System of the SBIR345-345-345-345-34515Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile sport for the Expeditionary Aerospace Forces initiative345-34515System of the Expeditionary Aerospace Forces initiative345-345-34515System of the Expeditionary Aerospace Forces initiative345-345-34516Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile sport for the Expeditionary Aerospace Forces initiative34515Significant Program Changes: The adjustments in FY 2000 and FY 2001-345-345-34516Significant	(U) C. <u>Program Change Summary (\$ in Thousands)</u> :						
FY 1998FY 1999FY 2000FY 2001CostJ) Previous President's Budget/FY 1999 PB14,502 $8,677$ $7,883$ $10,381$ ContJ) Appropriated Value15,338 $9,177$ $9,177$ $10,381$ ContJ) Adjustments to Appropriated Value $-502$ $-108$ $-108$ $-345$ a. Congressional/General Reductions $-345$ $-345$ $-345$ c. Omnibus/Other Above Threshold Reprogrammings $-99$ $-277$ $-2903$ $3,634$ J) Adjustments to Budget Year Since FY 1999 PB $2,903$ $3,634$ $-108$ J) Current Budget Submit/FY 2000 PB $14,115$ $9,069$ $10,786$ $14,015$ ContJ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile sport for the Expeditionary Aerospace Forces initiative. $-1999$ : \$248 identified as a source for SBIR.						Total	
J) Previous President's Budget/FY 1999 PB       14,502       8,677       7,883       10,381       Cont         J) Appropriated Value       15,338       9,177       J       Adjustments to Appropriated Value       6         a. Congressional/General Reductions       -502       -108       -108       -108         b. SBIR       -345       -345       -345       -108         c. Omnibus/Other Above Threshold Reprogrammings       -99       -99       -99       -3,634         J) Adjustments to Budget Year Since FY 1999 PB       2,903       3,634       -01         J) Current Budget Submit/FY 2000 PB       14,115       9,069       10,786       14,015       Cont         c) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile opport for the Expeditionary Aerospace Forces initiative.       -         '1999: \$248 identified as a source for SBIR.       -       -       -		<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost	
J) Appropriated Value       15,338       9,177         J) Adjustments to Appropriated Value       -502       -108         a. Congressional/General Reductions       -502       -108         b. SBIR       -345       -345         c. Omnibus/Other Above Threshold Reprogrammings       -99       -99         d. Below Threshold Reprogrammings       -277         J) Adjustments to Budget Year Since FY 1999 PB       2,903       3,634         J) Current Budget Submit/FY 2000 PB       14,115       9,069       10,786       14,015       Cont         ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile oport for the Expeditionary Aerospace Forces initiative.       -1999: \$248 identified as a source for SBIR.	U) Previous President's Budget/FY 1999 PB	14,502	8,677	7,883	10,381	Cont	
J) Adjustments to Appropriated Value         a. Congressional/General Reductions       -502       -108         b. SBIR       -345         c. Omnibus/Other Above Threshold Reprogrammings       -99         d. Below Threshold Reprogrammings       -277         J) Adjustments to Budget Year Since FY 1999 PB       2,903       3,634         J) Current Budget Submit/FY 2000 PB       14,115       9,069       10,786       14,015       Cont         ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile oport for the Expeditionary Aerospace Forces initiative.         ' 1999: \$248 identified as a source for SBIR.	U) Appropriated Value	15,338	9,177				
a. Congressional/General Reductions       -502       -108         b. SBIR       -345         c. Omnibus/Other Above Threshold Reprogrammings       -99         d. Below Threshold Reprogrammings       -277         J) Adjustments to Budget Year Since FY 1999 PB       2,903       3,634         J) Current Budget Submit/FY 2000 PB       14,115       9,069       10,786       14,015       Cont         ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile oport for the Expeditionary Aerospace Forces initiative.       -1999: \$248 identified as a source for SBIR.	U) Adjustments to Appropriated Value						
b. SBIR -345 c. Omnibus/Other Above Threshold Reprogrammings -99 d. Below Threshold Reprogrammings -277 J) Adjustments to Budget Year Since FY 1999 PB 2,903 3,634 J) Current Budget Submit/FY 2000 PB 14,115 9,069 10,786 14,015 Cont ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile oport for the Expeditionary Aerospace Forces initiative.	a. Congressional/General Reductions	-502	-108				
c. Omnibus/Other Above Threshold Reprogrammings -99 d. Below Threshold Reprogrammings -277 J) Adjustments to Budget Year Since FY 1999 PB 2,903 3,634 J) Current Budget Submit/FY 2000 PB 14,115 9,069 10,786 14,015 Cont ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile port for the Expeditionary Aerospace Forces initiative.	b. SBIR	-345					
d. Below Threshold Reprogrammings       -277         J) Adjustments to Budget Year Since FY 1999 PB       2,903       3,634         J) Current Budget Submit/FY 2000 PB       14,115       9,069       10,786       14,015       Cont         ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile port for the Expeditionary Aerospace Forces initiative.         ' 1999: \$248 identified as a source for SBIR.	c. Omnibus/Other Above Threshold Reprogrammings	-99					
J) Adjustments to Budget Year Since FY 1999 PB       2,903       3,634         J) Current Budget Submit/FY 2000 PB       14,115       9,069       10,786       14,015       Cont         ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile port for the Expeditionary Aerospace Forces initiative.         ' 1999: \$248 identified as a source for SBIR.	d. Below Threshold Reprogrammings	-277					
J) Current Budget Submit/FY 2000 PB       14,115       9,069       10,786       14,015       Cont         ) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile port for the Expeditionary Aerospace Forces initiative.       r       1999: \$248 identified as a source for SBIR.	U) Adjustments to Budget Year Since FY 1999 PB			2,903	3,634		
) Significant Program Changes: The adjustments in FY 2000 and FY 2001 are due to increased Air Force emphasis on cognitive and logistics modeling and for agile oport for the Expeditionary Aerospace Forces initiative.	U) Current Budget Submit/FY 2000 PB	14,115	9,069	10,786	14,015	Cont	
	<ul> <li>U) Significant Program Changes: The adjustments in FY 2000 upport for the Expeditionary Aerospace Forces initiative.</li> <li>FY 1999: \$248 identified as a source for SBIR.</li> </ul>	) and FY 2001 ar	e due to increase	d Air Force emp	hasis on cognitive	and logistics mode	ling and for agile

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603106F Logistics Systems Techn	PROJECT 2745
<ul> <li>(U) D. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0207219F, Advanced Tactical Fighter.</li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0602202F, Human Effectiveness Applied Research.</li> <li>(U) PE 0603721N, Integrated Diagnostic System.</li> <li>(U) PE 0604708F, Generic Integrated Maintenance Diagnostics System</li> <li>(U) PE 0604740F, Computer Resource Management Technology.</li> <li>(U) PE 0605801A, Pollution Prevention Research and Development.</li> <li>(U) PE 0708011F, Manufacturing Technology.</li> <li>(U) PE 0708011F, Manufacturing Technology.</li> <li>(U) This project has been coordinated through the Reliance process to F</li> </ul> </li> <li>(U) E. Acquisition Strategy: Not Applicable.</li> <li>(U) F. Schedule Profile: Not Applicable.</li> </ul>	s. harmonize efforts and eliminate duplication.	ibit R-2 (PE 0603106F)
110pet 27+3 1 4)	182	

#### **PE NUMBER: 0603108F**

UNCLASSIFIED

PE TITLE: Integrated Data Systems (IDS)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										<b>February 1999</b>		
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603108F Integrated Data Systems (IDS)						PROJECT <b>4427</b>		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
4427 Integrated Maintenance Data Systems (IMDS)	19,660	0*	0*	0*	0*	0*	0*	0*	Continuing	Continuing		
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	(		

\* FY 99 and outyear funding resides within PE 0708611F, Project 4654. Following FY 98, all funds for IMDS reside within PE 0708611F. All backup and justification material associated with this program is located within that PE.

#### (U) A. <u>Mission Description :</u>

The IMDS program is an evolutionary acquisition program that is developing an Air Force standard maintenance information system. This program element integrates information systems supporting Air Force maintenance activities into a single open architecture, modern decision support system. This enhanced decision support system increases operational production capability and support system efficiency, while decreasing mobility infrastructure requirements and cost of operations. The IMDS System will be integrated with the Global Combat Support System-Air Force (GCSS-AF) Program. IMDS provides a single virtual data repository for access by all Air Force command levels. Full IMDS capability is reached through multiple increments of the application software, each increment building on the previous one. The first increment entered test at Eglin AFB July 97 after one year of development. The second increment was delevered in July 98. Operational Test wholesale-level functionality as well as continued expansion of retail capabilities.

#### (U) FY 1998 (\$ in Thousands):

- (U) \$ 16,947 IMDS system contract Increment 2 - Base level system interfaces and Beta site support.

- (U) \$ 1,275 IMDS system contract Increment 3 - Requirements definition activities.

- (U) \$ 1,226 Support Contractors (MITRE, TELCOLOTE, TEMS).
- (U) \$ 212 SPO Operations
- (U) \$ 19,660 Total

#### (U) FY 1999 (\$ in Thousands):

- (U) \$ 0 Funding resides within PE 0708611F. See description for PE 0708611F, Project 4654

#### (U) <u>FY 2000 (\$ in Thousands):</u>

- (U) \$ 0 Funding resides within PE 0708611F. See description for PE 0708611F, Project 4654

Project 4427

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Exhibit R-2 (PE 0603108F)

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RDT&E BUDGET ITEM JU	STIFICATIO	N SHEET (	R-2 Exhibi	t)	DATE Febr	uary 1999
BUDGET ACTIVITY		PE NUMBER ANI	D TITLE			PROJECT
3 - Advanced Technology Development		0603108F	Integrated D	Data System	s (IDS)	4427
(U) <u>FY 2001 (\$ in Thousands):</u> – (U) \$ 0 Funding resides within PE 070	8611F. See descrip	otion for PE 0708	611F, Project 46	54		
(U) B. <u>Budget Activity Justification</u> This program is Budget Activity 3, Advanced Technology De	velopment.					
(U) C. Program Change Summary (\$ in Thousands)						
<ul> <li>(U) Previous President's Budget FY 1999 PB</li> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value <ul> <li>a. Congressional/General Reductions</li> <li>b. SBIR</li> <li>c. Omnibus or Other Above Threshold</li> <li>Reprogramming</li> <li>d. Below Threshold Reprogramming</li> </ul> </li> <li>(U) Adjustments to Budget Years Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> </ul>	<u>FY 1998</u> 18,541 19,753 -760 -461 -148 1,276 19,660	<u>FY 1999</u> 0	<u>FY 2000</u> 0	<u>FY 2001</u> 0	Total <u>Cost</u> Continuing Continuing	
(U) Significant Program Changes: \$1.276 million in FY 98 funds were added to cover addit outyear funding resides within PE 0708611F, Project 46 associated with this program is located within that PE.	ional beta developn 54. Following FY 9	nent costs resultin 98, all funds for I	ng from the Base MDS reside with	Realignment and in PE 0708611F.	l Closure (BRAC) a All backup and ju	activity. FY 99 and stification material
Project 4427	Pa	ge 2 of 3 Pages		E	xhibit R-2 (PE 060	03108F)
		184				

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE February 1999			
BUDGET ACTIVITY			PE NU	IMBER AND T	ITLE				-	PROJECT	
3 - Advanced Technology Developme	ent		060	3108F In	tegrated	Data Sy	stems (II	DS)		4427	
(U) D. Other Program Funding Summary (\$ in '	Thousands)		•								
(U) Other Procurement AF, BA 7, P-1:55, IMDS (PE 0708611F)	<u>FY 1998</u> 1,299	<u>FY 1999</u> 956	<u>FY 2000</u> 2,681	<u>FY 2001</u> 2,646	<u>FY 2002</u> 2,646	<u>FY 2003</u> 2,605	<u>FY 2004</u> 2,660	<u>FY 2005</u> 2,720	To <u>Compl</u> Cont	Total <u>Cost</u> Cont	
Related RDT&E: (U) PE 0708611F, Project 4654, Integrated Maintenance Data System (IMDS)	0	18,645	18,632	24,806	25,607	24,514	25,025	25,546	Cont	Cont	
(U) E. <u>Acquisition Strategy</u> : All major contracts within this Program Ele	(U) E. <u>Acquisition Strategy</u> : All major contracts within this Program Element were awarded after full and open competition.										
All major contracts within this Program Element were awarded after full and open competition. (U) F. <u>Schedule Profile</u> See description for PE 0708611F, Project 4654.											
Project 4427			Page 3 of .	3 Pages			Exhib	it R-2 (PE 0	603108F)		
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PE TITLE: Advanced Materials for Weapon Systems

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Developn	PE N 06 Sy	IUMBER AND 03112F stems	TITLE Advanced	d Materia	ls for We	eapon					
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
Total Program Element (PE) Cost	25,826	32,900	25,890	25,702	23,971	25,219	25,928	27,144	Continuing	Continuing	
2100 Laser Hardened Materials	9,205	10,959	11,242	11,260	11,675	11,947	12,197	12,451	Continuing	Continuing	
3153 Non-Destructive Inspection Development	6,383	4,492	4,352	3,890	4,038	4,412	4,759	5,108	Continuing	Continuing	
3946 Materials Transition	10,238	17,449	10,296	10,552	8,258	8,860	8,972	9,585	Continuing	Continuing	
Quantity of RDT&E Articles	0	0	C	0 0	0	0	0	0	0	0	

(U) A. <u>Mission Description</u>: This Advanced Technology Development program demonstrates materials technology options for application into Air Force weapon systems. Developing materials technologies for the broadband laser protection of aircrews and sensors from a variety of threats is a high priority of the Air Force. The Non-Destructive Inspection/Evaluation (NDI/E) techniques for fighter, bomber, and transport aircraft are critical to the logistics centers as well as the operational fleet as the service lives of these systems increase. This program provides critical data for prospective users to make engineering decisions on both structural and non-structural materials for air and space. Reducing risk in materials technology improves the affordability, supportability, survivability, and operational performance of current and future warfighting systems. Note: In FY 1999, Congress added \$3.0 million for the Aerospace Metals Program, \$5.0 million for the National Center for Industrial Competitiveness, and \$4.0 million for advanced low-observable coatings which explains the perceived decrease in FY 2000 and out.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Page 1 of 11 Pages

Exhibit R-2 (PE 0603112F)
RDT&E BUDGET ITEM JUS	DATE Februar	y 1999				
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AN 0603112F Systems	ID TITLE Advanced	Materials for V	Weapon		
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					Total	
	FY 1998	FY 1999	FY 2000	FY 2001	Cost	
(U) Previous President's Budget/FY 1999 PB	26,503	21,006	22,629	22,792	Cont	
(U) Appropriated Value	28,096	33,006				
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-952	-106				
b. SBIR	-565					
c. Omnibus/Other Above Threshold Reprogrammings	-181					
d. Below Threshold Reprogrammings	-572					
(U) Adjustments to Budget Year Since FY 1999 PB			3,261	2,910		
(U) Current Budget Submit/FY 2000 PB	25,826	32,900	25,890	25,702	Cont	

(U) Significant Program Changes: The adjustments in FY 2000 and FY 2001 reflect increased emphasis on implementation of Integrated Product Process Development (IPPD) and support of Air Expeditionary Force (AEF) operations.

FY1999: \$977 identified as a source for SBIR.

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Exhibit R-2 (PE 0603112F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Techr	PE N 06 Sy	UMBER AND 03112F stems	TITLE Advanced	d Materia	lls for We	apon	F	PROJECT 2100			
COST (\$ )	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2100 Laser Hardened Materia	Is	9,205 10,959 <sup>2</sup>			11,260	11,675	11,947	12,197	12,451	Continuing	Continuing
(U) A. <u>Mission Description</u> against laser radiation. The         any nation. Survivability sc         capable of countering a spec         demonstrated to provide har         (U) <u>FY 1998 (\$ in Th</u> - (U) \$1,360         - (U) \$3,914         - (U) \$3,931         - (U) \$9,205         (U) <u>FY 1999 (\$ in Th</u> - (U) \$1,563         - (U) \$4,563         - (U) \$4,507	10. Easer Hardened Materials       9,205       10,999       11,242       11,260       11,675       11,947       12,197       12,451       Continuing       Continuing         1) A. Mission Description:       This project develops new materials and concepts for protecting Air Force assets such as aircrews, munitions, sensors, and structures jainst laser radiation. The goal is to ensure mission capability before, during, and after laser exposure. The world laser market is rapidly expanding with easy export to y nation. Survivability solutions must account for a variety of lasers facing a mission. Current protection schemes are activated by intensity or color and are only upable of countering a specific portion of the laser threat. To harden systems against all potential lasers, a combination of approaches is required. Concepts are smonstrated to provide hardening options for transition to Air Force systems.         (U) FY 1998 (§ in Thousands):       – (U) \$1,360       Developed and demonstrated advanced materials technologies that enhance laser hardening of Air Force aircrews to ensure safety and to ensure safety, survivability, and operability in a laser threat environment.       – (U) \$3,914       Developed and demonstrated advanced materials technologies that enhance laser hardening for sensors, avionics, and components to increase survivability and mission effectiveness of electronic systems.         – (U) \$3,931       Developed and demonstrate advanced materials technologies that enhance laser hardening of Air Force aircraft and spacecraft structures to ensure safety, survivability, and operability in a laser threat environment.         – (U) \$9,205       Total         (U) FY 1999 (§ in Thousands): </th										
- (U) \$326	Identified as a source	for SBIR.		tronic syste							
- (0) \$10,959 Project 2100	10(21			Page 3 of	f 11 Pages			Exhibi	t R-2A (PE	0603112F)	,

RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603112F Advanced Materia Systems	PROJECT 2100
(U) <u>FY 2000 (\$ in T</u>	housands):		
– (U) \$1,654	Develop and demonstrate advanced materials techno ensure safety survivability and operability in a laser	logies that enhance laser hardening of Ai	r Force aircraft and spacecraft structures to
- (U) \$4,823	Develop and demonstrate advanced materials techno ciances and an accurate advanced materials techno	logies that enhance laser hardening for A	ir Force aircrews to ensure safety and to enable
– (U) \$4,765	Develop and demonstrate advanced materials techno survivability and mission effectiveness of electronic s	logies that enhance laser hardening for se	ensors, avionics, and components to increase
- (U) \$11,242	Total		
(U) <u>FY 2001 (\$ in T</u>	nousands):		
– (U) \$1,656	Develop and demonstrate advanced materials techno ensure safety, survivability, and operability in a laser	logies that enhance laser hardening of Ai threat environment.	r Force aircraft and spacecraft structures to
- (U) \$4,832	Develop and demonstrate advanced materials techno aircrews to perform required missions in a laser thre	logies that enhance laser hardening for A at environment.	ir Force aircrews to ensure safety and to enable
– (U) \$4,772	Develop and demonstrate advanced materials techno survivability and mission effectiveness of electronic s	logies that enhance laser hardening for se	ensors, avionics, and components to increase
- (U) \$11,260	Total		
Project 2100	Page	e 4 of 11 Pages	Exhibit R-2A (PE 0603112F)

RDT&E BUDGET ITEM JUSTI	FICATION SHEET (R-2A Exhil	bit) DATE February 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Systems	Materials for Weapon 2100
(U) B. <u>Project Change Summary - Description of Significant</u> (	Changes: Not Applicable.	
(U) C. <u>Other Program Funding Summary</u> :		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602202F, Human Effectiveness Applied Resear</li> <li>(U) PE 0603231F, Crew Systems and Personnel Protecti</li> <li>(U) PE 0604706F, Life Support System.</li> <li>(U) Coordinated through the Tri-Service Laser Hardenin</li> <li>(U) Coordinated through the Tri-Service Laser Hardenin</li> <li>(U) This project has been coordinated through the Relia</li> </ul> (U) D. <u>Acquisition Strategy</u> : Not Applicable. (U) E. <u>Schedule Profile</u> : Not Applicable.	rch. on Technology. ng Materials and Structures Working Group and nce process to harmonize efforts and eliminate of	the Joint Service Agile Laser Eye Protection Program. huplication.
Project 2100	Page 5 of 11 Pages	Exhibit R-2A (PE 0603112F)
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE Fe	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Tech	PE N 06 Sy	UMBER AND TO A STEERS	TITLE Advanced	l Materia	ls for We	apon	F	PROJECT 3153			
COST (\$	In Thousands)	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
3153 Non-Destructive Inspec	ction Development	6,383	4,492	4,352	3,890	4,038	4,412	4,759	5,108	Continuing	Continuin
(c) At <u>Encoded Percentipul</u> integrity and to detect failu manufacturing, and mainte NDI/Es faster than current reliability and cost-effectiv (U) <u>FY 1998 (\$ in TH</u> - (U) \$5,385 - (U) \$320 - (U) \$678 - (U) \$678 - (U) \$6,383 (U) <u>FY 1999 (\$ in TH</u> - (U) \$2,939 - (U) \$592 - (U) \$592 - (U) \$828 - (U) \$133 - (U) \$4,492	<ul> <li>Develops and definition</li> <li>re causing conditions in v nance practices. Reduction</li> <li>capability. This project p</li> <li>eness at field and depot means</li> <li>Developed advanced to</li> <li>reduce operation and means</li> <li>Developed advanced in</li> <li>performance and survi</li> <li>Developed advanced to</li> <li>maintenance to reduce</li> <li>Total</li> <li>Develop advanced tech</li> <li>reduce operation and means</li> <li>performance and survi</li> <li>Develop advanced tech</li> <li>reduce operation and means</li> <li>Develop advanced tech</li> <li>reduce operation and means</li> <li>Develop advanced tech</li> <li>reduce operation and means</li> <li>Develop advanced tech</li> <li>reduce cost and incrision</li> <li>Identified as a source for the field and survi</li> </ul>	lopment         6.383         4.492         4.352         3.890         4.038         4.412         4.759         5.108         Continuing         C           relops and demonstrates advanced Non-Destructive Inspection/Evaluation (NDI/E) methods and procedures to monitor performant is conditions in weapon systems components and materials. NDI/E capabilities greatly influence and/or limit many designs, actices. Reduction in the number of fighter wings and the need for rapid sortic generation demand an ability to perform real-time is. Reduction in the number of sighter wings and the need for rapid sortic generation demand an ability to perform real-time is. This project provides technology to satisfy critical Air Force requirements to extend lifetimes of current systems through increat field and depot maintenance levels, as well as assuring manufacturing quality, integrity, and safety requirements.           §2:         loped advanced technologies for improved capabilities in materials corrosion and fatigue monitoring and testing of aging aircraft to re operation and maintenance costs and to guarantee full operability and space systems.         loped advanced inspection technologies supporting low-observable and space systems.           loped advanced technologies for improved NDI/E capabilities in materials and process testing, monitoring, inspection, and tenance to reduce cost and increase reliability of advanced materials.           §2:         lop advanced technologies for improved capabilities in materials corrosion and fatigue monitoring and testing of aging aircraft to re operation and maintenance costs and to guarantee full operability and safety of the aircraft fleet.           lop advanced technologies suporting low-observable and space s								time ncreased raft to 't to	

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)						
BUDGET ACTIVITY 3 - Advanced Tech	3UDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603112F Advanced Materials for Weater         Systems       Systems						
(U) FY 2000 (\$ in T - (U) \$1,560 - (U) \$2,170 - (U) \$622 - (U) \$4,352 - (U) \$4,35	<u>Thousands</u> ): Develop advanced technologies for improved capabi reduce operation and maintenance costs and to guara Develop advanced inspection technologies supporting performance and survivability of low-observable syst Develop advanced technologies for improved Non-D monitoring, inspection, and maintenance to reduce co Total	lities in materials corrosion and fatigue monitoring intee full operability and safety of the aircraft fleet. g low-observable and space systems to enhance affo tems and rapid turnaround of space systems. Destructive Inspection/Evaluation (NDI/E) capabilition ost and increase reliability of advanced materials.	and testing of aging aircraft to rdability and ensure full es in materials and process testing,				
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:         <ul> <li>(U) \$1,439</li> <li>Develop advanced technologies for improved capabilities in materials corrosion and fatigue monitoring and testing of aging aircraft to reduce operation and maintenance costs and to guarantee full operability and safety of the aircraft fleet.</li> <li>(U) \$1,849</li> <li>Develop advanced inspection technologies supporting low-observable and space systems to enhance affordability and ensure full performance and survivability of low-observable systems and rapid turnaround of space systems.</li> <li>(U) \$602</li> <li>Develop advanced technologies for improved NDI/E capabilities in materials and process testing, monitoring, inspection, and maintenance to reduce cost and increase reliability of advanced materials.</li> <li>(U) \$3,890</li> <li>Total</li> </ul> </li> </ul>							
<ul> <li>(U) B. <u>Project Change</u></li> <li>(U) C. <u>Other Program</u></li> <li>(U) <u>Related Activiti</u></li> <li>(U) PE 0602102</li> <li>(U) This project</li> </ul>	<ul> <li>(U) B. Project Change Summary - Description of Significant Changes: Not Applicable.</li> <li>(U) C. Other Program Funding Summary: <ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602102F, Materials.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication</li> </ul> </li> </ul>						
<ul> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>							
Project 3153	Page	e 7 of 11 Pages Exh	ibit R-2A (PE 0603112F)				
		193					

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE Fe	DATE February 1999		
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603112F Advanced Materials for Systems								ls for We	apon		PROJECT <b>3946</b>	
COST (\$ In <sup>-</sup>	Thousands)	FY 1998 Actual	FY 1998FY 1999FY 2000FY 2001FY 2002FY 2003FY 2004ActualEstimateEstimateEstimateEstimateEstimateEstimate							FY 2005 Estimate	Cost to Complete	Total Cost
3946 Materials Transition		10,238	17,449	10	),296	10,552	8,258	8,860	8,972	9,585	Continuing	Continuing
3946       Materials Transition       10.238       17.449       10.296       10.552       8.258       8.860       8.972       9.585       Continuing       Continuing         (U)       A. Mission Description:       Develops data to accelerate the time to scale-up new defense-related materials and achieve their acceptance by designers. The goal is to reduce risk, improve confidence, and reduce cost of the incorporation of new materials into weapons, airframes, engines, and space applications. Advanced materials and related processes that have matured beyond applied research are characterized and critical data is developed to reduce the risk of demonstrating these technologies in Air Force applications. Critical evaluations of materials in the proposed design environment are performed. This design and scale-up data provides confidence to transition new materials to upgrades and future Air Force systems as well as provide the initial incentive for their industrial development.         (U)       FY 1998 (§ in Thousands):       - (U)       \$6,897       Developed technologies and databases to facilitate timely transition of advanced materials for high power radars, space-based sensors, and infrared countermeasure materials to warfighters, industry, and academia.       - (U)       \$10,238       Total         (U)       FY 1999 (§ in Thousands):       - (U)       \$10,238       Total         (U)       FY 1999 (§ in Thousands):       - (U)       \$10,238       Total         (U)       \$10,238       Total       Develope technologies and databases to facilitate timely transition of advanced stru												
Project 3946				Page	<u>8 of 11</u>	1 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0603112F)</u>	)

RDT	DATE Febr	<b>February 1999</b>							
BUDGET ACTIVITY 3 - Advanced Tech	Budget Activity       PE NUMBER AND TITLE         B - Advanced Technology Development       0603112F Advanced Materials for V         Systems       Systems								
(U) FY 2000 (\$ in Tl	nousands):								
- (U) \$1,356	Develop advanced materials technologies for air vehi	cles and subsystems to enhance lift,	propulsion, and low-observable p	performance and					
- (U) \$3,486	affordability of manned and unmanned air vehicles. Develop advanced materials technologies for space v improved access to space	ehicles and subsystems to provide e	nhanced surveillance and sensing	capabilities and					
– (U) \$1,408	\$1,408 Develop advanced materials technologies that enhance sustainability of Air Force air and space systems to lower operations and maintenance costs and to ensure full operability and safety of aircraft and personnel.								
– (U) \$1,156	Develop methods, processes, and technologies that su concepts into the Science and Technology (S&T) env engineer population.	ipport the continued implementation vironment by expanding education a	n of Integrated Product Process Do and training across a large Air For	evelopment (IPPD) ce scientist and					
– (U) \$2,890	Develop technologies (i.e., utilities and shelters) that improve air mobile systems performance and reduce airlift requirements in support of Air Expeditionary Force (AEF) operations.								
- (U) \$10,296	Total								
(U) FY 2001 (\$ in Th	nousands):								
– (U) \$1,376	Develop advanced materials technologies for air vehi affordability of manned and unmanned air vehicles.	cles and subsystems to enhance lift,	propulsion, and low-observable p	performance and					
– (U) \$3,656	Develop advanced materials technologies for space v improved access to space.	ehicles and subsystems to provide e	nhanced surveillance and sensing	capabilities and					
– (U) \$1,494	Develop advanced materials technologies that enhance costs and to ensure full operability and safety of aircr	ce sustainability of Air Force air and raft and personnel.	l space systems to lower operation	ns and maintenance					
– (U) \$1,156	Develop methods, processes, and technologies that su expanding education and training across a large Air	apport the continued implementation Force scientist and engineer popula	n of IPPD concepts into the S&T of tion.	environment by					
– (U) \$2,870	Develop technologies (i.e., utilities and shelters) that AEF operations	improve air mobile systems perform	nance and reduce airlift requirement	ents in support of					
- (U) \$10,552	Total								
Project 3946	Page	e 9 of 11 Pages	Exhibit R-2A (PE 06	03112F)					

BUDGET ACTIVITY     PE NUMBER AND TITLE     PROJECT       3 - Advanced Technology Development     D603112F Advanced Materials for Weapon     3946       (U) (U) B. Eroiect Change Summary - Description of Significant Changes:     Changes to this project since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.     Changes to this project since the previous President's Budget are due to higher priorities       (U) C. Other Program Funding Summary:     (U) Related Activities     Changes to this project since the previous President's Budget are due to higher priorities       (U) PE 0002102F, Materials.     (U) PE 0002102F, Materials.     (U) PE 000321F, Acrospace Structures.       (U) PE 0003203F, Advanced Aerospace Sensors.     (U) PE 0003216F, Aerospace Sensors.     (U) PE 0003216F, Aerospace Propulsion and Power Technology.       (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.     (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.	RDT&E BUDGET ITEM JUSTIFICATIO	N SHEET (R-2A Exhibit)	DATE February 1999
<ul> <li>(U) (U) B. Project Change Summary - Description of Significant Changes: Changes to this project since the previous President's Budget are due to higher priorities within the Science and Technology (S&amp;T) Program.</li> <li>(U) C. Other Program Funding Summary: <ul> <li>(U) Related Activities:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0603202F, Aerospace Propulsion Subsystem Integration.</li> <li>(U) PE 0603202F, Aerospace Propulsion and Power Technology.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul> </li> <li>Project 3946 Page 10 of 11 Pages Exhibit R-2A (PE 0603112F)</li> </ul>	BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced Materials for Systems	PROJECT 3946
(U) C. Other Program Funding Summary:         (U) Related Activities:         - (U) PE 0603202F, Aerospace Structures.         - (U) PE 0603202F, Aerospace Sensors.         - (U) PE 0603202F, Aerospace Propulsion and Power Technology.         - (U) PE 0603216F, Aerospace Propulsion and Power Technology.         - (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.         - (U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.	(U) (U) B. <u>Project Change Summary - Description of Significant Changes</u> within the Science and Technology (S&T) Program.	Changes to this project since the previous Presider	nt's Budget are due to higher priorities
Project 3946 Page 10 of 11 Pages Exhibit R-2A (PE 0603112F)	<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0603201F, Aerospace Structures.</li> <li>(U) PE 0603202F, Aerospace Propulsion Subsystem Integration.</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0603216F, Aerospace Propulsion and Power Technology.</li> <li>(U) This project has been coordinated through the Reliance process to</li> </ul> </li> </ul>	harmonize efforts and eliminate duplication.	
	Project 3946 Pa	ge 10 of 11 Pages Ex	whibit R-2A (PE 0603112F)

RDT&E BUDGET ITEM JUST	it) DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603112F Advanced M Systems	PROJECT Aterials for Weapon 3946
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 3946	Page 11 of 11 Pages	Exhibit R-2A (PE 0603112F)

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PE TITLE: Aerospace Propulsion Subsystem Integration

RDT&E BUDGET IT		February 1999								
BUDGET ACTIVITY 3 - Advanced Technology Developm	e Propul	sion Sub	system	F	PROJECT 668A					
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
668A Aircraft Propulsion Subsystem Integration	22,253	27,722	29,825	31,022	25,495	20,027	13,766	14,197	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0
(U) A. <u>Mission Description</u> : This Advanced Tec broad range of aircraft. The Aircraft Propulsion St (JTDE) for manned systems and the Joint Expenda engines apply the core technology developed under component technology such as low pressure fans a	chnology Dev ubsystem Inte ble Turbine r the Advanc nd low press	velopment pr egration (AP Engine Cond ed Turbine I ure turbines	rogram deve 'SI) program cept (JETEC Engine Gas ( (LPT), engij	Plops and der includes de () for uninha Generator (A ne controls, a	nonstrates g emonstrator ( bited air veh (TEGG) prog and nozzles)	as turbine pr engines such hicle and cru gram coupled developed as	opulsion system as the Joint ise missile and d with afford s part of APS	stem technol Technology pplications. dable and du	ogies applica Demonstra These demo rable system gram also fo	able to a tor Engine onstrator u cuses on

component technology such as low pressure fans and low pressure turbines (LPT), engine controls, and nozzles developed as part of APSI. This program also focuses on system integration aspects of inlets, nozzles, engine/airframe compatibility, and low-observable technologies. APSI will provide aircraft with potential for longer range and higher cruise speed with lower specific fuel consumption; surge power for successful engagements; high sortie rates with reduced maintenance; reduced life cycle cost; and improved survivability resulting in increased mission effectiveness. The APSI program supports the demonstration of performance, cost, and durability goals of the Integrated High Performance Turbine Engine Technology (IHPTET) program. IHPTET is a three phase, totally integrated DOD, Defense Advanced Research Projects Agency (DARPA), National Aeronautics and Space Administration (NASA), and industry initiative focused on doubling turbine engine propulsion capabilities while reducing cost of ownership. The IHPTET program structure provides continuous technology transition for military turbine engine upgrades and derivatives and has the added benefit of enhancing the U.S. turbine engine industry's international competitiveness.

#### (U) <u>FY 1998 (\$ in Thousands)</u>:

- (U) \$4,733 Designed, fabricated, and demonstrated durability and integration technology for turbofan/turbojet engines for improved supportability and affordability of current and future Air Force aircraft.
- (U) \$13,606 Designed, fabricated, and tested technology demonstration engines for improved performance and fuel consumption of turbofan/turbojet engines for fighters, aircraft, bombers, and transports.
- (U) \$3,914 Designed, fabricated, and tested technology demonstration engines for improved performance, durability, and affordability of engines for missile and uninhabited air vehicle applications.
- (U) \$22,253 Total

Proi	iect	668A
- FIO	ect	UUOA

RDT	&E BUDGET ITEM JUSTIFICATION	N SHEET (R-2 Exhibit)	February 1999		
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603202F Aerospace Propulsion Sub Integration	PROJECT System 668A		
(U) FY 1999 (\$ in Th	nousands):				
- (U) \$3,613	Design, fabricate, and demonstrate controls technolo	gy for turbofan/turbojet engines for improved perform	ance and reduced maintenance of		
- (U) \$8,830	Design, fabricate, and demonstrate durability and int affordability of current and future Air Force aircraft.	tegration technology for turbofan/turbojet engines for i	mproved supportability and		
- (U) \$9,848	Design, fabricate, and test technology demonstration	engines for improved performance and fuel consumption	tion of turbofan/turbojet engines		
- (U) \$4,551	Design, fabricate, and test technology demonstration and uninhabited air vehicle applications.	engines for improved performance, durability, and after	fordability of engines for missile		
- (U) \$880	Indentified as a source for SBIR.				
- (U) \$27,722	Total				
(U) <u>FY 2000 (\$ in TH</u> - (U) \$4,350 - (U) \$20,864 - (U) \$4,611	<u>housands</u> ): Design, fabricate, and demonstrate durability and int affordability of current and future Air Force aircraft. Design, fabricate, and test advanced component techn for fighters, aircraft, bombers, and transports. Design, fabricate, and test advanced component techn and uninhabited air vehicle applications.	egration technologies for turbofan/turbojet engines for nologies for improved performance and fuel consumpt nologies for improved performance, durability, and aff	improved supportability and ion of turbofan/turbojet engines fordability of engines for missile		
- (U) \$29,825	Total				
(U) <u>FY 2001 (\$ in Th</u>	nousands):				
– (U) \$5,522	Design, fabricate, and demonstrate durability and int affordability of current and future Air Force aircraft.	egration technologies for turbofan/turbojet engines for	improved supportability and		
– (U) \$19,896	Design, fabricate, and test advanced component techn for fighters, aircraft, bombers, and transports.	nologies for improved performance and fuel consumpt	ion of turbofan/turbojet engines		
– (U) \$5,604	Design, fabricate, and test advanced component techn and uninhabited air vehicle applications.	nologies for improved performance, durability, and aff	ordability of engines for missile		
- (U) \$31,022	Total				
Project 668A	Pag	e 2 of 4 Pages Exhib	it R-2 (PE 0603202F)		

RDT&E BUDGET ITEM JUS	TIFICATIO	N SHEET (	(R-2 Exhib	it)	DATE Febru	February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development	Subsystem	PROJECT 668A						
(U) B. <u>Budget Activity Justification</u> : This program is in Bud existing system upgrades and/or new system developments that	get Activity 3, A have military uti	dvanced Technol lity and address v	logy Developme warfighter needs.	nt, since it develop	s and demonstrates to	echnologies for		
<ul> <li>(U) C. <u>Program Change Summary (\$ in Thousands)</u>:</li> <li>(U) Previous President's Budget/FY 1999 PB</li> </ul>	<u>FY 1998</u> 23.378	<u>FY 1999</u> 30.814	<u>FY 2000</u> 31.616	<u>FY 2001</u> 32.620	Total <u>Cost</u> Cont			
<ul> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value</li> <li>a. Congressional/General Reductions</li> <li>b. SBIR</li> </ul>	24,785 -810 -611	27,814 -92	21,010	,	com			
<ul> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>d. Below Threshold Reprogrammings</li> <li>(U) Adjustments to Budget Years Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> </ul>	-159 -952 22,253	27,722	-1,791 29,825	-1,598 31,022	Cont			
<ul> <li>(U) (U) Significant Program Changes: Changes to this program (S&amp;T) Program.</li> <li>FY 1999: \$880 indentified as a source for SBIR</li> </ul>	n since the previ	ous President's E	Budget are due to	higher priorities v	vithin the Science an	d Technology		
<ul> <li>FY 1999: \$880 indentified as a source for SBIR.</li> <li>(U) D. Other Program Funding Summary: <ul> <li>(U) Related Activities:</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0603112F, Advanced Materials for Weapon Systems.</li> <li>(U) PE 0603216F, Aerospace Propulsion and Power Technology.</li> <li>(U) PE 0602122N, Aircraft Technology.</li> <li>(U) PE 0603217N, Air Systems Advanced Technology Demonstration.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul> </li> </ul>								
Project 668A	Pa	ge 3 of 4 Pages		E>	khibit R-2 (PE 0603	3202F)		

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RDT&E BUDGET ITEM JUST	t)	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603202F Aerospace I Integration	Propulsion Subsy	PROJECT stem 668A	
(U) E. <u>Acquisition Strategy</u> : Not Applicable.				
(U) F. <u>Schedule Profile</u> : Not Applicable.				
Project 668A	Page 4 of 4 Pages	Exhibit R	-2 (PE 0603202F)	
	202			

PE TITLE: Advanced Aerospace Sensors

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									February 1999		
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603203F Advanced Aerospace Sensors											
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
Total Program Element (PE) Cost	23,944	28,534	29,405	32,330	33,587	31,561	30,209	31,749	Continuing	Continuin	
665A Advanced Aerospace Sensors Technology	11,316	13,481	15,070	17,249	18,033	15,012	13,286	14,495	Continuing	Continuin	
69CK Advanced Electronics	1,114	1,562	815	952	1,430	2,080	2,084	2,088	Continuing	Continuin	
69DF Target Attack and Recognition Technology	11,514	13,491	13,520	14,129	14,124	14,469	14,839	15,166	Continuing	Continuin	
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0		

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops technology to enable continued sensors superiority from space and aerial platforms. Combat aircraft must defeat increasingly sophisticated active and passive countermeasures, destroy a wide variety of targets with precision under a myriad of environmental conditions, and reliably perform complex missions with less logistics support in a world of proliferating threats. This program responds to these needs by developing and demonstrating the means to find, fix, target track and engage air and ground targets, anytime, anywhere, and in any weather. Specifically, this program develops the aerospace radio frequency sensors (i.e., radar) and electro-optical sensors for detecting, locating, and targeting airborne, fixed, and time-critical mobile ground targets, whether those targets are obscured by natural or man-made means, while providing the capability to adapt to changes in target signatures and background environments. These advanced sensor capabilities will provide for flexible, multi-function/multi-mission combat aircraft that can: safely penetrate threat areas; destroy multiple ground targets per pass; accurately detect and identify targets beyond-visual-range within a complex mix of look-alike friendly, neutral, and enemy aircraft; win aerial engagements; and return to fight again. Note: In FY 1999, Congress added \$2.2 million for the Enhanced Recognition and Sensing Ladar (ERASER) program.

Page 1 of 11 Pages

Exhibit R-2 (PE 0603203F)

RDT&E BUDGET ITEM JUS	N SHEET (	R-2 Exhibi	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AND 0603203F	Advanced A	ensors	
(U) B. <u>Budget Activity Justification</u> : This program is in Budg	et Activity 3, Ad	vanced Technolo	gy Developmen	t, since it develops	and demonstrates technologies for
(II) C Program Change Summery (\$ in Thousands):	at system develoj	pments that have	mintary utinty a	ind address warnig	nter needs.
(U) C. <u>Frogram Change Summary (5 m Thousands)</u> .					Total
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost
(U) Previous President's Budget/FY 1999 PB	25,077	26,442	25,148	26,269	Cont
(U) Appropriated Value	26,507	28,642			
(U) Adjustments to Appropriated Value					
a. Congressional/General Reductions	-879	-108			
b. SBIR	-571				
c. Omnibus/Other Above Threshold Reprogrammings	-170				
d. Below Threshold Reprogrammings	-943		4.055	6.0.61	
(U) Adjustments to Budget Year Since FY 1999 PB	22.044	20 524	4,257	6,061	
(U) Significant Program Changes: Outyears reflect program red	lirection to increa	ase development of	of space-based set	ensor technology.	
FY 1999: \$780 identified as a source for SBIR.					
	P	2 (11 5		-	

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Techi	nology Developm	ent		PE 0	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors				PROJECT 665A		
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
665A Advanced Aerospace S	ensors Technology	11,316	13,481	15,07	70 17,249	18,033	15,012	13,286	14,495	14,495 Continuing C	
(U) A. <u>Mission Descripti</u> radars, and electronic coun targets (conventional and le complete sensor capabilitie background conditions, wit capability for threats obscu (U) <u>FY 1998 (\$ in Th</u> - (U) \$2,194 - (U) \$2,26 - (U) \$1,241 - (U) \$1,241 - (U) \$2,945 - (U) \$1,117 - (U) \$1,117	on: Develops and demo ter-countermeasures (EC ow radar cross section) a s as well as advanced co th emphasis on counterin red by these means. No <u>ousands</u> ): Developed integrated currently achievable, a day/night multispec Developed airborne, a demonstration of a m Developed and demon including developmen Developed processing sensor performance a refinement and demon Developed and demon critical targets obscurr Research Agency dem Developed critical com platform antenna for p	onstrates aero CCM) for rac ind ground-b omponent tec ag improven te: In FY 19 air-to-air ar whether the tral sensor a air-to-ground odular wind instrated rada at of concep g techniques ind increased instrated the ed by foliage nonstration of imponents re precision we	ospace senso dars. This pro- based, high-vo- chnologies. The pro- nents in carn 299, Congress and air-to-grout targets are conditioned in the pro- targets are conditing are c	or technolo roject will value, time The desire ouflage, cc ss added \$ und EO se amouflage of a mult ing techno designing chniques to neural nets utter and e nd targetir cessing tec ncy sensor ed through automated wer life cyo	provide warfi provide warfi critical target d warfighting oncealment, at 2.2 million for nsor technologed, low-observinational prog ologies to enha g a wind senso o negate air in to counter jar electromagneti in g performanc chniques for in and algorithm deceptive tect detection algo cle cost of cur	ed and umar ghters with t is from air an capability ir nd deception Enhanced F gies to detec able, or emp ram for affor ince accuracy r. tercept and s nming. c interference e against sop mproving rac n technology hniques, incl prithms for u rent and futu	aned platform he capability nd space-bas icludes the a techniques Recognition t, locate, and loying other rdable precise y of bomb d ynthetic ape bhisticated a lar performa required to uding a join nmanned ae re radar sys	ns, including y to precisely sed platform bility to detect that limit cu and Sensing d identify tar means of de sion targetin rops and car erture radar of ntional and u nd low radar ance under se detect, iden t Air Force/A erial vehicle- tems, includ	g electro-opt y detect and s. Work inc. ect and targe ment detecti Ladar (ERA rgets at range eception. Th g at standoff go delivery, electronic co unintentional r cross section evere jammi tify, and targe Army/Defense sized radars.	ical (EO) se target both a ludes develo t in difficult on and track SER) techn es longer tha his included ranges. including untermeasur l, for uninter on targets, in ng. get high-valu se Advanceo ts of an adva	nsors, airborne oping both cing ologies. an design of res, rrupted acluding ae, time- d Projects anced air
Project 665A				Page 3	of 11 Pagas			Fyhihi	t R-24 (PF	06032035	)

RDT	<b>&amp; E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exh	ibit)	<b>February 1999</b>						
BUDGET ACTIVITY	nology Development	PE NUMBER AND TITLE	Aerosnace Sens	PROJECT						
J - Auvanceu recin	lology Development		a Aerospace Dens	013 003A						
(U) <u>FY 1999 (\$ in Th</u>	ousands):									
- (U) \$3,953	Develop integrated electro-optical (EO) sensor techn whether the targets are camouflaged, low-observable operates in day or night across multiple bands.	ologies to detect, locate, and i , or employing other means o	identify targets at ranges f deception. This includes	onger than currently achievable, a fabricating an EO sensor that						
- (U) \$1,482	Develop and demonstrate radar electronic counter-co countermeasures, including assessing use of neural n	ountermeasure techniques to n ets to identify and remove jan	negate air intercept and sy nming waveforms.	nthetic aperture radar electronic						
- (U) \$3,543	Develop processing techniques to negate clutter and detection and targeting performance against sophistic demonstrations of advanced mitigation techniques for	electromagnetic interference, cated and low radar cross sect or severe interference and jam	for uninterrupted sensor p tion targets, including cor ming environments.	performance and increased ducting laboratory and rooftop						
- (U) \$3,253	Develop the radio frequency (RF) sensor and algorith obscured by foliage or concealed through deception, penetrating synthetic aperture radars.	hm technology required to det including ground testing real-	tect, identify, and target h -time image formation/int	igh-value, time-critical targets erference mitigation for foliage						
- (U) \$882	Develop critical components required to lower life cy antenna suitable for unmanned vehicles.	ycle cost of current and future	radar systems, including	flight testing an affordable						
- (U) \$368	Identified as a source for SBIR.									
- (U) \$13,481	Total									
(U) <u>FY 2000 (\$ in Th</u>	ousands):									
– (U) \$1,700	Develop integrated electro-optical (EO) sensor techno whether the targets are camouflaged, low-observable, initiating flight test of an EO sensor that operates in o	ologies to detect, locate, and i , or employing other means of day or night across multiple b	dentify targets at ranges l f deception. This includes bands.	onger than currently achievable, completing fabrication and						
– (U) \$4,587	Develop EO sensor technologies to detect and locate model validation data, conducting space sensor trade	deep hide targets from high a studies, and creating hypersp	ltitudes and space, includ bectral imaging/fusion alg	ing collecting infrared sensor orithms.						
– (U) \$2,204	Develop radar signal processing techniques to negate including developing adaptive processing for fighter enhanced antenna implementation, and developing ir	e clutter and interference and i detection of low-observable ta integrated processing methods	improve detection and tra argets, demonstrating imp for improved ground targ	cking of difficult targets, roved radar performance via get detection and tracking.						
– (U) \$3,419	Develop RF sensor and algorithm technology require obscured by deceptive techniques, including flight test	d to detect, identify, and targe sting image formation process	et high-value, time-critica sing and automatic target	targets obscured by foliage or detection.						
– (U) \$1,576	<ul> <li>obscured by deceptive techniques, including flight testing image formation processing and automatic target detection.</li> <li>\$1,576 Develop technology to lower life cycle costs of radar systems, including laboratory testing low-cost digital receivers and sensor components, evaluating space-based apertures using micro-electro-mechanical systems phase shifters, and demonstrating a millimeter wave array for high-altitude unmanned aerial vehicles.</li> </ul>									
Project 665A	Page	e 4 of 11 Pages	Exhibit	R-2A (PE 0603203F)						
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RDT&	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									
BUDGET ACTIVITY 3 - Advanced Techr	nology Development	PE NUMBER AND TITLE 0603203F Advanced A	Aerospace Senso	PROJECT 665A						
– (U) \$1,584	Develop technology for non-cooperative target ident sensor hardware, and evaluating laser vibration as a	ification, including building high solution to target identification.	n resolution algorithms,	validating models, flight testing						
– (U) \$15,070	Total	-								
(U) <u>FY 2001 (\$ in The</u>	ousands):									
– (U) \$5,715	Develop EO sensor technologies to detect and locate model validation data collection, analyzing sensor pe and fusion algorithms.	deep hide targets from high altit erformance, completing space ser	tudes and space, includi nsor trade studies, and t	ng completing infrared sensor esting hyperspectral imaging						
– (U) \$2,908	Develop radar signal processing techniques to negate flight testing use of adaptive processing for detecting integrated axionics systems, and developing advance	e clutter and interference and imp slow moving targets in presence d processing methods	prove difficult target de e of jamming, developin	tection and tracking, including ng techniques using highly						
– (U) \$3,797	Develop and demonstrate the radio frequency sensor critical targets obscured by foliage or concealed through and automatic target detection algorithms.	and algorithm technology requir ugh deceptive techniques, include	red to detect, identify, a ing completing flight te	nd target high-value, time- sts of real-time image formation						
– (U) \$1,090	Develop technology to lower life cycle costs of radar mechanical system-based apertures.	systems, including field testing l	low-cost, lightweight, lo	w-power, micro-electro-						
– (U) \$2,180	Develop technology for non-cooperative target ident resolution algorithms, analyzing sensor suite utility,	ification, including designing a s and flight testing a sensor suite.	ensor for transition risk	reduction, testing high						
– (U) \$1,559	Develop, with international partners, the EO sensor t automated standoff surveillance, identification, and t laser identification channels and optimizing sensor s	echnology needed to integrate w argeting, including designing an uite trade studies.	ide-area search with no d fabricating flight-wor	n-cooperative identification for thy hyperspectral sensor and						
– (U) \$17,249	Total									
Project 665A	Page	e 5 of 11 Pages	Exhibit	R-2A (PE 0603203F)						
		207								

BUDGET ACTIVITY       PENUMEER AND TITLE       PROJECT         3 - Advanced Technology Development       0603203F Advanced Aerospace Sensors       665A         (U) B. Project Change Summary - Description of Significant Changes: Not Applicable.       665A         (U) C. Other Program Funding Summary:       (U) Related Activities:       665D         - (U) PE 0602307F, High Vchicle Technology.       (U) DE 0602307F, High Vchicle Technology.       (U) PE 0603207F, High Vchicle Technology.         - (U) PE 0603237F, Electronic Combat Technology.       (U) PE 0603237F, Electronic Combat Technology.       (U) PE 0603237F, Electronic Combat Technology.         - (U) PE 060327F, Electronic Combat Technology.       (U) PE 060327F, Electronic Combat Technology.         - (U) PE 060327F, Electronic Combat Technology.       (U) PE 060327F, Electronic Combat Technology.         - (U) PE 060327F, Electronic Combat Technology.       (U) PE 060327F, Electronic Combat Technology.         - (U) PE 060327F, Electronic Combat Technology.       (U) D. Acquisition Strategy: Not Applicable between the Air Force Research Laboratory and the Defense Advanced Research Projects Agency (DARPA) to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments including deception, camouflage, concealment, and deep hide.         - (U) D. Acquisition Strategy: Not Applicable.       (U) E. Schedule Profile: Not Applicable.         (U) E. Schedule Profile: Not Applicable.       Explid E 020 (PE 00022025)	RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999							
<ul> <li>(U) B. Project Change Summary - Description of Significant Changes: Not Applicable.</li> <li>(U) C. Other Program Funding Summary: <ul> <li>(U) Related Activities:</li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0603207F; Weather Systems Advanced Development.</li> <li>(U) PE 0603170F; Weather Systems Advanced Development.</li> <li>(U) PE 0602111N, Weaphors Technology.</li> <li>(U) PE 0603270F; Electronic Combar Technology.</li> <li>(U) PE 0603270F; Determine thas been established between the Air Force Research Laboratory and the Defense Advanced Research Projects Agency (DARPA) to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments including deception, camouflage, concealment, and deep hide.</li> <li>(U) D. Acquisition Strategy: Not Applicable.</li> </ul> </li> <li>(U) E. Schedule Profile: Not Applicable.</li> </ul>	BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sens	PROJECT 665A							
<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0003205F, Aerospace Sensors.</li> <li>(U) PE 0003207F, Flight Vehicle Technology.</li> <li>(U) PE 0003107F, Weather Systems Advanced Development.</li> <li>(U) PE 002317N, Space and Electronic Warfare (SEW) Technology.</li> <li>(U) PE 0023270F, Electronic Warfare (SEW) Technology.</li> <li>(U) A memoradum of agreement has been established between the Air Force Research Laboratory and the Defense Advanced Research Projects Agency (DARPA) to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments including deception, camouflage, concealment, and deep hide.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul> </li> <li>(U) E. Schedule Profile: Not Applicable.</li> </ul>	(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Not	Applicable.								
<ul> <li>(U) <u>Related Activities:</u> <ul> <li>(U) PE 0603204F, Aerospace Sensors.</li> <li>(U) PE 0603207F, Flight Vehicle Technology.</li> <li>(U) PE 0603707F, Weather Systems Advanced Development.</li> <li>(U) PE 062121N, Space and Electronic Variare (SEW) Technology.</li> <li>(U) PE 062327V, Space and Electronic Variare (SEW) Technology.</li> <li>(U) PE 062327V, Electronic Combat Technology.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) A memorandum of agreement has been established between the Air Force Research Laboratory and the Defense Advanced Research Projects Agency (DARPA) to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments including deception, camouflage, concealment, and deep hide.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	(U) C. Other Program Funding Summary:									
(U) D. Acquisition Strategy: Not Applicable.         (U) E. Schedule Profile: Not Applicable.         Project 665A         Project 665A	<ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0603205F, Flight Vehicle Technology.</li> <li>(U) PE 0603707F, Weather Systems Advanced Development.</li> <li>(U) PE 062111N, Weapons Technology.</li> <li>(U) PE 062232N, Space and Electronic Warfare (SEW) Technology.</li> <li>(U) PE 0604249F, LANTIRN Night Precision Attack.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) A memorandum of agreement has been established between the Air Force Research Laboratory and the Defense Advanced Research Projects Agency (DARPA) to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments including deception, camouflage, concealment, and deep hide.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul>									
(U) E. <u>Schedule Profile</u> : Not Applicable.	(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.									
Project 6654 Page Evhibit P-24 (PE 0603203E)	(U) E. <u>Schedule Profile</u> : Not Applicable.									
Project 665 A Page 6 of 11 Pages Exhibit R-24 (PE 0603203E)										
Project 665A Exhibit P24 (PE 0603203E)										
Project 665 A Exhibit P-2A (PE 0603203E)										
Project 665 A Exhibit R-24 (PE 0603203E)										
Project 665 A Exhibit R-24 (PE 0603203E)										
Project 665 A Exhibit $P_{-2A}$ (PE 0603203E)										
$P_{ada,b} = f_{11} P_{ada,b}$ Exhibit $P_{-2\Delta}$ (PE 0603203E)										
	Project 665A Page	e 6 of 11 Pages Exhibi	t R-2A (PE 0603203F)							

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit) DATE February 1999										999
BUDGET ACTIVITY 3 - Advanced Tech	nology Developm	ent		PE N <b>06</b>	UMBER AND	TITLE Advanced	l Aerospa	ace Sens	sors	F (	PROJECT
COST <i>(</i> \$	S In Thousands) FY 1998 FY 1999 FY 2000 FY 2001 FY 2002 FY 2003 FY 2004 FY 2004 Estimate								FY 2005 Estimate	Cost to Complete	Total Cost
69CK Advanced Electronics	ed Electronics 1,114 1,562 815 952 1,430 2,080 2,084 2,088							Continuing	Continuinę		
<ul> <li>(C) A. <u>Inision Description</u></li> <li>performance, reliability, an applications. Results provise targets/threats at longer rar development of: aerospace electronics power distribution</li> <li>(U) <u>FY 1998 (\$ in TH</u> - (U) \$423</li> <li>- (U) \$445</li> <li>- (U) \$445</li> <li>- (U) \$1,114</li> <li>(U) <u>FY 1999 (\$ in TH</u> - (U) \$1,519</li> <li>- (U) \$43</li> <li>- (U) \$1,562</li> </ul>	<ul> <li>bevelops and defile</li> <li>d affordability of aerospatide</li> <li>de the warfighter with images, and more precise wardar monolithic solid station; microwave/microele</li> <li>beveloped advanced consumption, cost, we encapsulating microc</li> <li>Developed advanced performance, and dece development of packar microwave receiver.</li> <li>Developed advanced the development cost Total</li> <li>bevelop advanced micromance and jam high-speed digital ass designs for miniature Identified as a source Total</li> </ul>	ace radar, co acreased sense reapon emplo- tate transmit ctronics pack microelectro- eight, and vo- ircuits and d multi-function rease avioni aging techno- design autor and subsequ ulti-function resistance, a semblies, fab, , all-digital r for SBIR.	mmunicatio sor capabilit syment. Thi (receive moo kaging and i encise composi- olume of em- evelopment on sensor ele- cs cost, weig logies for m- nation tools tent support sensor elect and decrease pricating and nicrowave re-	ns, and elections, and elections, and elections, spore the definition of a spore the end	<ul> <li>an control of the control o</li></ul>	er-counterme situational a onics techno -to-digital co and radio fre a, packaging, Efforts incl blies for multi ated analog/o iccluded optin ceive modul g complex el stems, include ated analog/o iccluded analog/o iccluded analog/o iccluded analog/o	asure system wareness, h logies unava onverters; ph quency (RF and intercon uded demon i-function p ligital applic nization of v es, and demon ectronics/av- ling demons ligital applic ce sensors. 1 multichip a	ns for both r igher accura ailable from notonic proce photonic d nnect techno stration of in hased array eations, to in very high-spe- onstration o ionics. The strating the s	etrofit and ne ecomponent commercial essing techni listribution su plogies to red norganic coa radars. crease reliab eed digital as of a miniature se tools will a peed of auto crease reliab ide continuec nd completin	and tracking sources and ques, high r ubsystems. luce power tings for ility, improv ssemblies, e analog/digi significantly mated design ility, improv d developme g preliminat	g of includes eliability //e tal lower n tools. //e nt of very //y
Project 69CK				Page 7 of	11 Pages			Exhibi	it R-2A (PE	<u>0603203F)</u>	

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									
BUDGET ACTIVITY 3 - Advanced Techr	nology Development	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sens	PROJECT 69CK							
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:         <ul> <li>(U) \$458</li> <li>Develop advanced multi-function sensor electronics, including continued development of affordable, high performance radio frequency (RF) circuits and packaging technologies for use in phased array transmit/receive modules on manned and unmanned platforms.</li> <li>(U) \$357</li> <li>Perform application trade studies for space-based photonics RF signal distribution, including photonic beamforming for Global Positioning System (GPS) applications.</li> <li>(U) \$815</li> <li>Total</li> </ul> </li> </ul>										
(U) <u>FY 2001 (\$ in The</u> - (U) \$525 I a	busands): Develop advanced multi-function sensor electronics, inc ffordable, high performance RF circuits and packaging nmanned platforms	cluding low-cost multi-chip module/sub array coating technologies for use in phased array transmit/receive	approaches. Demonstrate modules on manned and							
<ul> <li>(U) \$237</li> <li>Develop analog, digital, and microwave/millimeter wave photonics technology for compact, affordable, optically-controlled RF aerospace applications, including designing dynamically reconfigurable RF signal distribution components, and demonstrating photonic components for wide bandwidth, high-throughput optical processing.</li> </ul>										
– (U) \$190 I ti F	Develop high performance RF phased array antenna con rue-time-delay processor and fabricating and testing an Project 2863.)	ntrols for extremely wide angle coverage, including te anti-jam GPS antenna. (In FY 2000, this effort was o	sting and integrating a photonics conducted under PE 0603726F,							
<ul> <li>(U) \$952 T</li> <li>(U) B. <u>Project Change S</u> within the Science and Tech</li> <li>(U) C. <u>Other Program Free</u></li> </ul>	otai ummary - Description of Significant Changes: Char hnology (S&T) Program. unding Summary:	nges to this project since the previous President's Bud	get are due to higher priorities							
<ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) PE 0603739E, Electronic Manufacturing Technology.</li> <li>(U) PE 0603706E, Microwave/Millimeter Wave Integrated Circuits.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul>										
(U) D. <u>Acquisition Strate</u>	gy: Not Applicable.									
(U) E. <u>Schedule Profile</u> :	Not Applicable.									
Project 69CK	Page	e 8 of 11 Pages Exhibi	it R-2A (PE 0603203F)							

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									February 1999	
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603203F Advanced Aerospace Sense					ors	PROJECT 69DF				
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
69DF Target Attack and Recognition Technology	11,514	13,491	13,520	14,129	14,124	14,469	14,839	15,166	Continuing	Continuing

(U) A. Mission Description: Develops and demonstrates advanced technologies for attack management, fire control, and target identification and recognition. This includes developing and demonstrating integrated and cooperative fire control techniques to provide for adverse-weather precision air strikes against multiple targets per pass at maximum weapon launch range. Specific fire control technologies include attack management, sensor fusion, automated decision aids, advanced tracking for low radar cross section threats, and targeting using both on-board and off-board sensor information. These fire control developments will provide force multiplication and reduce exposure to hostile fire. This project also develops and demonstrates technologies for positive, high confidence cueing, recognition, and identification of airborne and ground-based, high-value, time-critical targets at ranges compatible with tactical air-to-air and air-to-surface weapons in all weather, day or night, and in high-threat, multiple target battle areas. Model-based vision algorithms and target signature development techniques are key to target identification and recognition and are pursued in this project in partnership with the Defense Advanced Research Projects Agency. The techniques developed are evaluated to support the Theater Missile Defense efforts in surveillance and attack. The fire control and recognition technologies developed and demonstrated in this project are high leverage, providing for significant advancements in operational capabilities largely through software improvements readily transitioned to new and existing systems.

- (U) FY 1998 (\$ in Thousands):
- (U) \$3.607 Developed and demonstrated advanced air-to-air detection, tracking, identification, and engagement technologies, including transition of synthetic signature generation capability for hostile airborne target identification, investigation of advanced sensor suites using off-board sources, development of a preliminary design for all-aspect fire control, and completion of ground-to-air testing of combined radar modes. Developed advanced situation awareness technologies to increase air-to-ground engagement lethality and survivability, including design of -(U) \$2.225 a real-time information out of the cockpit approach to improve battle damage assessment, demonstration of embedded multi-source fusion of electronic intelligence and synthetic aperture radar data, and development of a concept for real-time embedded multi-source fusion. Developed and demonstrated innovative air-to-ground Automatic Target Recognition (ATR) and identification technologies to increase -(U) \$5.682 capacity to detect, identify, and target hostile ground forces, including development and integration of ATR/fusion design testbed, evaluation of use of current algorithms for longer timelines of reconnaissance platform radars, measurement of the performance of air-toground ATR algorithms using enhanced radar with third generation forward looking infrared and multispectral ATR, and completion of a critical design for modifications to a fire control radar for advanced identification of ground forces. Total
  - (U) \$11.514

#### (U) FY 1999 (\$ in Thousands):

Develop and demonstrate advanced air-to-air detection, tracking, identification, and engagement technologies, including continuing to - (U) \$1,563 investigate advanced sensors suites, and analyzing ground test data for target identification through combined radar modes.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit) February 1999								
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603203F Adva	nced Aerospace Sens	PROJECT 69DF				
- (U) \$6,663	Develop advanced situation awareness technologies demonstrate multisource fusion of electronic intellig low-observable platform using real-time information looking infrared and SAR data on an interdiction fig	to increase air-to-ground ence with synthetic aper in the cockpit (RTIC) te hter.	l engagement lethality and survi ture radar (SAR), flight demons echnology, and developing and t	vability, including continuing to strating real-time rerouting of an light testing fusion of forward				
– (U) \$4,896	Develop and demonstrate innovative air-to-ground A ability to detect, identify, and target hostile ground for downselecting and integrating an optimal algorithm ground ATR algorithms using enhanced radar with t identification of friendly and hostile ground forces.	automatic Target Recogn prces, including continui for longer timelines of re hird generation forward	ition (ATR) and identification t ing to develop and integrate an econnaissance radars, performin looking infrared and multispec	echnologies to increase the ATR/fusion algorithm testbed, ag detailed analysis of air-to- tral ATR and demonstrating the				
- (U) \$369	Identified as a source for SBIR.							
– (U) \$13,491	Total							
(U) FY 2000 (\$ in TI) - (U) \$2,699 - (U) \$2,699 - (U) \$2,947 - (U) \$1,577 - (U) \$1,214 - (U) \$3,004 - (U) \$3,004 - (U) \$2,079 - (U) \$13,520	<u>nousands</u> ): Develop advanced situation awareness technologies demonstrating ground station fusion of SAR and sig Develop and demonstrate RTIC technologies, includ retargeting for stealth strike platforms and developin Develop and evaluate radar ATR algorithms for trac ground targets and reducing transition risk by plann Develop target recognition concepts using hyperspe target/background phenomenology efforts, including Test and integrate Defense Advanced Research Proj facility for application to Air Force intelligence, sur Develop advanced tactical targeting technology in co of enemy air defenses, including hardware-in-the-lo Total	for rapid detection, loca mals intelligence and development ding continuing to flight ng real-time retargeting a cking moving ground tar ing affordable upgrades ctral imaging and other of building algorithms us ects Agency multi-senso veillance, and reconnaiss onjunction with Defense op testing against threat	tion, and prosecution of time-cr veloping on-board/off-board dat demonstrate and simulate real- algorithms for special operation rgets, including evaluating radat to strike and reconnaissance pla candidate sensor inputs to deter ing hyperspectral imaging data. or ATR fusion algorithms into the sance functions. Advanced Research Projects A radio frequency (RF) signals.	itical targets, including a and image fusion algorithms. time route replanning and forces. algorithms for tracking moving atforms. mine requirements for ATR and the Air Force ATR evaluation test gency (DARPA) for suppression				
$\begin{array}{rcrr} (U) & \underline{PP2001} (\$ \mbox{ III} 11) \\ - & (U) & \$2,131 \\ - & (U) & \$1,900 \end{array}$	Develop advanced situation awareness technologies demonstrating algorithms for fusion of on- and off-t Develop and demonstrate real-time information in th to develop real-time retargeting algorithms for speci	for rapid detection, loca board data and images. he cockpit (RTIC) techn al operation forces appli	tion, and prosecution of time-croologies, including completing F ications.	itical targets, including				
Project 69DF	Page	e 10 of 11 Pages	Exhibit	R-2A (PE 0603203F)				
<u> </u>		212						

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit) February 1999								
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603203F Advance	ed Aerospace Sensors	PROJECT 69DF				
<ul> <li>- (U) \$2,329</li> <li>- (U) \$1,664</li> <li>- (U) \$2,618</li> <li>- (U) \$300</li> <li>- (U) \$3,187</li> <li>- (U) \$14,129</li> </ul>	Demonstrate and laboratory test algorithms for tra upgrades to strike and reconnaissance platforms. Develop target recognition concepts using hypersp target recognition (ATR) and target/background p Continue testing and integrating Defense Advance into the Air Force ATR evaluation test facility for Develop technology to evaluate advanced air-to-ai studies. Develop advanced tactical targeting technology in demonstration of brassboard units that triangulate Total	acking moving ground targets, pectral imaging and other cand henomenology efforts, includin ed Research Projects Agency m application to Air Force intelli ir fire control and tracking algo conjunction with DARPA for threat emitter position and pro	emphasizing risk reduction for tran idate sensor inputs to determine re- ng evaluating algorithms using hyp ulti-sensor automatic target recogn gence, surveillance, and reconnais orithms, including performing sens suppression of enemy air defenses wide targeting for precision guided	nsition via planned sensor quirements for automatic perspectral imaging data. nition fusion algorithms sance functions. or-to-shooter trade , including ground d munitions.				
<ul> <li>(U) B. Project Change Summary - Description of Significant Changes: Not Applicable.</li> <li>(U) C. Other Program Funding Summary: <ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0603253F, Advanced Sensor Integration.</li> <li>(U) PE 0603726E, Sensor and Guidance Technology</li> <li>(U) Theater Missile Defense System Program Office.</li> <li>(U) Low Altitude Night Targeting and Infrared Navigation (LANTIRN) System Program Office.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> </ul>								
(U) E. Schedule Profile: Not Applicable.         Project 69DF       Page 11 of 11 Pages         Exhibit R-2A (PE 0603203F)								
		213						

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PE TITLE: Flight Vehicle Technology

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							February 1999			
BUDGET ACTIVITY 3 - Advanced Technology Development				UMBER AND 03205F F	TITLE Flight Vel	hicle Tec	hnology			
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	4,998	7,007	5,992	4,258	521	440	0	0	Continuing	Continuing
2978 Flight Vehicle Technologies	3,806	5,151	4,624	3,585	277	270	0	0	Continuing	Continuing
4398 Air Base Technology	1,192	1,856	1,368	673	244	170	0	0	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C

Note: This program element (PE) will be eliminated in FY 2004 and the ongoing technical programs will be transferred to PEs 0603245F, Flight Vehicle Technology Integration, and 0603112F, Advanced Materials for Weapon Systems.

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates advanced aerospace vehicle subsystems, aerodynamic/flight controls, and vehicle-pilot interface technologies for improved aerospace vehicle performance, decreased vulnerability, and reduced logistics support. This program also demonstrates technologies for fixed and bare base assets, including airfield pavements, energy systems, air base survivability, air base recovery, protective systems, fire protection, and crash rescue.

(U) B. <u>Budget Activity Justification</u> This program is in the Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing aerospace vehicle system upgrades and/or new system developments that have military utility and address warfighter needs.

Page 1 of 7 Pages

Exhibit R-2 (PE 0603205F)

RDT&E BUDGET ITEM JUS	DATE February 1999				
BUDGET ACTIVITY		PE NUMBER AN	ND TITLE		
3 - Advanced Technology Development		0603205F	Flight Vehi	cle Technolo	ду
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					Tatal
	EV 1009	EV 1000	EV 2000	EV 2001	Total
	<u>FY 1998</u>	<u>F 1 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost
(U) Previous President's Budget/FY 1999 PB	5,441	7,035	/,4/6	7,043	Cont
(U) Appropriated Value	5,766	7,035			
(U) Adjustments to Appropriated Value					
a. Congressional/General Reductions	-188	-28			
b. SBIR	-140				
c. Omnibus/Other Above Threshold Reprogrammings	-37				
d. Below Threshold Reprogrammings	-403				
(U) Adjustments to Budget Year Since FY 1999 PB			-1,484	-2,785	
(U) Current Budget Submit/FY 2000 PB	4,998	7,007	5,992	4,258	Cont.

(U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$212 identified as a source for SBIR.

Page 2 of 7 Pages

Exhibit R-2 (PE 0603205F)

BUDGET ACTIVITY         PEQUECT           3 - Advanced Technology Development         0603205F         Flight Vehicle Technology         P2978           COST (\$ In Thousands)         FY 1939         FY 1939         FY 2000         FY 2000         FY 2002         FY 2001         FY 2002         FY 2002         FY 2002         FY 2002         FY 2003         FY 2004         FY 2005         FY 2004         FY 2005	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit) February 1999											
COST (\$ In Trausands)FY 1998 ActualFY 2000 EstimateFY 2000 EstimateFY 2001 EstimateFY 2003 EstimateFY 2004 EstimateFY 2004 EstimateCost to CompleteCost to Complete2078Filipt Vehicle Technologies3.8005.1514.6243.588277270000Cost to Complete(U) A. Mission Description: Theohologies, and vehicle-pilot interesting affordability, and mission effectiveness. It is focused on exploiting advancements in acrospace vehicle component and subsystem technologies, areospace vehicles.000 </th <th>BUDGET ACTIVITY 3 - Advanced Techn</th> <th>ology Developm</th> <th>ent</th> <th></th> <th>PE N <b>06</b></th> <th>UMBER AND 03205F F</th> <th>TITLE Flight Veł</th> <th>nicle Tec</th> <th>hnology</th> <th></th> <th>F</th> <th>PROJECT 2978</th>	BUDGET ACTIVITY 3 - Advanced Techn	ology Developm	ent		PE N <b>06</b>	UMBER AND 03205F F	TITLE Flight Veł	nicle Tec	hnology		F	PROJECT 2978
2013       Fight Vehicle Technologies       3.806       5.151       4.624       3.585       277       270       0       0       Continuing         (U) A. Mission Description:       This program designs, develops, and demonstrates manned and ummanned aerospace vehicle technologies for improved performance, reliability, aministion effectiveness. It is focused on exploiting advancements in aerospace vehicle component and subsystem technologies, aerodynamic/flight control technologies, and vehicle-pilot integration technologies to enhance high priority target kill. Provides on-board software for automatic in-flight mission replanning for the foundation of future technology developments for aerospace vehicles.       - <th>COST <i>(\$ 1</i>/</th> <th>n Thousands)</th> <th>FY 1998 Actual</th> <th>FY 1999 Estimate</th> <th>FY 2000 Estimate</th> <th>FY 2001 Estimate</th> <th>FY 2002 Estimate</th> <th>FY 2003 Estimate</th> <th>FY 2004 Estimate</th> <th>FY 2005 Estimate</th> <th>Cost to Complete</th> <th>Total Cost</th>	COST <i>(\$ 1</i> /	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This program designs, develops, and demonstrates manned and unmanned aerospace vehicle technologies for improved performance, reliability, maintainability, and supportability while increasing affordability, and mission effectiveness. It is focused on exploiting advancements in aerospace vehicle component and subsystem technologies, aerodynamic/flight control technologies, and vehicle-pilot integration technologies to enhance high priority target kill. Provides on-board software for automatic in-flight mission replanning for the foundation of future technology developments for aerospace vehicles.</li> <li>- (U) \$42.20</li> <li>Developed real-time flight mission replanning technologies to enhance high priority target kill. Provides on-board software for automatic in-flight mission replanning for the foundation of future technology developments for aerospace vehicles.</li> <li>- (U) \$42.20</li> <li>Developed and demonstrated advanced integrated control strategies to enable the safe and effective cooperative employment of manned and increased performance and decreased vulnerability while decreasing both cost and supportability requirements.</li> <li>- (U) \$1,031</li> <li>Develop technologies for automatic in-flight replanning for the cockpit to reduce pilot workload. These benefits will be seen in future aerospace vehicle for air comba operations.</li> <li>- (U) \$1,023</li> <li>Develop advanced integrated aerospace vehicle subsystems to provide increased performance and decreased vulnerability while decreasing both cost and legistic supportability while decreasing both cost and legistic supportability while decreasing both cost and legistic supportability requirements.</li> <li>- (U) \$1,032</li> <li>Develop advanced integrated aerospace vehicle subsystems to provide increased performance and decreased vulnerability while decreasing both cost and legistic supportability requirements. Fabricate flight critical stabilator actuator to de</li></ul>	2978 Flight Vehicle Technolog	ies	3,806	5,151	4,624	3,585	277	270	0	0	Continuing	Continuing
Project 2978 Page 3 of 7 Pages Exhibit R-2A (PE 0603205F)	<ul> <li>(U) A. <u>Mission Descriptio</u> maintainability, and supportable technologies, aerodynamic/flig</li> <li>(U) <u>FY 1998 (\$ in The</u> - (U) \$2,313</li> <li>- (U) \$462</li> <li>- (U) \$1,031</li> <li>- (U) \$1,031</li> <li>- (U) \$3,806</li> <li>(U) <u>FY 1999 (\$ in The</u> - (U) \$2,205</li> <li>- (U) \$1,023</li> <li>- (U) \$1,767</li> <li>- (U) \$156</li> <li>- (U) \$5,151</li> </ul>	<ul> <li>J) A. <u>Mission Description</u>: This program designs, develops, and demonstrates manned and unmanned aerospace vehicle technologies for improved performance, reliability, and supportability while increasing affordability, and mission effectiveness. It is focused on exploiting advancements in aerospace vehicle component and subsystem chnologies, aerodynamic/flight control technologies, and vehicle-pilot integration technologies to enhance high priority target kill. Provides on-board software for automatic inflight mission replanning for the foundation of uture technology developments for aerospace vehicles.</li> <li>(U) \$42 Developed real-time flight attack replanning technologies to enhance high priority target kill. Provides on-board software for automatic inflight mission replanning for the foundation of uture technology developments for aerospace vehicles.</li> <li>(U) \$42 Developed software for multiple ship integrated control strategies to enhance high priority target kill. Provides on-board software for automatic increased performance and decreased vulnerability while decreasing both cost and supportability requirements.</li> <li>(U) \$1,031 Developed and demonstrated advanced integrated aerospace vehicle subsystems which included flight worthy electric stabilator to provide increased performance and decreased vulnerability while decreasing both cost and supportability requirements.</li> <li>(U) \$2,205 Develop technologies for automatic in-flight replanning for the cockpit to reduce pilot workload. These benefits will be seen in future aerospace vehicle designs and technologies.</li> <li>(U) \$1,023 Develop adjorithms for multiple ship integrated control strategies to enable the safe and effective cooperative employment of manned and unmanned strike aerospace vehicles for air combat operations.</li> <li>(U) \$1,023 Develop adjorithms for multiple ship integrated control strategies to enable the safe and effective cooperative employment of manned and unmanned strike aerospace vehicles for air combat ope</li></ul>										
	Project 2978				Page 3 of	f 7 Pages			Exhibi	t R-2A (PE	0603205F)	

RD	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit) DATE February 1999									
BUDGET ACTIVITY 3 - Advanced Tec	JUDGET ACTIVITYPE NUMBER AND TITLEPROJECT3 - Advanced Technology Development0603205F Flight Vehicle Technology2978									
(U) <u>FY 2000 (\$ in</u>	Thousands):									
– (U) \$2,209	Develop technologies for automatic in-flight replanning	for the cockpit to reduce pilot worklo	ad. These benefits will be seen	n in future aerospace						
- (U) \$854 Develop algorithms for multiple ship integrated control strategies to enable the safe and effective cooperative employment of manned and										
– (U) \$1,561	<ul> <li>unmanned strike aerospace vehicles for air combat operations.</li> <li>(U) \$1,561</li> <li>Develop advanced integrated aerospace vehicle subsystems to provide increased performance and decreased vulnerability while decreasing both</li> </ul>									
– (U) \$4,624	Total	finght effical stabilator actuator test to	demonstrate operational and	lillitary utility.						
(U) <u>FY 2001 (\$ in</u>	Thousands):									
- (U) \$1,649 Develop technologies for automatic in-flight re-planning for the cockpit to reduce pilot workload. These benefits will be seen in future										
<ul> <li>(U) \$694</li> <li>Develop algorithms for multiple ship integrated control strategies to enable the safe and effective cooperative employment of manned and unmanned strike aerospace vehicles for air combat operations.</li> </ul>										
- (U) \$1,242 Develop advanced integrated aerospace vehicle subsystems to provide increased performance and decreased vulnerability while decreasing both cost and logistic supportability requirements. Continue flight critical stabilator actuator test to demonstrate operational and military utility.										
– (U) \$3,585	Total									
(U) <b>B.</b> <u>Project Change</u> within the Science and Te	Summary - Description of Significant Changes: Changechnology (S&T) Program.	ges to this program since the previous	President's Budget are due to	higher priorities						
(U) C. Other Program	Funding Summary:									
<ul> <li>(U) <u>Related Activit</u></li> <li>(U) PE 060220</li> <li>(U) PE 060321</li> <li>(U) PE 060324</li> <li>(U) This project</li> </ul>	ies: 1F, Aerospace Flight Dynamics. 6F, Aerospace Propulsion and Power. 5F, Flight Vehicle Technology Integration. et has been coordinated through the Reliance process to h	armonize efforts and eliminate duplica	ation.							
(U) D. <u>Acquisition Str</u>	ategy: Not Applicable.									
(U) E. <u>Schedule Profil</u>	e: Not Applicable.									
Project 2978	Pag	e 4 of 7 Pages	Exhibit R-2A (PE 0	603205F)						
		218								

BUDGET ACTIVITY <b>3 - Advanced Technology</b> COST (\$ In Thousand 4398 Air Base Technology (U) A. <u>Mission Description</u> : This air base recovery, protective systems. (U) <u>FY 1998 (\$ in Thousands)</u> – (U) \$992 Develor equipm – (U) \$200 Develor Expedit – (U) \$1,192 Total (U) <u>FY 1999 (\$ in Thousands</u> – (U) \$624 Develor	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									999	
COST (\$ In Thousand 4398 Air Base Technology (U) A. <u>Mission Description</u> : This air base recovery, protective systems. (U) <u>FY 1998 (\$ in Thousands)</u> – (U) \$992 Develo equipn – (U) \$200 Develo Expedi – (U) \$1,192 Total (U) <u>FY 1999 (\$ in Thousands</u> – (U) \$624 Develo	BUDGET ACTIVITYPE NUMBER AND TITLE3 - Advanced Technology Development0603205F Flight Vehi									F	PROJECT
<ul> <li>4398 Air Base Technology</li> <li>(U) A. <u>Mission Description</u>: This air base recovery, protective systems.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u> <ul> <li>(U) \$992 Develor</li> <li>equipn</li> <li>(U) \$200 Develor</li> <li>Expedit</li> <li>(U) \$1,192 Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands</u> <ul> <li>(U) <u>FY 1999 (\$ in Thousands</u></li> <li>(U) <u>EX 1999 (\$ in Thousands</u></li> <li>(U) \$624 Develor</li> </ul> </li> </ul>	ands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This air base recovery, protective systems.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u> <ul> <li>(U) \$992</li> <li>Develote equipm</li> <li>(U) \$200</li> <li>Develote Expedite</li> <li>(U) \$1,192</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands)</u> <ul> <li>(U) <u>FY 1999 (\$ in Thousands)</u></li> <li>(U) <u>S24</u></li> </ul> </li> </ul>		1,192	1,856	1,368	673	244	170	0	0	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Description</u>: This project develops technologies for fixed and bare base operations, including airfield pavements, energy systems, air base survivability, air base recovery, protective systems, fire protection, and crash rescue.</li> <li>(U) <u>FV 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>5992</u> Developed and demonstrated aircraft and air base fire fighting technologies including environmentally-safe fire fighting agents, vehicles, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems.</li> <li>(U) <u>51,192</u> Total</li> </ul> </li> <li>(U) <u>FV 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>51,192</u> Total</li> </ul> </li> <li>(U) <u>5200</u> Developed aircraft and air base fire fighting and power generation technologies including clean environmentally safe fire fighting agents, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems.</li> <li>(U) <u>510 (\$ 17 1999 (\$ in Thousands)</u>: <ul> <li>(U) <u>520 (\$ in Thousands)</u>:</li> <li>(U) <u>542 Develop aircraft and air base fire fighting and power generation technologies including clean environmentally safe fire fighting agents, equipment, personnel protective clothing, fire risk assessment techniques, and fire fighter training systems.</u></li> <li>(U) <u>5103 Develop technologies</u>, utilities, and shelters that improve air base operations. These technologies include completion of the acoustic cycle heat pump that reduces airlift requirements in support of AEF operations rapid deployment.</li> <li>(U) <u>556 Identified as a source for SBIR</u>.</li> <li>(U) <u>5138</u> Total</li> </ul> </li> </ul>											
Project 4398				Page 5 of	<sup>c</sup> 7 Pages			Exhibit	t R-2A (PE	0603205F)	

RDT&E BUDGET ITEM JUSTIFICATIO	N SHEET (R-2A Exhibit)	DATE February 1999								
BUDGET ACTIVITY 3 - Advanced Technology Development	3UDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603205F Flight Vehicle Technology									
<ul> <li>(U) <u>FY 2000 (\$ in Thousands):</u> <ul> <li>(U) \$528 Develop aircraft and air base fire fighting and powequipment, personnel protective clothing, fire risk</li> <li>(U) \$727 Develop technologies, utilities, and shelters that in heat pump that reduces airlift requirements in supple (U) \$113 Construct an air transportable shelter advanced de</li> <li>(U) <u>FY 2001 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:</li> <li>(U) \$260 Develop aircraft and air base fire fighting and powequipment, personnel protective clothing, fire risk</li> <li>(U) \$357 Develop technologies, utilities, and shelters that in heat pump that reduces airlift requirements in supple.</li> <li>(U) \$357 Develop technologies, utilities, and shelters that in heat pump that reduces airlift requirements in supple.</li> <li>(U) \$56 Construct an air transportable shelter advanced de</li> <li>(U) \$673 Total</li> </ul> </li> <li>(U) B. <u>Project Change Summary - Description of Significant Changes</u>: Ch within the Science and Technology (S&amp;T) Program.</li> </ul></li></ul>	ver generation technologies including clean environment assessment techniques, and fire fighter training systems inprove air base operations. These technologies include of port of Air Expeditionary Force (AEF) operations rapid velopment model for field testing to support AEF operat assessment technologies including clean environment assessment techniques, and fire fighter training systems inprove air base operations. These technologies include of port of AEF operations rapid deployment. velopment model for field testing to support AEF operat anges to this program since the previous President's Buc	ally safe fire fighting agents, completion of the acoustic cycle deployment. ions. ally safe fire fighting agents, completion of the acoustic cycle ions rapid deployment. dget are due to higher priorities								
Project 4398 P	age 6 of / Pages Exhib	II K-ZA (PE U6U3ZU5F)								

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603205F Flight Vehicle Technology	PROJECT <b>4398</b>
(U) C. <u>Other Program Funding Summary</u> :		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0603307F, Air Base Operability Advanced Technology Develop</li> <li>(U) PE 0603231F, Crew Systems and Personnel Protection Technology.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul>	ment. armonize efforts and eliminate duplication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 4398 Pag	e 7 of 7 Pages Exhib	it R-2A (PE 0603205F)
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PE TITLE: Aerospace Structures

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE Fe	bruary 19	<del>)</del> 99
BUDGET ACTIVITY 3 - Advanced Technology Development				UMBER AND 03211F	TITLE Aerospac	e Structu	ires		F Z	'ROJECT <b>186U</b>
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
486U Advanced Aerospace Structures	9,593	12,411	13,749	15,182	16,379	17,549	19,092	18,265	Continuing	Continuing
Quantity of RDT&E Articles	0	0	C	0	0	0	0	0	0	0

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates affordable aerospace vehicle structures by utilizing innovative metallic and composite structures technologies to reduce the cost of airframe ownership. Innovative structural concepts integrate these two types of materials with design and monitoring techniques to develop and demonstrate solutions and repairs for corrosion fatigue, multi-site damage fatigue, and other damage to which aging aircraft are susceptible. The goal of this program is to develop technologies to restore structural integrity, extend life, and improve survivability of the current fleet, and future fleet of manned and unmanned aerospace vehicles. The results are less maintenance intensive, more durable, and more dependable structures for current and future aerospace systems. This yields lower cost of ownership (by delaying acquisition and by reducing support and maintenance costs), restored and improved sortie rates (due to durability, damage or threat tolerance, and design for supportability), and reduced observability (both radar cross section and infrared). The increased funding in this PE is due to the increased emphasis by the Air Force on advanced structures for space applications.

#### (U) <u>FY 1998 (\$ in Thousands)</u>:

- (U) \$3,923 Developed and assessed processes for the replacement of corrosion sensitive components with the completion of a wing spar for flight test to extend the structural life of aircraft.
- (U) \$1,302 Developed and demonstrated durability and performance of manned and unmanned aerospace vehicles structures operating in extreme thermal and acoustic environments, which resulted in a detailed design of an integrated aft fuselage and nozzle section and, thereby, decreasing vulnerability and longevity of aerospace vehicles.
- (U) \$4,368 Developed advanced structural concepts and design methods for future and existing aerospace vehicles which identified new design criteria for composite structures and design of sandwich structure component; these technologies were developed to maintain the Air Force's technology edge.
- (U) \$9,593 Total

Project 486U	Page 1 of 5 Pages

#### Exhibit R-2 (PE 0603211F)
RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603211F Aerospace Stru	uctures	PROJECT 486U				
(U) <u>FY 1999 (\$ in T</u> h	nousands):							
- (U) \$5,700	Improve durability and performance, affordability, a operating in extreme thermal and acoustic environm fabrication of an integrated aft fuselage and nozzle s	nd longevity of existing aging aircraft ents to decrease vulnerability and incr ection.	and future aerospace vehicle stru rease longevity of aerospace vehic	ctures cles with the				
- (U) \$5,886	Develop advanced structural concepts and design me structural component for demonstration or flexible v	ethods for future and existing air vehic ying demo that twists to control flight.	cles, such as the fabrication of a fu.	ull-scale				
- (U) \$461	Develop and apply new analysis methods and design and future aerospace vehicles by maximizing the use	criteria to advanced composite struct of composite structures.	ures for reduction in life cycle cos	sts of current				
- (U) \$364 - (U) \$12,411	Identified as a source for SBIR. Total							
(U) FY 2000 (\$ in Thous	ands):							
<ul> <li>- (U) \$7,420</li> <li>- (U) \$5,844</li> <li>- (U) \$485</li> </ul>	Improve durability and performance, affordability, and in extreme thermal and acoustic environments to dec an integrated aft fuselage and nozzle section. Develop advanced structural concepts and design me structural component for demonstration or flexible w Develop and apply new analysis methods and design	nd longevity of existing aging aircraft rease vulnerability and increase longe thods for future and existing aerospac- ing demo that twists to control flight. criteria to advanced composite structu	and future aerospace vehicle structure vity of aerospace vehicles with the vehicles, such as the fabrication ures for reduction in life cycle cost	ctures operating e fabrication of 1 of a full-scale sts of current and				
– (U) \$13,749	Total	omposite structures.						
Project 486U	Pag	e 2 of 5 Pages	Exhibit R-2 (PE 0603	3211F)				
		224						

	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603211F Aerospace Structures	PROJECT 486U						
(U) <u>FY 2001 (\$ in Th</u> – (U) \$8,211 – (U) \$6,436 – (U) \$535 – (U) \$15,182	nousands): Improve durability and performance, affordability, and in extreme thermal and acoustic environments to dec an integrated aft fuselage and nozzle section. Develop advanced structural concepts and design me structural component for demonstration or flexible w Develop and apply new analysis methods and design future aerospace vehicles by maximizing the use of c Total	nd longevity of existing aging aircraft and future aer rease vulnerability and increase longevity of aerosp thods for future and existing aerospace vehicles, suc- ring demo that twists to control flight. criteria to advanced composite structures for reduct omposite structures.	rospace vehicle structures operating ace vehicles with the fabrication of ch as the fabrication of a full-scale tion in life cycle costs of current and						
() <b>B. <u>Budget Activity J</u></b> xisting system upgrades a	<b><u>ustification</u></b> : This program is in Budget Activity 3, Ad nd/or new system developments that have military utili	vanced Technology Development, since it develops ty and address warfighter needs.	and demonstrates technologies for						
() <b>B. <u>Budget Activity J</u></b> xisting system upgrades a	<b>ustification:</b> This program is in Budget Activity 3, Ad nd/or new system developments that have military utili	vanced Technology Development, since it develops ty and address warfighter needs.	and demonstrates technologies for						
() <b>B. <u>Budget Activity J</u></b> xisting system upgrades a	<b>ustification:</b> This program is in Budget Activity 3, Ad nd/or new system developments that have military utili	vanced Technology Development, since it develops ty and address warfighter needs.	and demonstrates technologies for						
u) <b>B. <u>Budget Activity J</u></b> xisting system upgrades a	<b><u>ustification</u></b> : This program is in Budget Activity 3, Ad nd/or new system developments that have military utili	vanced Technology Development, since it develops ty and address warfighter needs.	and demonstrates technologies for						
(U) <b>B. <u>Budget Activity J</u></b> existing system upgrades a	<b><u>ustification</u></b> : This program is in Budget Activity 3, Ad nd/or new system developments that have military utili	vanced Technology Development, since it develops ty and address warfighter needs.	and demonstrates technologies for						

RDT&E BUDGET ITEM JUS	STIFICATIO	ON SHEET	(R-2 Exhib	it)	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603211F	ND TITLE <b>Aerospace</b>		PROJECT 486U		
(U) C. Program Change Summary (\$ in Thousands):							
	FV 1008	EV 1000	EV 2000	EV 2001	Total		
(II) Previous President's Budget/FY 1999 PB	9 734	<u>17 1999</u> 12 494	14 435	15 041	Cont		
(U) Appropriated Value	10.423	12,494	11,155	15,011	Cont		
(U) Adjustments to Appropriated Value	10,120	,					
a. Congressional/General Reductions	-437	-83					
b. SBIR	-227						
c. Omnibus/Other Above Threshold Reprogrammings	-66						
d. Below Threshold Reprogrammings	-100						
(U) Adjustments to Budget Year Since FY1999 PB			-686	141			
(U) Current Budget Submit/FY 2000 PB	9,593	12,411	13,749	15,182	Cont		
(U) Significant Program Changes: Not Applicable.							
FY 1999: \$364 identified as a source for SBIR.							

Project 486U

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Exhibit R-2 (PE 0603211F)

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RDT&E BUDGET ITEM JUSTIFICATIO	DATE February 1999	
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced Technology Development	0603211F Aerospace Structures	486U
(U) D. <u>Other Program Funding Summary</u> :		
(U) <u>Related Activities</u> :		
- (U) PE 0603245F, Flight Vehicle Technology Integration.		
- (U) This project has been coordinated through the Reliance process to	harmonize efforts and eliminate duplication.	
(U) E. <u>Acquisition Strategy</u> : Not Applicable.		
(U) F. <u>Schedule Profile</u> : Not Applicable.		
Project 486U P	age 5 of 5 Pages	Exhibit R-2 (PE 0603211F)
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PE TITLE: Aerospace Propulsion and Power Technology

RDT&E BUDGET I	EM JUS	STIFICA	TION S	HEET (F	R-2 Exhi		February 1999			
BUDGET ACTIVITY 3 - Advanced Technology Developm	PE N 06 Te	IUMBER AND 03216F chnology	TITLE Aerospac /	e Propul	sion and	Power				
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	31,398	36,867	38,778	3 39,061	37,895	35,081	29,504	30,335	Continuing	Continuing
2480 Aerospace Fuels and Atmospheric Propulsion	1,444	2,052	2,210	2,170	3,087	3,193	3,260	3,328	Continuing	Continuing
3035 Aerospace Power Systems Technology	3,133	3,388	3,162	2 2,511	2,724	4,261	4,350	4,441	Continuing	Continuing
681B Advanced Turbine Engine Gas Generator	26,821	31,427	33,400	34,380	32,084	27,627	21,894	22,566	Continuing	Continuing
Quantity of RDT&E Articles	0	0	(	0 0	0	0	0	0	0	0

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates affordable turbine engine high pressure core components, advanced airbreathing engine concepts, high heat sink and thermally stable fuels, and power technology for aerospace vehicles. Anticipated technology advances include turbine engine improvements providing a 33% reduction in aircraft takeoff gross weight for tactical fighter aircraft and a 100% increase in aircraft range/loiter; ducted rocket improvements that increase missile average and terminal velocity by 50% and range by 100% for enhanced lethality; higher temperature fuels for propulsion and thermal management; an aircraft battery with a 20-year maintenance-free life expectancy; and electric aircraft power components projected to provide a two- to five-fold improvement in reliability and maintainability, a 20% reduction in power system weight, and enhanced survivability.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Page 1 of 11 Pages

Exhibit R-2 (PE 0603216F)

RDT&E BUDGET ITEM JUS	DATE February 1999									
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603216F Technolog	Aerospace gy	Propulsion a	nd Power					
U) C. <u>Program Change Summary (\$ in Thousands)</u> :										
					Total					
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost					
(U) Previous President's Budget/FY 1999 PB	33,126	38,984	40,524	42,132	Cont					
(U) Appropriated Value	35,183	36,984								
(U) Adjustments to Appropriated Value										
a. Congressional/General Reductions	-1,148	-117								
b. SBIR	-885									
c. Omnibus/Other Above Threshold Reprogrammings	-226									
d. Below Threshold Reprogrammings	-1,526									
(U) Adjustments to Budget Year Since FY 1999 PB			-1,746	-3,071						
(U) Current Budget Submit/FY 2000 PB	31,398	36,867	38,778	39,061	Cont					

(U) (U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$1,195 identified as a source for SBIR.

Page 2 of 11 Pages

Exhibit R-2 (PE 0603216F)

	RDT	&E BUDGET IT	EM JUS	TIFICAT	ION SH	IEET (R·	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVIT 3 - Advance	BUDGET ACTIVITY 3 - Advanced Technology Development					UMBER AND D3216F A chnology	TITLE Aerospac	e Propul	sion and	Power	F	PROJECT 2480
	COST (\$	) In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2480 Aerospace	e Fuels and <i>i</i>	Atmospheric Propulsion	2,210	2,170	3,087	3,193	3,260	3,328	Continuing	Continuin		
$\begin{array}{r} \text{maintenance, an} \\ \text{temperature fuel} \\ \text{air turborockets,} \\ (U) \underline{FY 19} \\ - (U) \\ (U) \underline{FY 19} \\ - (U) \\ (U) \underline{FY 19} \\ - (U) \\ $	id improve l system de , dual-mod <u>998 (\$ in T</u> \$874 \$185 \$325 \$60 \$1,444 <u>999 (\$ in T</u> \$1,364 \$211 \$311 \$100 \$66 \$2,052	performance of aircraft a ssigns and components of e ramjets, and combined/ housands): Demonstrated therma greater cooling capac Demonstrated effectiv Demonstrated advand JP-8+100 and high he Completed final docu Total housands): Demonstrate thermal cooling capacity (per Demonstrate advance JP-8+100 and high he Develop and demons applications which w reconnaissance/strike Identified as a source Total	and missiles. n upgraded a /advanced-cy ally stable JP city (perform veness of the ced fuel syste eat sink fuels imentation of ly stable JP-4 formance) for eness of ther ed fuel syster eat sink fuels strate the desi cill provide te e vehicles and for SBIR.	Emphasis i nd advanced cle engines f -8+100 and ance) for up rmally stable em designs a s. n Variable F 8+100 and h or upgraded a mally stable n designs an s. ign and cons cchnology at d airbreathin	s on demon systems. E to assure fut high heat sin graded and f e JP-8+100 nd high tem low Ducted igh heat sin and future a JP-8+100 for d high temp truction of c lower risk f g boosters.	strating the e Demonstrates ure propulsion nk fuels that future aircraft for reduced n perature com Rocket techn k fuels that r ircraft and m perature comp critical high- for future mis	effects/benef a unconvention on options for reduce fuel ft and missile maintenance nponents that nology and c reduce fuel s issiles. a intenance i ponents that speed proput ssile systems	its of JP-8+1 onal airbreat or high-speed system main es. in a variety t permit util oncepts. ystem maint n a variety of permit utiliz lsion compo	100 on curre hing propuls d missiles. ntenance on of aircraft. ization of the enance on c of aircraft. zation of the nents/structu -to-target is	nt systems, a sion subsyste current aircra e increased co urrent aircraf increased co ures for mani critical and f	nd advanced ms such as a aft and prove ooling capa it and provid oling capaca hed and unn for next gend	d high ramjets, ide city of de greater ity of hanned eration

	RDT		DATE February 1999			
BUDGET ACTIVIT 3 - Advance	ed Tech	nology Development	PE NUMBER AND TITLE 0603216F Aerospace Pro Technology	opulsion and	Power	PROJECT <b>2480</b>
(U) FY 2000 (\$	in Thousa	ands):				
- (U)	\$884	Demonstrate thermally stable JP-8+100 fuel that redu	aces fuel system maintenance on cur	rent aircraft and pr	ovides greater coo	ling capacity
– (U)	\$771	(performance) for upgraded and future aircraft and n Demonstrate thermally stable JP-8+225 and high hea cooling capacity (performance) for upgraded and fut	hissiles. It sink fuels that reduce fuel system in the aircraft and missiles	maintenance on cu	rrent aircraft and p	rovide greater
– (U)	\$555	Develop and demonstrate the design and construction applications which will provide technology at lower	n of critical high-speed propulsion co risk for future missile systems where	omponents/structur time-to-target is c	es for manned and ritical and for next	unmanned generation
– (U)	\$2,210	reconnaissance/strike vehicles and airbreathing boost	ers.			
(U) FY 20	01 (\$ in Tł	housands):				
– (U)	\$868	Demonstrate thermally stable JP-8+100 fuel that redu	aces fuel system maintenance on cur	rent aircraft and pr	ovides greater coo	ling capacity
– (U)	\$760	(performance) for upgraded and future aircraft and n Demonstrate thermally stable JP-8+225 and high hea	hissiles. It sink fuels that reduce fuel system is a singular to the system is a system is a singular to the system is a system is a system is a singular to the system is a singular to the system is a syste	maintenance on cu	rrent aircraft and p	rovide greater
– (U)	\$542	Develop and demonstrate the design and construction applications which will provide technology at lower	n of critical high-speed propulsion consistence of the speed propulsion of the systems where the systems where	omponents/structur time-to-target is c	res for manned and ritical and for next	unmanned
– (U)	\$2,170	Total	ers.			
Project 2480		Page	e 4 of 11 Pages	Exhibit	R-2A (PE 06032	16F)
			232			

RDT&E BUDGET ITEM JU	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Pr Technology	opulsion and Power 2480	Т
(U) B. <u>Project Change Summary - Description of Signifi</u>	cant Changes: Not Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) This project has been coordinated through the F</li> </ul>	Reliance process to harmonize efforts and eliminate dupl	ication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2480	Page 5 of 11 Pages	Exhibit R-2A (PE 0603216F)	

	RDT	&E BUDGET ITI	EM JUS	TIFICAT		SHEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVIT 3 - Advance	<sup>ץ</sup> ed Tech	nology Developm	ent		PI (	E NUMBER AND D603216F Fechnology	TITLE Aerospac V	e Propul	sion and	Power	F	PROJECT 3035
	COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 200 Estimat	0 FY 2001 e Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3035 Aerospace	Power Syste	ems Technology	3,133	3,388	3,	162 2,511	2,724	4,261	4,350	4,441	Continuing	Continuing
(U) A. <u>Mission</u> distribution syste aircraft and grou Representative in (U) FY 19 - (U) - (U) - (U) - (U) (U) FY 19 - (U) (U) FY 19 - (U) - (U) - (U) - (U)	Description Description Description Description Description Description Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Solution Description Description Description Solution Description Description Description Solution Description Description Description Solution Description Solution Description Description Solution Description Description Solution Description Description Description Description Solution Description	on: Develops and demo principal focus is to provi systems. This will be acc nuts include increased reli <u>nousands</u> ): Designed, fabricated, survivability. Designed, fabricated, reliability and suppor Designed, fabricated, auxiliary power, and o Total <u>nousands</u> ): Design, fabricate, and survivability. Develop an aircraft el tolerant architecture a Design, fabricate, and emergency power. Identified as a source Total	nstrates airc ade a two- to complished b ability (9009 and tested a and tested a and tested c tability. and tested a emergency p l test an elec lectrical pow and will imp l test a demo	raft and grou five-fold im by replacing %), improved n electrical omponents s demonstrate ower. trical distrib ver generatio rove aircraft onstrator airc	and power provement fluid-power distributi distributi supportion or aircraft oution system n and distribution reliabilities raft on-b	er systems inclu ent in reliability wered (hydraulid tability (15-25% on system which og a demonstrate ft on-board Integ stem which ensu- stribution system ty and survivabi- poard IPU which	ding engine and maintai cs/bleed air) and reduc h ensures fa or aircraft ele grated Powe ures fault tol n for test val lity. n is critical f	starters, aux nability and accessories y ed vulnerabi ult tolerant a ectrical distr r Unit (IPU) erant archite idation and or aircraft er	iliary power significantly with electric ility (15%). architecture, ibution syste which is cri ecture, impro- flight demon ngine startin	units, and e reduced cos ally-powered improving a em for increa itical for airco wing aircraft nstration whi g, auxiliary p	lectrical pov st of owners d systems. ircraft reliab used aircraft and aircraft traft engine s t reliability a ch will ensu	ver hip for bility and starting, and ure fault
Project 3035					Page 6	of 11 Pages			Exhibi	t R-2A (PE	<u>0603216F)</u>	
						234						

RDT	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Tech	PROJECT 3035		
(U) <u>FY 2000 (\$ in T</u> – (U) \$1,839 – (U) \$910 – (U) \$413 – (U) \$3,162 (U) <u>FY 2001 (\$ in TT</u> – (U) \$1,558 – (U) \$70 – (U) \$70 – (U) \$883 – (U) \$2,511 (U) <b>B.</b> <u>Project Change</u> (U) <b>C.</b> <u>Other Program I</u> (U) <u>Related Activitie</u> – (U) PE 0602203 – (U) PE 0602201 – (U) This project (U) <b>D.</b> <u>Acquisition Strat</u> (U) <b>E.</b> <u>Schedule Profile</u> :	<ul> <li><u>housands</u>): <ul> <li>Develop an aircraft electrical power generation and of tolerant architecture and will improve aircraft reliable Design, fabricate, and test a demonstrator aircraft or auxiliary power, and emergency power.</li> <li>Design, fabricate, and test power sources for electric Total.</li> </ul> </li> <li><u>housands</u>): <ul> <li>Develop an aircraft electrical power generation and of tolerant architecture and improve aircraft reliability. Design, fabricate, and test a demonstrator aircraft or power.</li> <li>Design, fabricate, and test a demonstrator aircraft or power.</li> <li>Design, fabricate, and test power sources for electric Total.</li> </ul> </li> <li>Summary - Description of Significant Changes: Not Funding Summary: <ul> <li>Es:</li> <li>F, Aerospace Propulsion.</li> <li>F, Aerospace Flight Dynamics.</li> <li>has been coordinated through the Reliance process to heregy: Not Applicable.</li> <li>Not Applicable.</li> </ul> </li> </ul>	distribution system for test validation and lity and survivability. a-board Integrated Power Unit (IPU) which ally-based aircraft for survival and emerge distribution system for test validation and and survivability. and survivability. board IPU which is critical for aircraft of ally-based aircraft for survival and emerge Applicable.	I flight demonstration which will ensure fault ch is critical for aircraft engine starting, gency power. I flight demonstration which will ensure fault engine starting, auxiliary power, and emergency gency power.
Project 3035	Pag	e 7 of 11 Pages	Exhibit R-2A (PE 0603216F)

BUDGET ACTIVITY         PEQUECT           3 - Advanced Technology Development         PENUMPER AND TITLE         0603216F Aerospace Propulsion and Power         681B <u>COST (\$ In Thousandu)</u> FY 1998         FY 1998         FY 2001         FY 2002         FY 2004         FY 2005         Estimate	RDT&E BUDGET ITI	EM JUS	TIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
COST (\$ In Thousands)         FY 1998         FY 1998         FY 2001         FY 2001         FY 2003         FY 2004         FY 2004 </th <th>BUDGET ACTIVITY 3 - Advanced Technology Developm</th> <th>ent</th> <th></th> <th>PE N 060 Teo</th> <th>UMBER AND D3216F Chnology</th> <th>TITLE Aerospac</th> <th>e Propul</th> <th>sion and</th> <th>Power</th> <th>F</th> <th>PROJECT 681B</th>	BUDGET ACTIVITY 3 - Advanced Technology Developm	ent		PE N 060 Teo	UMBER AND D3216F Chnology	TITLE Aerospac	e Propul	sion and	Power	F	PROJECT 681B
Bits       Advanced Turbine Engine Gas Generator       26,821       31,427       33,406       34,380       32,084       27,827       21,884       22,566       Continuing       Continuing         (U)       A. Mission Description:       This project develops turbine engine gas generator technology to meet the requirements of current and future aircraft propulsion systems.       The objective is to provide the continued evolution of technologies into an advanced gas generator in which the performance, cost, durability, repairability, and         maintainability aspects can be assessed in a real engine environment. The gas generator, or core, is the basic building block of the engine and i consists of a compressor, a combustor, and a high pressure turbine. Experimental core engine testing enhances early, low-risk transition of key engine technologies into engineering development where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, fumissites, land combut vehicles, and ships. The Advanced Turbine Engine Gas Generator project supports the Integrated High Performance Turbine Engine Technology (IHPTET) program. IHPTET is a three phase, totally integrated DoD. Defense Advanced Rearch Projects Agency (DARPA), National Aeronautics and Space Advancing cost on invership. The HHPTET program structure provides continuous technology transition for military turbine engine upgrades and derivatives and has the added benefit of enhancing the U.S. turbine engine industry sinternational competitiveness and demonstrates affordable turbine engine ongle core components.         (I) <u>FY 1998 (S in Thousands)</u> :       – (U)       §23,388       Designed, fab	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This project develops turbine engine gas generator technology to meet the requirements of current and future aircraft propulsion systems. The objective is to provide the continued evolution of technologies into an advanced gas generator in which the performance, cost, durability, repairability, and maintainability aspects can be assessed in a real engine environment. The gas generator, or core, is the basic building block of the engine and it consists of a compressor, a combustor, and a high pressure turbine. Experimental core engine testing enhances early, low-risk transition of key engine technologies into engineering development where they can be applied to derivative and/or new systems. These technologies are applicable to a wide range of military and commercial systems including aircraft, missiles, land combat vehicles, and ships. The Advanced Turbine Engine Gas Generator project supports the Integrated High Performance Turbine Engine Technology (IHPTET) program. IHPTET is a three phase, totally integrated DoD. Defense Advanced Research Projects Agency (DARPA), National Aeronautics and Space Administration (NASA), and industry program focused on doubling turbine engine uproalso negabilities while reducing cost of ownership. The IHPTET program structure provides continuous technology transition for military urbine engine high pressure core components.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) <u>S23,888</u> Designed, fabricated, and performance tested technology demonstration core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for fighters, attack aircraft, bombers, and large transports.</li> <li>(U) <u>S23,37</u> Designed, fabricated, and durability tested technology demonstration core engines to provide improved performance and fuel consumption for turbofan/turbojet engines for trainers, rotorcraft, special operations aircraft, th</li></ul></li></ul>	681B Advanced Turbine Engine Gas Generator	26,821	31,427	33,406	34,380	32,084	27,627	21,894	22,566	Continuing	Continuing
	<ul> <li>(U) A. <u>Mission Description</u>: This project develop The objective is to provide the continued evolution maintainability aspects can be assessed in a real eng combustor, and a high pressure turbine. Experimen where they can be applied to derivative and/or new missiles, land combat vehicles, and ships. The Adv (IHPTET) program. IHPTET is a three phase, total Administration (NASA), and industry program focu structure provides continuous technology transition industry's international competitiveness and demons</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: – (U) \$23,888 Designed, fabricated, consumption for turbo – (U) \$596 Designed, fabricated, turbofan/turbojet eng – (U) \$2,337 Designed, fabricated, turboshaft/turboprop air vehicles.</li> <li>– (U) \$26,821 Total</li> </ul>	of technolog gine environ tal core engi systems. The ranced Turbi ly integrated used on doub for military strates afford and perform ofan/turboje and durabili ines for figh and tested to and small tu	gine gas ger gies into an a ment. The g ine testing e nese technolo ne Engine C DoD, Defer oling turbine turbine engi dable turbine nance tested t engines for ity tested tec ters, attack a echnology durbofan engin	Page 8 of	iology to me s generator in c, or core, is y, low-risk t olicable to a r project sup d Research 1 oulsion capab and derivat n pressure co demonstration ack aircraft, nonstration c bers, and lan n core engine ers, rotorcraf	et the requir n which the p the basic bui ransition of wide range of ports the Im Projects Age pilities while ives and has ore compone on core engir bombers, ar core engines ge transport es to provide rt, special op	ements of cu performance lding block key engine t of military and tegrated Hig ncy (DARP, reducing co the added b nts. the added b nts. the sto provide ad large trans to provide in s. improved p erations airco	Exhibi	ture aircraft ility, repaira e and it cons into enginee ial systems in ace Turbine I Aeronautics ship. The IH nancing the U performance rability and a and fuel con transports, a	propulsion s bility, and ists of a cor- ering develo- neluding air Engine Tech and Space PTET progr J.S. turbine and fuel ffordability sumption fo and large un	systems. npressor, a pment craft, nology ram engine for r inhabited

RDT	&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhi	bit)	February 1999
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603216F Aerospace Technology	e Propulsion and	PROJECT Power 681B
(U) EV 1000 (\$ in Th	pousands):			
$(0) \frac{111999}{(31111)}$ - (U) \$25.558	Design, fabricate, and performance test technology d	emonstration core engines to p	rovide improved perform	nance and fuel consumption for
	turbofan/turbojet engines for fighters, attack aircraft,	bombers, and large transports		
– (U) \$650	Design, fabricate, and durability test technology dem	onstration core engines to prov	vide increased durability	and affordability for
(II) ¢4.000	turbofan/turbojet engines for fighters, attack aircraft,	bombers, and large transports		1
- (U) \$4,200	Design, fabricate, and test technology demonstration turboshaft/turboprop and small turbofan engines for	trainers rotorcraft special operations	ved performance and fue	ransports and large uninhabited
	air vehicles.	trainers, rotorerart, special ope	fations anotari, incator (	ransports, and rarge unimabiled
– (U) \$1,019	Identified as a source for SBIR.			
- (U) \$31,427	Total			
$(U) \frac{FY}{L} \frac{2000}{500} (5 \text{ In } 11) \frac{1}{5} (U) \frac{5}{5} \frac{1}{5} \frac{1}{5}$	<u>IOUSANUS</u> : Design fabricate and performance test technology de	emonstration core engines to n	rovide improved perform	ance and fuel consumption for
- (0) \$20,918	turbofan/turboiet engines for fighters, attack aircraft.	bombers, and large transports.	tovide improved periori	lance and fuel consumption for
– (U) \$2,488	Design, fabricate, and durability test technology dem	onstration core engines to prov	ide increased durability	and affordability for
	turbofan/turbojet engines for fighters, attack aircraft,	bombers, and large transports.		
– (U) \$4,000	Design, fabricate, and test technology demonstration	core engines to provide improv	ved performance and fue	l consumption for
	turboshaft/turboprop and small turbofan engines for	trainers, rotorcraft, special ope	rations aircraft, theater t	ransports, and large uninhabited
- (II) \$33.406	air venicies. Total			
- (0) \$33,400	10141			
(U) <u>FY 2001 (\$ in Th</u>	ousands):			
- (U) \$24,663	Design, fabricate, and performance test technology de	emonstration core engines to p	rovide improved perform	nance and fuel consumption for
	turbofan/turbojet engines for fighters, attack aircraft,	bombers, and large transports.		
- (U) \$5,417	Design, fabricate, and durability test technology dem turbofon/turboiot angings for fighters, attack aircraft	onstration core engines to prov	ide increased durability	and affordability for
- (U) \$4,300	Design fabricate and test technology demonstration	core engines to provide improv	ved performance and fue	l consumption for
(0) \$1,000	turboshaft/turboprop and small turbofan engines for	trainers, rotorcraft, special ope	rations aircraft, theater t	ransports, and large uninhabited
	air vehicles.		,	
- (U) \$34,380	Total			
Project 681B	Page	9 of 11 Pages	<u>E</u> xhibit	R-2A (PE 0603216F)
		237		

RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	<b>February 1999</b>
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace Propulsion and Technology	PROJECT 681B
(U) (U) B. Project Change Summary - Description of Significant Changes: within the Science and Technology (S&T) Program.	Changes to this project since the previous President's	Budget are due to higher priorities
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602201F, Aerospace Flight Dynamics.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0603202F, Aircraft Propulsion Subsystem Integration.</li> <li>(U) PE 0603210N, Aircraft Propulsion.</li> <li>(U) PE 0603003A, Aviation Advanced Technology.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul>	armonize efforts and eliminate duplication.	
Project 681B Page	10 of 11 Pages Exhib	it R-2A (PE 0603216F)
	238	<b>-</b>

RDT&E BUDGET ITEM JUSTIF	ICATION SHEET (R-2A Exhibi	t) DATE Febru	ary 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603216F Aerospace F Technology	Propulsion and Power	PROJECT 681B
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 681B	Page 11 of 11 Pages	Exhibit R-2A (PE 060	3216F)
	239		

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PE TITLE: Personnel, Training, and Simulation Technology

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							DATE Fe	bruary 1	999	
BUDGET ACTIVITY 3 - Advanced Technology Development				UMBER AND 03227F F chnology	TITLE Personne	I, Trainin	g, and S	imulatior	- 	PROJECT 2743
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2743 Advanced Training/Force Management	5,655	6,595	4,827	6,538	7,905	8,645	5,829	5,949	Continuing	Continuing
Quantity of RDT&E Articles	0	0	C	0	0	0	0	0	0	0
readiness. Develops, demonstrates, and evaluates to environments, technologies for long distance netwo strategies to support warfighter training in a joint sy contributing to combat readiness. Develops models information warfare, and tools for mission planning technologies necessary to provide realistic training representative tasks in high technology jobs, and so systems which continually interact with students fo at the unit level. Work concentrates on aircrew, sp	echnologies orking to enhynthetic batt s to support a g, rehearsal, for night tin oftware to en r effective in ace, and info	for Distribut hance joint-S lespace. Pro aircrew, spac execution, a he warfightir able Air For ndividualized formation dor	ed Mission ervice train vides a tech ee, and info nd force pro- g. Develop ce training l training. I ninance do	Training (D) ing, visual di mology testb rmation oper otection in a os and demor developers to Develops and nains.	isplays for re ed for exam ations, perfo distributed r istrates com o rapidly and demonstrat	ng realistic, o eal-time and ining warfig ormance mea nission envir puter-based i l affordably l es informatio	post-missio hter skills, c surement sy conment. De intelligent tu build intellig on managen	a arrorable n debrief, an ognitive fun stems for air evelops and o ttoring techn gent compute hent technolo	d instruction ctions, and le , space and demonstrate ology for er assisted tr ogy for the v	ombat hal behaviors s aining varfighter

Project 2743

Page 1 of 4 Pages

RDT	&E BUDGET ITEM JUSTIFICATION	N SHEET (R-2 Exhibit)	DATE February 1999
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and S Technology	PROJECT Simulation 2743
(U) FY 1998 (\$ in Th	nousands):		
- (U) \$1,242	Developed, demonstrated, and evaluated technologie testbed with a mobile, interactive, air and ground thr Service, nationwide air and ground crew training too	s to create Distributed Mission Training (DMT) capa eat environment, and a simulated command and cont ol.	bilities including a four-aircraft rol module, for use as a multi-
- (U) \$1,086	Developed, demonstrated, and evaluated simulator vivisual displays with "real world" resolution. Incorport for simulator/training systems and developed multi-le information to be used simultaneously on simulation	isual technologies. Continued development of high r prated scene imagery from actual medium and high al evel security manager (MLM) to allow for incorporat /training systems.	esolution microlaser projector for titude imagery on visual displays ing different levels of classified
- (U) \$2,126	Developed and demonstrated technologies to enable demonstrating proof-of-concept enhanced real-time I dynamic noise, and goggle gain response. Demonstr with NVGs in fighter aircraft.	and enhance Night Vision Goggle (NVG) training an NVG simulation for combat mission training, includinated low-cost light emitting diode (LED)-based inter	d rehearsal for aircrews by 1g special effects such as halos, im cockpit lighting compatible
- (U) \$1,201	Developed, demonstrated, and evaluated computer-b modeling technologies. Initiated migration of succes	ased training technologies and evaluated knowledge sful techniques to the JAVA computer language for e	epresentation and student enhanced deployability.
- (U) \$5,655	Total		
(U) FY 1999 (\$ in Th	nousands):		
- (U) \$1,200	Develop, demonstrate, and evaluate technologies to a threat systems and to allow for a more accurate repre- Forces (SAF) and Synthetic Theater of War (STOW) certified dynamic threat system which incorporates r	create DMT capabilities including electronic combat esentation of the battlespace in the DMT environment to give a more realistic representation of the combat epresentative real-world threat systems.	environment tools to represent . Incorporate Semi-Automated environment and develop a
- (U) \$ 956	Develop, demonstrate, and evaluate simulator visual portraying friendly and threat airborne systems.	technologies including a high-resolution laser projec	tion system for more accurately
- (U) \$2,070	Develop and demonstrate technologies to enable and requirements for physics-based, low-cost, deployable technical support to Air Force and DoD for NVG de syllabus development.	enhance NVG training and rehearsal for aircrews by e real-time simulation of NVG imagery to support mi sign, acquisition, flight test, lighting compatibility, n	developing simulation ssion training and provide hishap investigations, and training
- (U) \$2,165	Develop, demonstrate, and evaluate computer-based technologies. Evaluate adaptive instruction authored architecture requirements into the virtual and constru- technology into brief/debrief stations to support squa Identified as a source for SBIP	training technologies and evaluate knowledge repres I by targeted end users. Incorporate interconnection to active training systems, and advances in display, network dron-level briefing room and training capability.	entation and student modeling cchnology including high level vorking, and computing
Project 2743	Page	e 2 of 4 Pages Exhi	oit R-2 (PE 0603227F)

	RDT&E BUDGET ITEM JUSTIFICATI	ON SHEET (R-2 Exhibit)	DATE February 1999
BUDGET ACTIVIT	d Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and S Technology	PROJECT 2743
- (U) \$	6,595 Total		
(U) <u>FY 200</u>	) (\$ in Thousands):		
– (U) \$1	788 Develop, demonstrate, and evaluate technologies to for constructive simulations to more accurately repr to allow for human-in-the-loop training scenarios. I real-time intelligence updates and develop technologi incorporate live ground segments.	create Distributed Mission Training (DMT) capabilities in resent real-world systems and representation technologies Develop real-time intelligence fusion into the DMT battles gies to include weapons controller interfaces and wing co	ncluding physics-based modeling including a virtual threat cockpit space environment to simulate mmand and control system to
- (U) \$	639 Develop, demonstrate, and evaluate simulator visual generation systems to allow for higher resolution, m	l technologies including affordable, increased performanc nore realistic visual displays in the simulation systems.	e, personal computer-based image
– (U) \$1	500 Develop and demonstrate technologies to enable and wide area, networked multi-ship, high fidelity NVG shadowing and illumination effects associated with guidelines for distance estimation, scanning techniq orientation when wearing NVGs.	d enhance Night Vision Goggle (NVG) training and rehea combat mission simulation including a lunar illuminatio combat related light sources (fires, explosions, flares). D ques, task management techniques, and maintenance of si	arsal for aircrews by demonstrating n model as well as dynamic evelop perceptual training tuational awareness and spatial
– (U) \$	900 Develop guidelines and techniques for incorporating	g force-on-force modeling into DMT for training force pro-	otection units.
– (U) \$4	827 Total		
(I) <b>EV 20</b> (	11 (\$ in Thousands):		
- (U) \$1	211 Develop, demonstrate, and evaluate technologies to the flying environment and information technologie	create DMT capabilities including technologies to cue hu s to integrate live/virtual/constructive interfaces.	man sensory systems to changes in
- (U) \$2	,027 Develop, demonstrate, and evaluate simulator visua at forward basing locations and including human-co	l technologies including smaller visual display systems to omputer interfaces to incorporate more flexible and realist	allow for mobile, realistic training tic combat training scenarios.
- (U) \$1	500 Develop and demonstrate technologies to enable an helicopter aircrews, to evaluate measures of training Conduct field evaluation of NVG training technique maneuvering.	d enhance NVG training and rehearsal for aircrews invol g effectiveness, mission performance and transfer of train es to include distance estimation for helicopter, formation	ving operational aircraft and ing from simulator to the aircraft. and aerial refueling, and combat
- (U) <b>\$</b> 1	800 Develop advanced training technologies with force- biological, and chemical threats.	on-force capabilities to train force protection units to pro-	ect against terrorist, nuclear,
– (U) \$6	538 Total		
Project 2743		Page 3 of 4 Pages Exhi	bit R-2 (PE 0603227F)

	DATE February 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603227F Personnel, Training, and Simulation Technology
(U) B. <u>Budget Activity Justification</u> : This program is in Budget Ac new system developments that have military utility and address warfig	ctivity 3, Advanced Technology Development, since it develops and demonstrates technologies for ghter needs.

RDT&E BUDGET ITEM JUS	DATE Februa	DATE February 1999				
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603227F Technolog	ID TITLE Personnel, gy	Training, and	Simulation	PROJECT 2743
(U) C. Program Change Summary (\$ in Thousands):						
<ul> <li>(U) Previous President's Budget/FY 1999 PB</li> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value <ul> <li>a. Congressional/General Reduction</li> <li>b. SBIR</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>d. Below Threshold Reprogrammings</li> </ul> </li> <li>(U) Adjustments to Budget Year Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> <li>(U) Significant Program Changes: Changes to this program sim Program.</li> <li>FY 1999: \$204 identified as a source for SBIR.</li> <li>(U) D. Other Program Funding Summary: <ul> <li>(U) Related Activities:</li> <li>(U) PE 0602202F, Human Effectiveness Applied Rese</li> <li>(U) PE 0604227F, Distributed Mission Training (DM'</li> <li>(U) This project has been coordinated through the Rel</li> </ul> </li> <li>(U) E. Acquisition Strategy: Not Applicable.</li> </ul>	<u>FY 1998</u> 5,668 6,147 -320 -133 -39 5,655 ce the previous P arch. Γ).	<u>FY 1999</u> 6,636 6,636 -41 6,595 President's Budg	FY 2000 6,165 -1,338 4,827 et are due to high s and eliminate d	FY 2001 7,013 -475 6,538 her priorities within	Total <u>Cost</u> Cont the Science and Tec	hnology (S&T)
Project 2743	Pa	are 4 of 4 Pages		Fx	hibit R-2 (PE 0603)	227F)
	1 U)	245				

PE TITLE: Crew Systems & Personnel Protection Technology

	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										999
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603231F Crew Systems & Personnel Protection         Technology       Technology											
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Progra	am Element (PE) Cost	28,052	29,818	14,841	15,276	14,661	15,033	15,317	17,658	Continuing	Continuing
2830 Crew Works	stations, Life Support, and Escape	12,667	12,086	8,312	8,590	8,165	8,372	8,517	8,764	Continuing	Continuing
3257 Helmet-Mou	unted Sensory Technologies	15,385	17,732	6,529	6,686	6,496	6,661	6,800	8,894	Continuing	Continuing
Quantity of	RDT&E Articles	0	0	0	0	0	0	0	0	0	0

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments. Specific projects within this PE advance and integrate human factors technologies into crew workstation, life support, and protective equipment designs. Technologies encompass the development and demonstration of escape system flight control and life protection devices for high-speed and low-altitude, adverse-attitude flight regimes to include those derived from the Russian ejection seat (U.S. - Russian cooperation). Improves life support technologies principally focused on protecting aircrew from effects of altitude and G-forces in high performance aircraft and adjusting specifications of existing equipment to accommodate the increasing operational envelope and a more diversified population of aircrew members. Technology for an advanced on-board oxygen generation system for transport aircraft will be demonstrated to alleviate the logistics burden of current liquid oxygen systems that require ground-based oxygen generation plants. Technologies improve the ability to quantify crew system automation and information cognition requirements through data from constructive analysis and real-time distributed simulation. Models of human perception and knowledge of cognitive function are developed and applied to improve operator performance in high workload environments. Technologies will be developed that will incorporate advanced helmet-mounted capability tracker and displays for target detection, identification, sighting, and weapons firing. Improved helmet-mounted night vision device capability and laser eye protection capability will be incorporated to address the operational limitations of fighting at night and in hazardous laser environments. Note: Congress added \$13.45 million in FY 1999 for ejection seat technology (\$2 million), helmet display technology (\$5 million), panoramic night vision goggles (\$2.2 millio

Page 1 of 8 Pages

Exhibit R-2 (PE 0603231F)

RDT&E BUDGET ITEM JUS	DATE Febru	uary 1999						
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603231F Technolog	ID TITLE Crew Syste Gy	ems & Person	nel Protection	I		
<ul> <li>(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies to protect and enhance the performance of Air Force personnel in operational environments.</li> <li>(U) C. <u>Program Change Summary (\$ in Thousands)</u>:</li> </ul>								
<ul><li>(U) Previous President's Budget /FY 1999 PB</li><li>(U) Appropriated Value</li></ul>	<u>FY 1998</u> 24,881 26,204	<u>FY 1999</u> 16,603 30,053	<u>FY 2000</u> 17,356	<u>FY 2001</u> 18,267	Total <u>Cost</u> Cont			
<ul> <li>(U) Adjustments to Appropriated Value <ul> <li>a. Congressional/General Reductions</li> <li>b. SBIR</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>d. Below Threshold Reprogrammings</li> </ul> </li> <li>(U) Adjustments to Budget Year Since FY 1999 PB</li> <li>(U) Current Budget Submit/EX 2000 PB</li> </ul>	-959 -649 4,732 -1,276 28.052	-235	-2,515	-2,991 15 276	Cont			
(U) Significant Program Changes: The Above Threshold Repro	28,032 Ogramming in FY	29,010 7 1998 is for a Co	ongressional add	for the Wallace-Ke	ettering Neurosciend	ces Institute.		

Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$977 identified as a source for SBIR.

Page 2 of 8 Pages

RDT	&E BUDGET IT	EM JUS	TIFICAT	ION SI	HEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 3 - Advanced Tech	nology Developn	nent		PE 1 06 Te	NUMBER AND 03231F chnology	TITLE Crew Sys	tems & F	Personne	l Protecti	on 2	PROJECT <b>2830</b>
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2830 Crew Workstations, Lif	e Support, and Escape	12,667	12,086	8,31	8,312 8,590 8,165 8,372 8,517 8,764 Continuing Cont					Continuing	
(U) A. <u>Mission Descrip</u> protect aircrews from physinjuries in emergency eject full range of the pilot population (U) <u>FY 1998 (\$ in T</u> - (U) \$ 1,245 - (U) \$ 9,873 - (U) \$ 9,873 - (U) \$ 1,304 - (U) \$ 245 - (U) \$ 12,667 (U) <u>FY 1999 (\$ in T</u> - (U) \$ 1,882 - (U) \$ 1,882 - (U) \$ 7,808 - (U) \$ 7,808 - (U) \$ 2,000 - (U) \$ 396 - (U) \$ 12,086	<ul> <li>tion: This project provisiological stresses such a stions at high-speed and alation.</li> <li><u>housands</u>): <ul> <li>Developed concept f reduce cost/risk of cr</li> <li>Demonstrated advan low altitude, adverse 36D-3.5A lightweigh Demonstrated advan Developed and demorated advan Developed and demorated advan Developed and demorated advan fighter aircraft, incluse seat to U.S. aircraft. Finalize design of act Identified as a source Total</li> </ul></li></ul>	ades technolog as high altitud at low-altitud for quantifyin rew system ac aced escape te e attitude fligh ht ejection se aced hybrid or onstrated cust a simulation- Begin to deve strate subsyst iding reducin dvanced hybri e for SBIR.	gy to improv de, high G-fo le, adverse-a g future crew cquisition. echnologies t ht conditions at to U.S. air kygen techno tom oxygen techno tom oxygen techno tom oxygen techno tom oxygen techno tom oxygen technologies id oxygen technologies id oxygen technologies	e operator prces, high ttitude fligh v system po o reduce ai , including craft. blogies for a mask advan d to quanti n performant ct the aircre and techn chnologies	combat perfor temperature, nt conditions, erformance re rcrew fatalitie reducing the aeromedical of nced technolo fy crew perfo nce model lin ew member d ology risks as for transport	rmance; dev and aerodyn while impro- quirements es and major science and operations. gy for high- rmance requ king crew po- uring emerg ssociated with aircraft.	elop rigorou amic forces: oving suppor with a simul r injuries in a technology G and high a direments, st ency ejectio th adapting t	is, traceable i ; and reduce rtability, affor ation-based emergency e risks associa altitude oper reamline des with predicte ons in current the Russian i	human-cente aircrew fata ordability, an testbed to str jections duri ated with ada ations.	red design t lities and ma d accommo eamline des ng high-spe upting the R uce cost/risk ntcome. nigh perforn lightweight	ools; ajor dating the sign and ed and ussian K- c of crew nance ejection
Project 2830				Page 3 a	of 8 Pages			Exhibi	t R-2A (PE	0603231F	)
				24	7						

RD	DATE February 1999				
BUDGET ACTIVITY 3 - Advanced Tec	hnology Development	PE NUMBER AND TITLE 0603231F Crew Systems Technology	& Personnel	Protection	PROJECT <b>2830</b>
(U) <u>FY 2000 (\$ in</u> - (U) \$ 1.872	<u>Thousands</u> ): Continue to develop a simulation-based testbed to quant	ify crew performance requirements.	streamline design.	reduce cost/risk of	crew system
(0) \$ 1,012	acquisition, demonstrate the ability to quantify crew per support missions.	formance requirements for a tactical	attack mission, an	d analyze the poter	ntial for space
– (U) \$ 2,440	Develop and demonstrate subsystems to protect the airc aircraft.	rew member during emergency eject	tion in current and	future high perform	nance fighter
– (U) \$ 4,000	Develop and demonstrate subsystems to reduce the science ejection seat for potential use in future high performance	nce and technology risks associated a fighter aircraft.	with adapting the R	ussian K-36D-3.5A	A lightweight
– (U) \$ 8,312	Total				
(U) <u>FY 2001 (\$ in</u>	Thousands):				
- (U)\$ 1,717	Complete functional specification for a simulation-base cost/risk of crew system acquisition. Demonstrate the a	d testbed to quantify crew performance bility to quantify crew performance	requirements, st requirements for sp	ace support mission	nd reduce ns.
– (U) \$ 2,573	Continue to demonstrate subsystems to protect the aircr aircraft.	ew member during emergency ejecti	ons in current and	future high perforn	nance fighter
– (U) \$ 4,300	Develop and demonstrate subsystems to reduce the scie ejection seat for potential use in future high performance	nce and technology risks associated e fighter aircraft.	with adapting the R	Lussian K-36D-3.5A	A lightweight
– (U) \$ 8,590	Total				
Project 2830	Pag	e 4 of 8 Pages	Exhibit	R-2A (PE 060323	31F)
		248			

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1	999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Person Technology	nel Protection	PROJECT 2830
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Char within the Science and Technology (S&T) Program.	ges to this program since the previous President's	Budget are due to higher pr	iorities
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602202F, Human Effectiveness Applied Research.</li> <li>(U) PE 0604703F, Aeromedical/Casualty Care Systems Development.</li> <li>(U) PE 0604706F, Life Support Systems.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul>	armonize efforts and eliminate duplication.		
(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. Schedule Profile: Not Applicable.			
Project 2830 Pag	e 5 of 8 Pages Ex	hibit R-2A (PE 0603231F)	
	249		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE Fe	February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development				PE N 06 Te	PE NUMBER AND TITLE PROJECT 0603231F Crew Systems & Personnel Protection 3257 Technology						PROJECT <b>3257</b>	
COST (\$	\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
3257 Helmet-Mounted Sens-	ory Technologies	15,385	17,732	6,529	6,686	6,496	6,661	6,800	8,894	Continuing	Continuir	
situational awareness duff technologies, pilots will b vision goggles (NVG) to biological effects of laser (U) <u>FY 1998 (\$ in T</u> – (U) \$ 3,320 – (U) \$ 2,610 – (U) \$ 2,610 – (U) \$ 1,555 – (U) \$ 3,000 – (U) \$ 4,900 – (U) \$ 15,385	hig day and hight hissis be able to detect, identify enhance aerial combat of weapons. <u>'housands)</u> : Developed and dem Flight demonstrated demonstrated high I To improve night op of-the-art for image Advanced the state- Laser Threat Analys technology for prote Developed a passive Conducted Advance segmentation, next a collaborative researd Total	onstrated HM capabilities at onstrated HM and transition uminance Cat perations, com intensifier tub of-art for adva sis System to de cetion from ain e matrix, high ed Neuroscien generation neu ch efforts focu	T/D and sub ned enhance thode Ray Tu ppleted desig be technolog anced laser e evaluate grou rborne laser luminance, ce Interface uro-navigatio used on maxi	system tech ons faster a nologies are system tech d uplook an ibe. n for panor y for NVGs ye protection ind-based la threats. miniature, f Research pro on, and Pos mizing the	amic night vi amic night vi amic night vi amic night vi aser threat, co lat-panel ima rogram focus itron Emissic effectiveness	essed color s ng reticles to sion goggle nologies and ompleted flig age source te ed on advan on Tomograp s of human p	ymbology, a cymbology, a cymbology, a cymbology, a cymbology, a cymbology fo compared a susce ght test of di chnology fo ced magneti ohy (PET) bi erformance	and evaluate and evaluate lots with an umic symbol ptibility mod electric stack r use in HM c resonance tochemical i in both clini	d eye tracker exclusive kii overlay and lels, complet c technology T/Ds. imaging vist maging. All cal and milit	r technologie Il zone, and evaluated th ted version 2 v, and evalua ualization ar projects are tary settings	ex night ate the es. he state- 2 of a tted nd e.	
Project 3257				Page 6 o	f 8 Pages			Exhibi	t R-2A (PE	0603231F)	)	

RD	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Tec	hnology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Personnel Technology	PROJECT 3257
(U) <u>FY 1999 (\$ in</u> – (U) \$ 8,019 – (U) \$ 3,340 – (U) \$ 5,792	<u>Thousands</u> ): Continue to develop and demonstrate helmet-mounted conduct risk reduction for the Joint Helmet-Mounted C HMT/D with High Off-Boresight Angle (HOBA) missi Demonstrate the operational potential of panoramic nig Continue to develop and demonstrate laser eye protect Analysis System (LTAS) into a distributed simulation analysis tool to evaluate high-energy laser hazard. Con	tracker and display (HMT/D) and subsystem technolog Cueing System (JHMCS) program, and document advar files. The vision goggles (PNVGs) with symbology overlay. Fon (LEP) technologies and susceptibility models, and b to evaluate laser, directed energy, and broadband optica nplete flight test of dielectric stack technology.	ies including color symbology, aced air-to-air capabilities for begin to integrate a Laser Threat al threats. Develop reflectivity
- (U) \$ 581 - (U) \$17,732	Identified as a source for SBIR. Total		
<ul> <li>(U) <u>FY 2000 (\$ in</u></li> <li>(U) \$ 3,608</li> <li>(U) \$ 1,615</li> <li>(U) \$ 1,306</li> <li>(U) \$ 6,529</li> </ul>	<u>Thousands</u> ): Continue to develop and demonstrate HMT/D and subsy technologies for JHMCS, HMT/D with LEP visors and Continue to evaluate the operational potential of PNVG Continue to integrate a LTAS into a distributed simulate factors evaluation of optical materials for frequency-agil Total	extem technologies including color symbology, pre-plan spectacles, and inertial head-mounted tracker. s with imaging sensor overlay and symbology overlay. ion to evaluate laser, directed energy, and broadband o le laser eye protection. Develop Laser Range Safety To	nned product improvement ptical threats. Begin human pol for high energy laser.
<ul> <li>(U) <u>FY 2001 (\$ in 7</u></li> <li>(U) \$ 4,247</li> <li>(U) \$ 1,103</li> <li>(U) \$ 1,336</li> <li>(U) \$ 6,686</li> </ul>	<u>Thousands</u> ): Continue to develop and demonstrate HMT/D and subsy cathode ray tubes in HMT/Ds, and demonstrate HMT/D Evaluate LEP visors integrated with PNVGs. Deliver certified Laser Range Safety Tool for high energy protection to support airborne laser testing. Begin initia evaluation of optical materials for frequency-agile laser Total	Astem technologies including color symbology, retrofit of for air-to-ground missions. gy lasers to flight test ranges to support airborne laser to al integration of LTAS with Laser Warning Receivers. eye protection.	miniature flat displays to replace esting. Deliver laser eye Continue human factors
Project 3257	Pag	<u>e 7 of 8 Pages</u> 251	R-2A (PE 0603231F)

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1	999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603231F Crew Systems & Person Technology	nel Protection	PROJECT <b>3257</b>
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Chang within the Science and Technology (S&T) Program.	ges to this program since the previous President's	Budget are due to higher p	riorities
<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) <u>Related Activities</u>: <ul> <li>(U) PE 0602202F, Human Effectiveness Applied Research.</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0603112F, Advanced Materials for Weapon Systems.</li> <li>(U) PE 0603319F, Airborne Laser.</li> <li>(U) PE 0604706F, Life Support Systems.</li> <li>(U) PE 0604201F, Common Avionics Planning/Development.</li> <li>(U) PE 0207130F, F-15 Squadrons.</li> <li>(U) This project has been coordinated through the Reliance process to ha</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	armonize efforts and eliminate duplication.		
Project 3257 Page	e 8 of 8 Pages Ex	nibit R-2A (PE 0603231F	=)

PE TITLE: Flight Vehicle Technology Integration

RDT&E BUDGET IT	EM JUS	<b>STIFICA</b>	TION	SHEET (F	R-2 Exhi	bit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603245F Flight Vehicle Technology						hnology	Integrati	on 2	PROJECT 2568	
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2568 Flight Vehicle Technology Integration	5,618	7,642	8,3	35 9,711	11,031	12,066	12,301	14,237	Continuing	Continuing
Quantity of RDT&E Articles	0	0		0 0	0	0	0	0	0	0

(U) A. <u>Mission Description</u>: This Advanced Technology Development program integrates and demonstrates advanced flight vehicle technologies that will improve the performance and supportability of existing and future manned and unmanned aerospace vehicles. System level integration brings together the aerospace vehicle technologies along with avionics, propulsion, and weapon systems to flight demonstrate them in a near-realistic operational environment. Integration and flight test demonstrations reduce the risk and time required to transition technologies into operational aircraft. This program provides proven aerospace vehicle technologies for all-weather, day or night operations, and technologies for improved affordability.

#### (U) FY 1998 (\$ in Thousands):

- (U) \$2,041 Developed and integrated advanced aeromechanics, propulsion, and flight control technologies for increased combat effectiveness. Completed detailed design and initiated fabrication of selected critical components required for the next generation exhaust nozzle and airframe integration.
   (U) \$555 Initiated development of control strategies that extended range, ensured safe operation, and allowed precision close operations for mixed manned and unmanned aerospace vehicles.
- (U) \$3,022 Developed and completed design and fabrication of aerospace vehicle structural components, integrated, and demonstrated advanced subsystem technologies
- (U) \$5,618 Total

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Pro	iect	2568
110	ιυυι	2000

Page 1 of 3 Pages

RD	T&E BUDGET ITEM JUSTIFICATION	N SHEET (R-2 Exhibit)	February 1999
BUDGET ACTIVITY 3 - Advanced Tec	hnology Development	PE NUMBER AND TITLE 0603245F Flight Vehicle Te	chnology Integration
(U) <u>FY 1999 (\$ in </u>	Thousands):		
- (U) \$2,443	Develop and integrate advanced aeromechanics, pro- exhaust nozzle and airframe structural critical compo- systems.	pulsion, and flight control technologies, onents for increasing combat effectivene	and complete fabrication of next generation ss for current and future aerospace vehicle
- (U) \$ 1,017	Complete development and flight-test control strateg mixed manned and unmanned aerospace vehicles.	ies to extend range, ensure safe operatio	n, and allow precision close operations of
- (U) \$3,927	Develop flight test units of electric actuator stabilato aerospace vehicle mission. Integrate and demonstrat air combat effectiveness for aerospace vehicles.	rs for reducing weight and manufacturin a advanced subsystem technologies for a	ig technologies as they relate to the unmanned evaluation of significant improvement in air-to-
- (U) \$255	Identified as a source for SBIR.		
- (U) \$7,642	Total		
(U) <u>FY 2000 (\$ in </u>	Thousands):		
- (U) \$2,430	Develop and integrate advanced aeromechanics, propuls exhaust nozzle and airframe structural critical component	sion, and flight control technologies, and nts for increasing combat effectiveness f	l complete fabrication of next generation for Air Force aircraft systems.
– (U) \$ 1,919	Continue development and flight-test control strategies manned and unmanned aerospace vehicles. Continue u	to extend range, ensure safe operation, a nmanned aerospace vehicle developmen	nd allow precision close operations of mixed
– (U) \$3,986	Develop flight test units of electric actuator stabilators f aerospace vehicle mission. Integrate and demonstrate a combat effectiveness for aerospace vehicles.	or reducing weight and manufacturing to dvanced subsystem technologies for eva	echnologies as they relate to the unmanned luation of significant improvement in air-to-air
– (U) \$8,335	Total		
(U) <u>FY 2001 (\$ in</u> )	<u>Ihousands)</u> :	ing and flight control to shu sho sing and	d complete fabrication of yout comparison
- (U) \$3,265	exhaust nozzle and airframe structural critical componer	and flight control technologies, and ats for increasing combat effectiveness f	f complete fabrication of next generation for current and future aerospace vehicles
– (U) \$1,286	Complete development and flight-test control strategies manned and unmanned aerospace vehicles. Continue u	to extend range, ensure safe operation, a nmanned aerospace vehicle developmen	and allow precision close operations of mixed at.
- (U) \$5,160	Develop flight test units of electric actuator stabilators f aerospace vehicle mission. Integrate and demonstrate a combat effectiveness for aerospace vehicles.	or reducing weight and manufacturing to dvanced subsystem technologies for eva	echnologies as they relate to the unmanned luation of significant improvement in air-to-air
– (U) \$9,711	Total		
	Pag	a 2 of 3 Pagas	Exhibit R-2 (PE 0603245E)

Page 2 of 5 Pages

EXHIBIL R-2 (PE 0003243F)

RDT&E BUDGET ITEM JUS	DATE Februar	ry 1999				
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE			PROJECT
3 - Advanced Technology Development		0603245F	Flight Vehicle	e Technology	Integration	2568
(U) B. <u>Budget Activity Justification</u> : This program is in Budgexisting system upgrades and/or new system developments that I	get Activity 3, A nave military uti	dvanced Technol lity and address v	logy Development, warfighter needs.	since it develops a	and demonstrates tech	hnologies for
(U) C. Program Change Summary (\$ in Thousands):						
					Total	
	<u>FY 1998</u>	FY 1999	FY 2000	<u>FY 2001</u>	Cost	
(U) Previous President's Budget/FY 1999 PB	6,062	7,674	8,807	10,884	Cont	
(U) Appropriated Value	6,423	7,674				
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-210	-32				
b. SBIR	-155					
c. Omnibus/Other Above Threshold Reprogrammings	-41					
d. Below Threshold Reprogrammings	-399				Cont	
(U) Adjustments to Budget Year Since FY1999 PB			-472	-1,173		
(U) Current Budget Submit/FY 2000 PB	5,618	7,642	8,335	9,711	Cont	
(U) Significant Program Changes: Not Applicable.						
FY 1999: \$255 identified as a source for SBIR.						
(U) D. Other Program Funding Summary:						
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603106F, Logistics Systems Technology.</li> <li>(U) PE 0603205F, Flight Vehicle Technology.</li> <li>(U) PE 0603211F, Aerospace Structures.</li> <li>(U) PE 0604237F, Variable Stability In-Flight Simulation</li> <li>(U) This project has been coordinated through the Relational Stability of the S</li></ul>	ion Test Aircraf	t. harmonize effort	s and eliminate dup	olication.		
(U) E. <u>Acquisition Strategy</u> : Not Applicable.						
(U) F. <u>Schedule Profile</u> : Not Applicable.						
Project 2568	Pa	ge 3 of 3 Pages		Exh	bit R-2 (PE 060324	45F)
		255				

		DATE February 1999				
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603245F Flight Vehicle Technology Integration					

PE TITLE: Advanced Sensor Integration

	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE February 1999		
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603253F Advanced Sensor Integration							on				
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	11,825	10,462	9,443	11,984	13,043	13,677	13,516	13,343	Continuing	Continuinę
2735	Avionics Integration Technology	5,696	5,974	5,976	6,796	6,945	7,443	7,174	7,085	Continuing	Continuin
3833	Integrated Avionics for Aging Aircraft	2,349	0	(	0 0	0	0	0	0	Continuing	Continuin
666A	Reference and Information Transmission Technology	3,780	4,488	3,467	5,188	6,098	6,234	6,342	6,258	Continuing	Continuine
	Quantity of RDT&E Articles	0	0	(	0 0	0	0	0	0	0	(

Note: In FYs 1999 and out, Project 3833 transferred into Project 2735.

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates advanced radio frequency sensors for performing integrated intelligence, surveillance, and reconnaissance functions. Specificially, this program develops and improves: digital receiver components for space-based radar and advanced unmanned aerial vehicle applications; advanced Global Positioning System receivers and anti-jam techniques for aerospace platforms; aircraft communications, navigation, and identification technologies; technologies for low-probability-of-detection communication between aircraft to improve aircrew situation awareness; and collaborative engineering environments to evaluate the integration of on-board and off-board sensor data.

Page 1 of 10 Pages

Exhibit R-2 (PE 0603253F)

RDT&E BUDGET ITEM JUS	DATE February 1999										
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603253F	D TITLE Advanced \$	Sensor Integra	ation						
(U) B. <u>Budget Activity Justification</u> : This program is in Budg existing system upgrades and/or new sensor and electronic comb	get Activity 3, Ac at system develo	lvanced Technolo pments that have	ogy Developmen military utility a	t, since it develops and address warfigl	and demonstrates technologies for hter needs.						
(U) C. Program Change Summary (\$ in Thousands):											
<ul> <li>(U) Previous President's Budget/FY 1999 PB</li> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value <ul> <li>a. Congressional/General Reductions</li> <li>b. SBIR</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>d. Below Threshold Reprogrammings</li> </ul> </li> <li>(U) Adjustments to Budget Year Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> <li>(U) Significant Program Changes: Not Applicable.</li> <li>FY 1999: \$233 identified as a source for SBIR.</li> </ul>	<u>FY 1998</u> 12,012 12,716 -422 -290 -81 -98 11,825	<u>FY 1999</u> 10,536 10,536 -74 10,462	<u>FY 2000</u> 8,747 696 9,443	<u>FY 2001</u> 10,796	Total <u>Cost</u> Cont Cont						
	Pag	ee 2 of 10 Pages		Ex	hibit R-2 (PE 0603253F)						
RDT	&E BUDGET IT	EM JUS	TIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE <b>Fe</b>	bruary 1	999
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BUDGET ACTIVITY 3 - Advanced Tech	nology Developm	ent		PE N <b>06</b>	UMBER AND	TITLE Advanced	l Sensor	Integrati	on	F	PROJECT 2735
COST (\$	s In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2735 Avionics Integration Te	chnology	5,696	5,974	5,976	6,796	6,945	7,443	7,174	7,085	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Descripti</u> aerospace platforms. Thes sensors, and perform sensor</li> <li>(U) <u>FY 1998 (\$ in T</u> - (U) \$3,902</li> <li>- (U) \$1,228</li> <li>- (U) \$566</li> <li>- (U) \$5,696</li> <li>(U) <u>FY 1999 (\$ in Thou</u> - (U) \$3,936</li> </ul>	ion: Develops and demo         e advanced technologies         or management functions         housands):         Developed and demo         and weight savings, i         demonstrating integra         navigation, and ident         Developed integrated         requirements for mul         and expandability. T         location.         Developed architectu         compact, reliable digi         developments.         Total         sands):         Develop and demonsi         increased multimission	nstrates adva will enable a nstrated adva mproved rel- ated sensor s ification fun avionics arc ti-platform c his included ral compone ital technolo trate advance	anced radio sensors to ga anced modul iability, and ystem technic ctions. chitecture co ommonality flight demo ints required gy which pro-	ar, sharable increased se ology for sir mponents w , open system nstrations of to convert F ovides signif	radio freque radio freque ensor data fu nultaneously hich leverag m architectu f low-level c RF functions ficant cost/pe sensor proc	ency (RF) set ation from a sion opportu y performing ge prior techr re compliand overt penetra (radar, EW, erformance p essor technol sensor data	Insor processi nities. This radar, electronic ation capabil communica ayoffs, inclu	veillance, ar e-based asse ing technolo included in ronic warfar opments and high-level s lity and dem tions) from iding assess vide for avi- rtunities. Th	ad reconnaiss ts, integrate of egies to provi tegration of of re (EW), com d incorporate oftware languonstration of bulky, analog ment of com onics cost an his includes of	de for avion components imunication, additional u age, afford improved t g electronics mercial d weight saw	ics cost for buser ability, hreat to more
– (U) \$500	Develop technologies reduce risks and costs needs, including deve	s for collecti s of advance cloping a col	ng and integ d technology laborative er	rating senso demonstrat ngineering c	r data from v ion and to e apability and	various sourd nable faster t d evaluating	ransition of sensor data	affordable t in a collabo	gineering enviro	vironment in meet warfig nment.	a order to ghter
Project 2735				Page 3 of	10 Pages			Exhib	it R-2A (PE	0603253F)	

RDT	DATE Fe	February 1999		
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603253F Advanced Sensor II	ntegration	PROJECT 2735
- (U) \$1,405	Develop and demonstrate technologies to support mareal-time avionics environment, thereby providing a technology for simultaneous execution of existing 16 architectural framework. (In FY 1999, this work tra	aximum use of existing avionics software in cost-effective incremental upgrade capability 5-bit avionics software with 32-bit application nsferred from Project 3833, Integrated Avio	concert with newly de ty, including optimizing on software and developics for Aging Aircra	eveloped software in a ng testing of pp preliminary ft.)
- (U) \$133	Identified as a source for SBIR.		0 0	,
– (U) \$5,974	Total			
(ID) FY 2000 (\$ in Th	ousands).			
- (U) \$1,867	Develop and demonstrate advanced modular, sharabl intelligence, reconnaissance, and surveillance applic trade studies for space-based radar components.	e radio frequency (RF) sensor technologies ations. This includes designing a dual-use r	for aerospace sensor s nodular, digital RF rea	uites performing ceiver and conducting
– (U) \$2,482	Develop technologies for collecting and integrating of environment, reducing cost and risk of advanced tech multiple platforms in a collaborative engineering environment	on- and off-board sensors over multiple platf mology demonstration. This includes evalu vironment.	forms in a collaborativ ating on-board and of	e engineering f-board sensors and
– (U) \$444	Develop and demonstrate technologies to support ma environments, including transitioning these technologies	ximum use of existing avionics software tog gies to fighter and transport aircraft.	gether with new softwa	are in real-time
– (U) \$1,183	Develop and demonstrate advanced architecture condumnanned aerial vehicles (UAVs), including develop developing an Assured Space Access Architecture (A information infrastructure needed for ASAA.	septs to support seamless information flow a bing UAV architecture concepts applicable t SAA) for the space maneuver vehicle as we	nd fusion for applicat o multiple UAV appli ell as the command an	ion in space and cations and d control (C2)
– (U) \$5,976	Total			
(U) FY 2001 (\$ in Th	ousands):			
– (U) \$3,095	Develop and demonstrate advanced modular, sharable reconnaissance, and surveillance applications. This RF receiver components for space-based radar.	e digital RF sensor technologies for aerospa includes completing the design and initiatin	ce sensor suites perfo g fabrication of dual-u	rming intelligence, use, modular, digital
– (U) \$2,261	Develop technologies for collecting and integrating risk of transitioning advanced technology.	network-centric sensor data in collaborative	engineering environm	ent in order to reduce
– (U) \$1,440	Develop and demonstrate advanced architecture cond UAVs, including demonstrating UAV and space man and affordability.	eepts to support seamless information flow a neuvering vehicle architecture and C2 strate	nd fusion for applicat gy and assessing perfo	ion in space and ormance, reliability,
– (U) \$6,796	Total			
Project 2735	Page	e 4 of 10 Pages	Exhibit R-2A (PE	0603253F)

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Sensor Integ	ration 2735
(U) B. Project Change Summary - Description of Significant Changes: Not	Applicable.	
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0603204F, Aerospace Sensors.</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0603270F, Electronic Warfare Technology.</li> <li>(U) This project has been coordinated through the Reliance process to I</li> </ul>	narmonize efforts and eliminate duplication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 2735 Pag	e 5 of 10 Pages Ex	xhibit R-2A (PE 0603253F)
	261	

RDT	&E BUDGET IT	EM JUS	TIFICA		IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 3 - Advanced Tech	nology Developm	ent		PE N <b>06</b>	UMBER AND	TITLE Advanced	d Sensor	Integrati	ion	F	PROJECT 3833
COST (	ያ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3833 Integrated Avionics for	· Aging Aircraft	2,349	0	0	0	0	0	0	0 0	Continuing	Continuin
supportability needed to su commercially available pro- but, this project transfers t (U) <u>FY 1998 (\$ in T</u> – (U) \$388 – (U) \$1,377 – (U) \$584 – (U) \$2,349 (U) <u>FY 1999</u> : Not A (U) <u>FY 2000</u> : Not A (U) <u>FY 2001</u> : Not A	<ul> <li>apport worldwide operation of project 2735.</li> <li><u>'housands</u>): <ul> <li>Developed and demonstructurently fielded airc</li> <li>Developed and demonstructurent of a real-time avionic</li> <li>Developed avionics i environment for cost-Total</li> </ul> </li> <li>Applicable.</li> <li>Applicable.</li> <li>Applicable.</li> </ul>	ons with redu open system s onstrated prog raft applicati nstrated tech es environme ntegration te -effective mo	grammable i ons to provi nologies to and, there chnologies to odernization	ructure. Thi r cost-effecti ntegrated co de fleet wide support max eby, provide o enable cor of aging avi	is project for ve retrofit o ommunication e commonal imum use of a cost-effec nmercial-off onics.	cuses on tech f user-require ins, navigatio ity, attendant f existing avi tive increment f-the-shelf co	nologies to s ed upgrades on, and ident t economies onics softwa ntal upgrade omponents to	support tran to existing a ification han of scale, and re in concer capability. o function re	sition of moc avionics syste rdware/softw d increased p rt with newly liably in a co	dular avionic ems. In FY are modules latform avai developed s ombat aircraf	es, 1999 and s for lability. software ft
								_			

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Sensor Integr	PROJECT 3833
(U) B. Project Change Summary - Description of Significant Changes: Not A	pplicable.	
(U) C. Other Program Funding Summary (\$ in Thousands):		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0602301E, Intelligence System Program.</li> <li>(U) PE 0602232N, Navy Command, Control, and Communications (C3)</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0604201F, Common Avionics.</li> <li>(U) This project has been coordinated through the Reliance process to has</li> </ul>	Technology. armonize efforts and eliminate duplication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
Project 3833 Page	7 of 10 Pages Ex	hibit R-2A (PE 0603253F)

RDT&E BUDGET ITI		DATE February 1999								
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603253F Advanced Sensor Integration				PROJECT ion 666A		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
666A Reference and Information Transmission Technology	3,780	4,488	3,467	5,188	6,098	6,234	6,342	6,258	Continuing	Continuing
(U) A. <u>Mission Description</u> : Develops and demon and reliable information links for future Air Force is capabilities of the Global Positioning System (GPS) radars. In addition, this project develops high-speed aircrew situation awareness. These technologies wis survivability. The focus is on transitioning transcei are needed for real-time information in the cockpit, platform shared resources, and affordable and support	nstrates the a nformation a to provide h l, jam-resista ll also reduc vers, intertia stealth opera oratable weap	dvanced refe rchitectures. highly accura int, low-prob e the electro l component ations, preciss pon systems.	erence and in Specificall ate reference bability-of-d magnetic sig s, navigation sion targetin	nformation t y, this proje informatior etection info gnatures of r n system tec g and strike,	ransmission cts develops a for precisio prmation trar havigation ar hnology into , timely bom	technologie the advance on targeting a asmission tea ad communio o air vehicles b damage as	s required for ed technique and the preci- chnologies a cation system s. Technologissessment, for	or precise national s for exploiti ision location nd technique ms, increasin gies demonst prece multipli	vigation and ing and prote n of enemy a es to improve g aircraft tated under t cation throu	targeting ecting the ir defense e overall his project gh multi-

#### (U) FY 1998 (\$ in Thousands):

- (U) \$2,409
   Developed enhancements to GPS user equipment and system integration techniques to maximize position accuracy and jam resistance and exploit the benefits of GPS to improve offensive and defensive combat capabilities at reduced costs. This included completion of flight experiments for GPS-based rapid location and countering of emitters, development of optimum anti-jam techniques that fully exploit digital architectures, and development of precision attack techniques using improved GPS signals and all-digital user equipment.
- (U) \$1,371
   Developed multi-user, medium to high capacity, jam-resistant airborne network technology to provide for low probability of detection exchange of time-critical threat, sensor, and other information between aircraft and cooperative assets, including completion of a brassboard design and ground-tests of high-speed, high-bandwidth data transfer technology.
- (U) \$3,780 Total

#### (U) FY 1999 (\$ in Thousands):

- (U) \$2,706
   Develop enhancements to GPS user equipment and system integration techniques to maximize position accuracy and jam resistance and exploit the benefits of GPS to improve offensive and defensive combat capabilities at reduced costs. This includes continuing development of optimum anti-jam techniques and techniques for precision attack using improved GPS.
- (U) \$1,682 Develop multi-user, medium to high capacity, jam-resistant airborne network technology to provide for low probability of detection exchange of time-critical threat, sensor, and other information between aircraft and cooperative assets, including completing the evaluation of a common, affordable, open system architecture for unmanned aerial vehicles.
- (U) \$100 Identified as a source for SBIR.
- (U) \$4,488 Total

Exhibit R-2A (PE 0603253F) Page 8 of 10 Pages Project 666A

BUIDER TATIVITY         DEVELOP         PROJECT           3 - Advanced Technology Development         G603253F Advanced Sensor Integration         666A           (I)         FY 2000 (5 in Tousands):         -         (U) \$2,647         Develop technologies to maximize Global Positioning System (GPS) jam resistance, position accuracy, and exploitation techniques to improve offensive and defensive combat capabilities at reduced costs. This includes completing (GPS space-time adaptive algorithms and trade studies and evaluating impacts of GPS signal moderization to logicay and rescarch user coupment         -         (U) \$820         Develop and evaluate multi-user, medium to high capacity airborne platform information transfer technology to provide jam-resistant, lower probability of detection exchange of information between aircraft and cooperating space, airborne, and surface communication assets. This includes fabrication of a space-based air traffic communications and positioning brassboard.         -         (U) \$3,467         Total           (I) <u>FY 2000 (S in Thousands):</u> -         (U) \$4,301         Develop technologies to maximize GPS jam resistance, position accuracy, and exploitation techniques to improve offensive and defensive combat capabilities at reduced costs, including integrating algorithms and receiver processor techniques and developing direct acquisition techniques to improve delivery of precision numitions.         -         (U) \$43.01         Develop technologies to maximize GPS jam resistance, position accuracy, and exploitation techniques to improve offensive and defensive combat capabilities at reduced costs, including integrating algorithms and receiver processor techniques and develop	RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE Feb	ruary 1999
<ul> <li>(I) <u>FY 2000 (S in Thousands):</u> <ul> <li>(U) \$2,647 Develop technologies to maximize Global Positioning System (GPS) jam resistance, position accuracy, and exploitation techniques to improve offensive and defensive combat capabilities at reduced costs. This includes completing GPS space-time adaptive algorithms and trade studies and evaluating impacts of GPS signal modernization to legacy and research user equipment.</li> <li>(U) \$820 Develop and evaluate multi-user, medium to high capacity airborne platform information transfer technology to provide jam-resistant, lower probability of detection exchange of information between aircraft and cooperating space, airborne, and surface communication assets. This includes fabrication of a space-based air traffic communications and positioning brassboard.</li> <li>(U) <u>S4.301 Develop technologies to maximize GPS jam resistance, position accuracy, and exploitation techniques to improve offensive and defensive combat capabilities at reduced costs, including integrating algorithms and receiver processor techniques to improve offensive and defensive combat capabilities at reduced costs, including integrating algorithms and receiver processor techniques to improve offensive and defensive combat capabilities at reduced costs, including integrating algorithms and receiver processor techniques to improve offensive and defensive combat capabilities at reduced costs, including integrating algorithms and receiver processor techniques to improve offensive, and surface communication assets, including developing advanced radio frequency switching and amplification technologies.</u></li> <li>(U) \$5,188 Total</li> </ul> </li> </ul>	BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603253F Advanced Sensor II	ntegration	PROJECT <b>666A</b>
<ul> <li>(b) 5007 Book production by the exchange of time-critical threat, sensor, and command and control information between aircraft and cooperating space, airborne, and surface communication assets, including developing advanced radio frequency switching and amplification technologies.</li> <li>(U) \$5,188 Total</li> </ul>	(U) FY 2000 (\$ in T- (U) \$2,647- (U) \$820- (U) \$3,467(U) FY 2001 (\$ in T- (U) \$4,301- (U) \$887	housands): Develop technologies to maximize Global Positionin improve offensive and defensive combat capabilities trade studies and evaluating impacts of GPS signal m Develop and evaluate multi-user, medium to high ca probability of detection exchange of information bet includes fabrication of a space-based air traffic comm Total housands): Develop technologies to maximize GPS jam resistant combat capabilities at reduced costs, including integret techniques to improve delivery of precision munition Develop technology to increase airborne platform in	g System (GPS) jam resistance, position acc at reduced costs. This includes completing nodernization to legacy and research user eq pacity airborne platform information transfe ween aircraft and cooperating space, airborn nunications and positioning brassboard.	curacy, and exploitation to GPS space-time adaptive uppment r technology to provide j e, and surface communic niques to improve offens chniques and developing	echniques to e algorithms and jam-resistant, lower cation assets. This ive and defensive direct acquisition
Project 666A Page 9 of 10 Pages Exhibit R-2A (PE 0603253F)	– (U) \$5,188	exchange of time-critical threat, sensor, and comma surface communication assets, including developing Total	and and control information between aircraft g advanced radio frequency switching and ar	t and cooperating space, nplification technologies	airborne, and
	Project 666A	Pag	e 9 of 10 Pages	Exhibit R-2A (PE 0	603253F)

RDT&E BUDGET ITEM JUSTIFICATIO	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603253F Advanced Sensor Int	PROJECT 666A						
(U) B. Project Change Summary - Description of Significant Changes: Not	Applicable.							
(U) C. Other Program Funding Summary:								
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0602782A, Command, Control, and Communications (C3) Ted</li> <li>(U) PE 0602232N, Navy C3 Technology.</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0603270F, Electronic Combat Technology.</li> <li>(U) This project has been coordinated through the Reliance process to</li> </ul>	chnology. harmonize efforts and eliminate duplication.							
(U) D. <u>Acquisition Strategy</u> : Not Applicable.								
(U) E. <u>Schedule Profile</u> : Not Applicable.								
Project 666A Pag	e 10 of 10 Pages	Exhibit R-2A (PE 0603253F)						
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PE TITLE: Electronic Combat (EC) Technology

	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									February 1999			
BUDG <b>3 - /</b>	et activity Advanced Technology Developm	ent		PE N <b>06</b>	UMBER AND <b>03270F E</b>	TITLE Electronio	c Comba	t (EC) Te	Fechnology				
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
	Total Program Element (PE) Cost	33,170	25,476	27,334	26,775	26,969	27,606	28,332	28,971	Continuing	Continuing		
2432	Defensive System Fusion Technology	8,083	7,150	8,336	6,278	7,573	8,148	8,318	8,491	Continuing	Continuing		
431G	Radio Frequency (RF) Warning and Countermeasures	12,278	9,187	8,501	7,639	8,696	8,775	8,957	9,143	Continuing	Continuing		
691X	Electro-Optical/Infrared (EO/IR) Warning and Countermeasures	12,809	9,139	10,497	12,858	10,700	10,683	11,057	11,337	Continuing	Continuing		
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C		

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates technologies to support critical Air Force EC requirements. The projects are categorized by the development of components, subsystems, and technologies that have potential application to satisfy combat, space, special operations, and airlift EC requirements and to reduce acquisition and life cycle costs of EC systems. The program develops and demonstrates: radio frequency; infrared; electro-optical; warning; and command, control, and communications countermeasure technologies for air and space platforms. Technology demonstrations include flyable brassboards against validated threat simulators. In addition, the program develops and demonstrates technologies and concepts for signature reduction, advanced electronic warfare transmitters, receivers, and power management. This program ensures the Air Force maintains demonstrated technology solutions to current and next generation threat capabilities. Note: In FY 1998, Congress added \$3.75 million for Closed-Loop Infrared Countermeasures technology and \$5.0 million for Precision Location and Identification technologies, which explains the perceived decrease in FYs 1999 and out.

Page 1 of 11 Pages

Exhibit R-2 (PE 0603270F)

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RDT&E BUDGET ITEM JUS	TIFICATIO	N SHEET (	R-2 Exhibi	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603270F	D TITLE Electronic	Combat (EC)	Technology
(U) B. <u>Budget Activity Justification</u> : This program is in Bud existing system upgrades and/or new sensor and electronic comb	get Activity 3, A at system develo	dvanced Technol pments that have	ogy Developmer military utility a	nt, since it develop and address warfig	and demonstrates technologies for hter needs.
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					
<ul> <li>(U) Previous President's Budget/FY 1999 PB</li> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value <ul> <li>a. Congressional/General Reductions</li> <li>b. SBIR</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>d. Below Threshold Reprogrammings</li> </ul> </li> </ul>	<u>FY 1998</u> 32,540 34,371 -1,125 -754 -221 899	<u>FY 1999</u> 25,553 25,553 -77	<u>FY 2000</u> 26,533	<u>FY 2001</u> 27,486	Total <u>Cost</u> Cont
<ul><li>(U) Adjustments to Budget Year Since FY1999 PB</li><li>(U) Current Budget Submit/FY 2000 PB</li></ul>	33,170	25,476	801 27,334	-711 26,775	Cont
<ul><li>(U) Significant Program Changes: Not Applicable.</li><li>FY 1999: \$792 identified as a source for SBIR.</li></ul>					
	Pag	e 2 of 11 Pages		Ex	khibit R-2 (PE 0603270F)

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										999
BUDGET ACTIVITY 3 - Advanced Tech	nology Developm	ent		PE N <b>06</b>	UMBER AND	TITLE Electronic	c Comba	t (EC) Te	chnology	F	PROJECT 2432
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2432 Defensive System Fusion	on Technology	8,083	7,150	8,336	6,278	7,573	8,148	8,318	8,491	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Description</u></li> <li>develops the advanced algorized aircraft as well as those tect suppression of adversary a methods to inform the field</li> <li>(U) <u>FY 1998 (\$ in TH</u> - (U) \$5,180</li> <li>- (U) \$5,180</li> <li>- (U) \$2,379</li> <li>- (U) \$524</li> <li>- (U) \$8,083</li> </ul>	ion: This project develop orithms and assessment to chnology efforts required in defense operations. In d commander of changes <u>nousands</u> ): Developed low-cost to sensors to enhance site optimized sensor fusion Developed and invest networks. This include technique designs to of Developed and evalued offensive sensors, offi- preliminary design of Total	ps and demo echniques no for comman cluded in the in the electr echnologies tuation awar on technolog igated comm ded critical of counter adva ated advance -board broad a combat in	onstrates tech ecessary to c and and contr ese are: 1) a conic environ to demonstr eness in both gy suitable for nand and con design of har inced naviga ed defensive least informa- formation sy	nniques and cope with the ol warfare, s advanced con- nment; and 3 ate data fusi h new and e: or tactical ai ntrol (C2) w rdware/softw tion systems techniques b ation, off-bo ystem that in	technologies e projected n standoff jam mponents an 3) advanced on (e.g., thre xisting aeros rcraft. arfare electro vare designs s. based on fusi ard data link tegrates defe	s for integrati nulti-spectra ming, and su d techniques standoff jam eat, targeting pace platform onic attack () for jamming on of multip s, and coope ensive avion	ing electroni l threat and o pport counter needed to ja mer technolo , command a ms, includin EA) technique g modern dig le information rative off-boo ics functions	c combat se countermeas ermeasures f am enemy ra ogies. and control, g hardware- ues to suppro- gital C2 netwo on sources st oard sensors. s.	nsors and sy ure environm for denial, di adar; 2) nove etc.) from of in-the-loop c ess and coun vork links an uch as defens This includ	stem fusion. nents for con sruption, and l electronic f-board and lemonstratio ter adversar d preliminar sive sensors, led completio	It also mbat d collection on-board on of y C2 ry on of a
(U) <u>FY 1999 (\$ in Th</u> - (U) \$1,335 - (U) \$5,593 - (U) \$222 - (U) \$7,150	<ul> <li><u>nousands</u>):</li> <li>Develop low-cost technologies to demonstrate data fusion (e.g., threat, targeting, command and control, etc.) from off-board and on-board sensors to enhance situation awareness in both new and existing aerospace platforms, including code optimization and completing preliminary design trade offs for candidate techniques and algorithms using commercial technology architectures.</li> <li>Develop and investigate C2 warfare EA techniques to suppress and counter adversary C2 networks. This includes completing critical hardware/software designs and fabricating components for denying modern digital C2 network links, fabricating EA demonstration model hardware, and preparing to test designs against advanced telemetry links.</li> <li>Identified as a source for SBIR.</li> <li>Total</li> </ul>										
Project 2432				Page 3 of	11 Pages			Exhibi	t R-2A (PE	0603270F)	
				269	)						

RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A E	xhibit)	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603270F Electro	onic Combat (EC) Teo	chnology	PROJECT <b>2432</b>	
(U) <u>FY 2000 (\$ in Thousa</u>	<u>nds)</u> :					
- (U) \$1,894 - (U) \$1,500 - (U) \$3,514	Develop low-cost technologies to demonstrate data f board sensors to enhance situation awareness in both sensor fusion algorithms in a coalition environment. Develop, as part of international cooperative effort, situation awareness in a joint or coalition theater env Develop and investigate C2 warfare electronic attack completing a brassboard demonstration model, cond laboratory testing and threat exploitation, and design	usion (e.g., threat, targetin a new and existing aerospa the combat information ma vironment. (EA) techniques to suppru ucting ground/field testing ing experimental hardwar	g, command and control (C2 ce platforms, including groun anagement technologies nece ess and counter adversary C2 against modern digital C2 n e/software to counter navigat	), etc.) from off-bo nd demonstrating of ssary to provide re c networks. This ir etwork links, comp tion and tracking s	ard and on- optimized al-time ncludes pleting EA ystems.	
– (U) \$1,428	Conduct evaluations and risk reduction demonstratio awareness, including conducting technology survival	ns of defensive sensors an bility trade studies for adva	d fusion of multiple informat anced fighter applications.	ion sources for situ	uational	
- (U) \$8,336 (U) FY 2001 (\$ in Th	Total					
- (U) \$904	Develop low-cost technologies to demonstrate data f situation awareness in both new and existing aerospa joint coalition tactical platform as part of internation	usion (e.g., threat, targetin ace platforms, including fli al cooperative effort	g, C2, etc.) from off-board an aght demonstrating optimized	nd on-board sensor l sensor fusion algo	s to enhance orithms on a	
– (U) \$3,446	Develop and investigate C2 warfare EA techniques t fabricating experimental hardware/software for coun	o suppress and counter ad- tering navigation and track	versary C2 networks, includi king systems.	ng transitioning an	EA suite and	
– (U) \$1,441	Conduct evaluations and risk reduction demonstratio awareness, including evaluating in the laboratory rec	ns of defensive sensors an eiver technology for advar	d fusion of multiple information of multiple information of multiple information of the second	ion sources for situ	uational	
– (U) \$487	Develop affordable threat alert technologies for com defense systems, including trade study analyses for to	bat aircraft to increase survechniques to defeat future	vivability against advanced, threat radar guided missile sy	integrated radio fre stems.	equency air	
– (U) \$6,278	Total					
Project 2432	Daa	A of 11 Pages	Evhihit	R-24 (PE 06032	970E)	
P10]ect 2452	Page	e 4 of 11 rages		N-2A (FE 00032	./ UF)	

RDT&E BUDGET ITEM JUSTIFICATION	I SHEET (R-2A Exhibit)	DATE Februa	ry 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC)	Technology	PROJECT <b>2432</b>
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : Not	Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0604270F, Electronic Warfare (EW) Development.</li> <li>(U) This project has been coordinated through the Reliance process to here.</li> </ul>	narmonize efforts and eliminate duplication.		
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2432 Pag	e 5 of 11 Pages Ex	hibit R-2A (PE 0603	270F)
	271		

RDT&E BUDGET IT	EM JUS	TIFICAT	ION SH	IEET (R·	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 3 - Advanced Technology Developn	ent		PE N 06	UMBER AND 03270F E	TITLE Electronic	c Comba	t (EC) Te	chnology	F I A	PROJECT 431G
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
431G Radio Frequency (RF) Warning and Countermeasures	B1G     Radio Frequency (RF) Warning and     12,278     9,       Countermeasures     12,278     12,278     12,278						8,957	9,143	Continuing	Continuing
<ul> <li>(U) A. <u>Mission Description</u>: This project developent and space vehicles and frequency receivers, EC preprocessors, advanced stechnology area focuses on the development and d includes the development of novel ECM technique Congress added \$5.0 million for Precision Location</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$2,135</li> <li>Developed low-cost receiver technology area for improving perfor</li> <li>(U) \$6,649</li> <li>Developed aircraft se systems, including confor improving perfor</li> <li>(U) \$3,494</li> <li>Developed technology modification of PLA common radar warmine</li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>:</li> <li>(U) \$12,278</li> <li>Total</li> </ul> </li> </ul>	pps and demo l to provide c orting/prepro emonstration s as well as a n and Identif advanced rad and developm elf-protection ompletion of mance of cur gy for multiag ID algorithm ng receiver s	instrates adva rew situation ocessing algo of subsysten advanced EC ication techr ar and RF en ient of widel technologie design of cri rent inventor perture preci s for use wit ubcomponer and RF emi	anced techno n awareness prithms, and ms and comp M technolo nologies. mitter warni pand digital s to counter tical flight ry RF count sion location h the antenno t to reduce tter warning	ologies for ra . One major expert softw ponents for g gies such as ng concepts receiver tech advanced R worthy comp ermeasures s n and identif na baselines of risk of transi	adio frequence area address vare for appli- generating or antennas, po and techniqu- mology base F threats assi- ponents neces- suites. ication (PLA of slow-mov itioning PLA	cy (RF) elect sed covers to actions on e a-board/off-to wer amplifient wer amplifient wer, including d on PE 060 octated with ssary to jam ID) of grout ing, large ai ID technolo	tronic count echnologies existing and board RF cou- ers, preampl g demonstra 02204F brass current and monopulse nd and airbo rcraft and co- ggy to large a a preliminar	ermeasures ( for missile/tf future EC sy untermeasure ifiers, etc. N tion of evolv board test. future air de radar system orne RF emitt ompletion of aircraft.	ECM) suites nreat warnin stems. Ano e techniques lote: In FY ving jam-on- fense weap s and trade s ters, includin initial desig	s to g, radar ther major . This 1998, -pulse RF on studies ng n of a digital
<ul> <li>receiver for affordab</li> <li>improves gain by a f</li> <li>(U) \$6,347</li> <li>Develop aircraft self</li> <li>defense weapon syst</li> <li>steerable high-power</li> <li>multifunction, comp</li> <li>(U) \$286</li> <li>Identified as a source</li> <li>(U) \$9,187</li> </ul>	le electronic actor of ten a -protection az ems, includir arrays, comj act, modular e for SBIR.	support mea t half the cos nd support ja g developin oleting desig ECM jammi	sures and ra st of current umming tech g and demon n trade offs ng technolo	idar warning designs. nnologies to o nstrating mor for affordab gy.	receiver sui counter adva nopulse angl le improvem	nced RF thr e jamming e ents to exist	pleting a des eats associa electronic co ing ECM su	ted with curr untermeasure ites, and dev	lvanced anto ent and futu es, developi eloping	enna that re air ng
Project 431G			Page 6 of	11 Pages			Exhibi	t R-2A (PE	0603270F)	

RDT	&E BUDGET ITEM JUSTIFICATION	N SHEET (R-2	2 Exhibit)	DATE Februa	ry 1999
BUDGET ACTIVITY 3 - Advanced Techi	nology Development	PE NUMBER AND TIT	LE ectronic Combat (EC) Te	chnology	PROJECT 431G
(U) <u>FY 2000 (\$ in Th</u>	ousands):				
– (U) \$1,534	Develop low-cost advanced radar and radio frequence wideband digital receiver for affordable electronic su	y (RF) emitter warni pport measures (ESN	ng concepts and techniques, inclu M) and radar warning receiver suit	ding completing fa	brication of a
– (U) \$3,883	Develop wideband, multimode, multifunction aperture improves gain by a factor of ten at half the cost of cu	res for electronic was	rfare applications, including fabric	cating an advanced	l antenna that
- (U) \$3,084	Develop aerospace platform self-protection and supp future air defense weapon systems, including develop laboratory testing a steerable high power array, and	ort jamming technolo bing electronic count	ogies to counter advanced RF thre ermeasure (ECM) techniques to ir	ats associated with crease satellite sur	current and vivability,
– (U) \$8,501	Total		ceu monopuise angle jamming tec	innques.	
(U) <u>FY 2001 (\$ in Th</u>	ousands):				
– (U) \$1,100	Develop low-cost advanced radar and RF emitter was affordable ESM and radar warning receiver suites.	rning concepts and te	echniques, including evaluating a	wideband digital re	eceiver for
– (U) \$4,260	Develop wideband, multimode, multifunction apertur	res for electronic was e in determining any	rfare applications, including integ	rating and testing 1	nultimode
– (U) \$2,279	Develop aerospace platform self-protection and supp future air defense weapon systems, including conduc completing demonstration of a steerable high-power jamming integrated electronic countermeasures.	ort jamming technolo ting laboratory evalu array, and designing	ogies to counter advanced RF thre ations of ECM techniques to incre and developing a flight-worthy br	ats associated with ase satellite surviv assboard for mono	a current and vability, opulse angle
– (U) \$7,639	Total				
Project 431G	Page	e 7 of 11 Pages	Exhibit	R-2A (PE 06032	270F)
		273			

RDT&E BUDGET ITEM JUSTIFICATION	DATE Februa	ry 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat (EC)	) Technology	PROJECT 431G
(U) B. Project Change Summary - Description of Significant Changes: Not A	Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) PE 0604270F, Electronic Warfare (EW) Development.</li> <li>(U) PE 0604270N, EW Development.</li> <li>(U) This project has been coordinated through the Reliance process to has</li> </ul>	rmonize efforts and eliminate duplication.		
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 431G Page	8 of 11 Pages Ex	xhibit R-2A (PE 06032	270F)

RDT	<b>&amp;E BUDGET IT</b>	EM JUS	TIFICAT	ION SH	IEET (R·	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 3 - Advanced Techr	nology Developn	nent		PE N <b>06</b>	PE NUMBER AND TITLE 0603270F Electronic Combat (EC) Technology						
COST (\$ /	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
691X Electro-Optical/Infrared Countermeasures	(EO/IR) Warning and	12,809	9,139	10,497	12,858	10,700	10,683	11,057	11,337	Continuing	Continuing
(U) A. <u>Mission Description</u> infrared (IR), and laser three solutions for protection aga frequency (RF) missiles. C peacekeeping, and supply m	on: This project develo at systems. The off-bo inst IR missiles with at countermeasure capabili nission environments.	ops and demo ard (decoys a utonomous se ity against ad Note: In FY	nstrates the nd expendab ekers, multi- vanced EO, 1998, Congr	advanced w bles) and on- spectral thro IR, and lase ress added \$	earning and c -board count eats, laser-gu r-guided thro 3.75 million	ountermeasu ermeasure te nided weapo eats are vital for Closed-2	re technologies chnologies ns, and EO/I for operation Loop Infrare	gies required developed w IR tracking s onal platforn od Counterm	l to negate el ill provide ro systems used ns survival ir easures techn	ectro-optica obust, afford to direct EC wartime, nology.	l (EO), able D/IR/radio
(U) <u>FY 1998 (\$ in Th</u> - (U) \$11,270	ousands): Developed on-board defeat current and fu fabrication and integ demonstration of sig missile detection to t	, threat adapta ature IR missi gration of brass nature manag the counterme	able, laser-ba les in multip sboard dem gement techn causure syste	ased infrared le scenarios onstration h ologies, deve em, and deve	l countermea This effort ardware, hat elopment ar	usure (IRCM t included to dware-in-the d fabrication a miniature	) technology wer tests of e-loop and d n of a two-co pointer-track	and off-boa threat-adapt ligital simula olor missile	ard (active de able, laser-ba ation experin warning sens	ecoy) techno ased jammin nents, field t sor to hand-o	logy to g codes, ests and off
- (U) \$1,069	Developed laser war threat air defense sys mechanical beam-ste seekers.	ning and courstems, includied	ntermeasure ng completio ogies, and c	technologie on of technic ompletion o	es necessary f que developi f threat defir	to defeat adv ment for lase nition for con	vanced day/n er beamrider ncept design	ight EO/IR missile dete of IR/RF de	acquisition/t ection, develo ecoys for mu	racking sens opment of no ltimode threa	ors on on- at
- (U) \$470 - (U) \$12 809	Developed IR missil plane arrays, assessn Total	e warning tec nent of use of	hnologies to commercial	detect adva l image proc	nced, low si cessors for IF	gnature threa R threat algo	at missiles, i rithms, and o	ncluding eva design of IR	aluation of us sensors and	ncooled IR f algorithms.	focal
(U) <b>EV</b> 1999 ( $\$$ in Th	oueande).										
– (U) \$5,184	Develop on-board, c and future infrared ( live fire IR demonstr loop laser IRCM har	losed-loop, la IR) missiles i rations at Wh dware for flig	ser-based in n multiple so ite Sands Mi ght demonstr	frared count cenarios, inc ssile Range rations in a (	ermeasure te cluding conti against bras C-17 or othe	chnology an nued tower sboard demo r large aircra	d off-board testing of the onstration ha aft.	(active deco reat-adaptab rrdware, and	y) technolog le, laser-base design of fli	y to defeat c ed jamming ight-worthy	urrent codes, closed-
Project 691X				Page 9 of	11 Pages			Exhibi	t R-2A (PE	0603270F)	

RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A	Exhibit)	DATE Februa	ry 1999
BUDGET ACTIVITY 3 - Advanced Techn	ology Development	PE NUMBER AND TITLE 0603270F Elect	ronic Combat (EC) Tec	hnology	PROJECT 691X
- (U) \$751	Conduct in-house experiments to analyze current and threat IR missiles, and validating countermeasure tea seekers.	d future infrared (IR) th chniques for conventior	reat missiles, including develop al IR missiles, and developing a	ing digital threat in a target simulator	nodels of for imaging IR
- (U) \$1,998	Develop aerospace laser warning and countermeasur air defense systems, including detecting and locating completing threat modeling technologies to counter	re technologies necessar g both high power (dazz dual-mode missile seek	y to defeat advanced laser acqu le/damage) and low-power (lase ers.	isition/tracking ser er guided ordinanc	nsors on threat e) signals, and
- (U) \$922	Develop infrared (IR) missile warning technologies aperture algorithms and clutter rejection techniques.	to detect advanced, low	signature threat missiles, includ	ling developing di	stributed
- (U) \$284	Identified as a source for SBIR.				
- (U) \$9,139	Total				
(U) <u>FY 2000 (\$ in The</u> – (U) \$5,786 – (U) \$1,725 – (U) \$942 – (U) \$2,044 – (U) \$10,497	Develop on-board, closed-loop, laser infrared counter scenarios, including completing live fire aerial cable IRCM suite for demonstration on C-17 or other large Conduct in-house analysis of current and future IR the techniques for imaging IR missiles, and integrating a Develop aerospace laser warning technologies for tir detecting and locating both high power (dazzle/dama technologies for special operations aircraft. Develop IR missile warning technologies to detect and algorithms, collecting data, and demonstrating real-tit Total	rmeasures (IRCM) for 1 car testing at White Sate e aircraft. hreat missiles, including a target simulator for im nely alert and response age) and low power (las dvanced, low signature ime missile warning alg	arge aircraft to defeat current ar nds Missile Range and fabrication g refining digital threat models, haging IR seekers. to advanced laser acquisition/tra- er guided ordnance) signals, and threat missiles, including evaluat corithms for low-cost, uncooled	ad future IR missil ng a flight-worthy creating counterm acking sensors, inc l developing low-o uting distributed ap sensors.	es in multiple closed-loop easure cluding cost warning perture
(U) <u>FY 2001 (\$ in The</u>	usands):				
– (U) \$3,634	Develop on-board, closed-loop, laser IRCM for large integration and flight testing of closed-loop IRCM te	e aircraft to defeat curre echnology on a C-17 or	nt and future IR missiles in mul other large aircraft.	tiple scenarios, inc	cluding
– (U) \$1,325	Conduct in-house analysis of current and future IR the countermeasure techniques for conventional and image	nreat missiles, developin ging IR missiles.	ng digital models of IR threat m	issiles and testing	
– (U) \$1,092	Develop aerospace laser warning technologies for tin detecting and locating both high power (dazzle/dama operations aircraft, and space-based laser warning se	nely alert and response age) and low power (las nsors.	to advanced laser acquisition/tra er guided ordnance) signals, test	acking sensors, ind ting low-cost warr	eluding ing for special
Project 691X	Page	10 of 11 Pages	Exhibit	R-2A (PE 06032	270F)
		2.76			·

RDT&I	nibit) DATE Februar	ry 1999		
BUDGET ACTIVITY 3 - Advanced Technc	logy Development	PE NUMBER AND TITLE 0603270F Electroni	c Combat (EC) Technology	PROJECT 691X
<ul> <li>(U) \$2,109</li> <li>(U) \$2,766</li> <li>(U) \$1,932</li> <li>(U) \$12,858</li> <li>U) B. Project Change Sun</li> <li>U) C. Other Program Fun</li> <li>(U) Related Activities:</li> <li>(U) PE 0602204F, 4</li> <li>(U) PE 0604270F, 1</li> <li>(U) PE 0604270N,</li> <li>(U) PE 0603203F, 4</li> </ul>	Develop infrared (IR) missile warning technology for use in missile warn Develop the laser countermeasure technology threat air defense systems to track air and sy Develop technology to defeat imaging IR m Fotal <b>Imary - Description of Significant Chang</b> <b>ding Summary:</b> Aerospace Sensors. Electronic Warfare (EW) Development. EW Development. Advanced Aerospace Sensors.	nologies to detect advanced, low signat ing and/or as a distributed aperture sen gy to defeat advanced electro-optical/in pace platforms in day or night, includir issiles, including decoys and lethal exp <u>es</u> : Not Applicable.	ture threat missiles, including evaluating hyp sor. Ifrared (EO/IR) acquisition/tracking sensors ng gimballess beam steering technologies. Deendables.	berspectral that allow
<ul> <li>(U) This project has</li> <li>J) D. <u>Acquisition Strategy</u></li> <li>J) E. <u>Schedule Profile</u>: N</li> </ul>	<ul><li>been coordinated through the Reliance pro</li><li>Not Applicable.</li><li>ot Applicable.</li></ul>	ocess to harmonize efforts and eliminate	e duplication.	

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PE TITLE: Space and Missile Rocket Propulsion

	RDT&E BUDGET IT	EM JUS	STIFICA	TION SI	HEET (R	R-2 Exhi	bit)		February 1999		
BUDG <b>3 - /</b>	et activity Advanced Technology Developm	PE N <b>06</b>	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion								
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	15,407	23,982	11,231	10,863	11,498	12,269	22,992	22,472	Continuing	TBC
0003	Launch Vehicle Technology	608	584	0	0	0	0	0	0	0	TBD
4373	Launch and Orbit Transfer Propulsion Technology	13,240	21,598	9,457	9,374	10,003	10,766	21,457	20,905	Continuing	Continuing
6339	Tactical Propulsion Technology	144	292	288	0	0	0	0	0	0	TBD
6340	Satellite Control and Maneuvering Propulsion Technology	1,415	1,508	1,486	1,489	1,495	1,503	1,535	1,567	Continuing	Continuing
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C

Note: Project 0003 transfers to PE 0603401F, Project 1026, starting in FY 2000. Strategic sustainment efforts have been consolidated in Project 4373; this involved moving the Post-Boost Control and Non-Destructive Evaluation efforts and associated funding from Project 6340 to Project 4373. The electric propulsion efforts, originally in Project 4373, have been moved to Project 6340. Efforts in Project 6339 will be terminated at the end of FY 2000. Finally, solar thermal efforts have been moved from Project 6340 to Project 4373.

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates advanced rocket propulsion and space launch technologies. This program provides the technological step necessary to transition the most promising rocket propulsion and space launch technologies to applications using full-scale, proof-of-principle demonstrations. The projects within this program are structured to support Air Force Space Command's and Air Combat Command's mission area requirements for space and missile technologies which include the goals established in the Integrated High Payoff Rocket Propulsion Technology Initiative, a multi-agency/industry effort to focus the development of U.S. rocket propulsion technology. New and improved components will be integrated with the environmentally improved propellants developed in this program to create new propulsion systems for the next generation of launch vehicles and satellites. Anticipated technological advances in this program will improve the performance of expendable systems' payload capabilities by 21% and reduce the launch and operations and support (O&S) costs by 28%. In a reusable launch system, the anticipated improvements are an increase in payload capability of 170% and a reduction in launch and O&S costs of 79%. The advances in propulsion in this program result from the achievement of the 2010 goals of the Integrated High Payoff Rocket Propulsion Technology Initiative. The development of these technologies has been coordinated with National Aeronautics and Space Administration (NASA) to eliminate duplication of efforts. The space launch and missile propulsion industry will leverage the technologies from this program to enhance the country's industrial competitiveness. Note: In FY 1999, Congress added \$3 million for Integrated High Payoff Rocket Propulsion Technology (IHPRPT).

Page 1 of 10 Pages

Exhibit R-2 (PE 0603302F)

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RDT&E BUDGET ITEM JUS	TIFICATIO	N SHEET	(R-2 Exhib	it)	DATE February 1999					
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603302F	PE NUMBER AND TITLE 0603302F Space and Missile Rocket Propulsion							
U) B. <u>Budget Activity Justification</u> : This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.										
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					<b>T</b> . 1					
	<b>FV</b> 1000	<b>FV</b> 1000	<b>FX</b> 2000	<b>EX</b> 2001	Total					
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost					
(U) Previous President's Budget/FY 1999 PB	17,249	21,121	21,622	21,332	Cont					
(U) Appropriated Value	18,147	24,121								
(U) Adjustments to Appropriated Value	10.0	1.00								
a. Congressional/General Reductions	-609	-139								
b. SBIR	-302									
c. Omnibus/Other Above Threshold Reprogrammings	-116									
d. Below Threshold Reprogrammings	-1,713									
(U) Adjustments to Budget Year Since FY 1999 PB			-10,391	-10,469						
(U) Current Budget Submit/FY 2000 PB	15,407	23,982	11,231	10,863	Cont					
<ul><li>(U) Significant Program Changes: Changes to this program sin Program.</li><li>FY 1999: \$682 identified as a source for SBIR.</li></ul>	ce the previous F	President's Budge	et are due to high	er priorities within	1 the Science and Technology (S&T)					

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	RDT	LE BUDGET ITE	EM JUS	TIFICAT	ION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY <b>3 - Advanced</b>	Techr	nology Developm	ent		PE N <b>06</b>	NUMBER AND	TITLE Space and	d Missile	Rocket	Propulsio	on (	PROJECT 0003
(	COST (\$ /	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
0003 Launch Vehicl	e Technol	ogy	608	584	C	0 0	0	0	0	0	0	TBD
(U) A. <u>Mission D</u>	escriptio	<b><u>on</u>:</b> This project develop	s advanced	and innovati	ve launch v	vehicle techno	ologies in the	e areas of str	ructures (i.e.	, fairings, in	terstages, st	ruts,
thermal protection s	systems,	etc.), tanks, and operation	ons. Project	t 0003 transf	ers to PE 06	503401F, Pro	oject 1026, st	arting in FY	2000.			
(U) <u>FY 1998</u>	(\$ in Th	ousands):										
– (U)	\$125	Defined technological	l needs for f	uture reusab	le military l	aunch vehicl	es including	lightweight	airframe str	uctures, dura	able compos	site
– (U)	\$57	cryogenic tanks, light Defined technological	weight com l needs for f tanks_secon	bined therma uture expend dary payload	ally protecti lable launch	ng structures n vehicles inc structures an	s, and integra cluding opera d integrated	ated acoustic ations techno acoustic atte	c attenuation plogies, light enuation	tweight struc	tures, durab	le
– (U)	\$426	Fabricated advanced	composite la	unch vehicle	e structures	including fu	ll-size inters	tage and grid	d stiffened s	hrouds.		
- (U)	\$608	Total	1			U		0 0				
(U) <u>FY 1999</u>	(\$ in Th	ousands):										
– (U)	\$150	Continue to define tec	chnological	needs for fut	ure reusable	e military lau	unch vehicles	s including o	perations te	chnologies, l	ightweight	airframe
– (II)	\$100	structures, durable co	mposite cry	ogenic tanks	, and structu	ure multifund	ctionality inclusion	luding thern	nal and acou	stic tailorabi	llity. eight airfra	me
- (0)	\$100	structures, durable co	mposite cry	ogenic tanks	, and struct	ure multifund	ctionality inc	luding thern	nal and acou	istic tailorabi	lity.	
– (U)	\$317	Develop advanced co	mposite laur	nch vehicle s	tructures in	cluding grid	stiffened shr	ouds.			5	
– (U)	\$17	Identified as a source	for SBIR.									
– (U)	\$584	Total										
(U) <u>FY 2000</u> :	Not Ap	oplicable.										
(U) <u>FY 2001</u> :	Not Ap	plicable.										
Project 0003					Page 3 of	f 10 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0603302</u> F	)
					28	1						

RDT&E BUDGET ITEM JUSTIFICATION	DATE Februar	y 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rock	et Propulsion	PROJECT 0003
(U) B. <u>Project Change Summary - Description of Significant Changes</u> : In FY	2000, efforts currently in this project move to PE	0603401F, Project 1026	5.
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0603401F, Advanced Spacecraft Technology.</li> <li>(U) PE 0603853F, Evolved Expendable Launch Vehicle Program.</li> <li>(U) This project has been coordinated through the Reliance process to have a second second</li></ul>	armonize efforts and eliminate duplication.		
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 0003 Page	4 of 10 Pages Ex	hibit R-2A (PE 060330	)2F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										Fe	February 1999			
BUDGET ACTIVITY 3 - Advance	d Techn	ology Developm	ent		PE N <b>06</b>	PE NUMBER AND TITLE 0603302F Space and Missile Rocket I					Propulsion 4			
	COST (\$ II	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
4373 Launch and	d Orbit Transf	er Propulsion Technology	13,240	21,598	9,457	9,374	10,003	10,766	21,457	20,905	Continuing	Continuir		
reduced operation program will imp advances in propu (U) <u>FY 199</u> – (U) – (U) – (U) – (U)	and launce or and launce prove the pe ulsion in the <u>98 (\$ in The</u> \$8,004 \$1,336 \$3,900 \$13,240	h costs, and increased li rformance of expendabl is program will result fr <u>busands</u> ): Developed propulsion provide higher reliabi Developed propulsion chamber for liquid up Developed technologi which meets all Interd levels. Total	at technologie ite and perfo om the achie ity for large technologie oper stage en ies for the su continental H	openants. Cormance of p payload capa evement of t e liquid engi es for existin agines, solar istainment o Ballistic Mis	and future nes. ag and future nes. ag and future electric pro f strategic s sile (ICBM)	e launch veh e upper stage pulsion, and ystems. Initi	nphasized in nce the launc egrated High icles. Fabric and orbit tra solar therma ated a multi- ts, reduces h	this project h and operat Payoff Roc ated and tes ansfer vehict l propulsion use, less det ardware cos	ty, anordabi . Technolog tions and sup ket Propulsion ted cryogeni les. Fabricat  conable (Class ts by 25%, a	ic engine turl ted and tested as 1.3) solid und sustains of	bomachinery d combustion propellant perfo	v that n roject ormance		
(II) <b>FV 19</b>	99 (\$ in Th	oucande).												
- (U)	\$14,889	Continue to develop p	propulsion te	chnologies t	for existing	and future la	unch vehicle	s. Complete	e fabrication	and testing	of oxygen a	nd		
– (U)	\$3,096	nydrogen turbopump Continue to develop p and begin integration	assemblies a propulsion te of compone	and preburne echnologies f ents into dem	for existing for existing for impulse	nts for integr and future up ngine. Demo (Isp)	ation into an oper stage an onstrate solar	advanced li id orbit trans thermal pro	quid booster sfer vehicles ppulsion tech	c engine. . Complete on conclusion conclusi conclusicon conclusion conclusion conclusion conclusion conclusion	component t round test to	esting prove		
– (U)	\$3,000	Develop technologies	for the sust ts all ICBM	ainment of s	trategic syst	tems. Contin	ue developm	nent of a mu	lti-use, less o	detonable (C ormance leve	lass 1.3) soli Is	d		
- (U) - (U)	\$613 \$21,598	Identified as a source Total	for SBIR.	- oqunomon					- anom porte					

RDT&	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 3 - Advanced Techno	ology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocke	PROJECT 4373
(U) FY 2000 (\$ in Thousan	<u>ds)</u> :		
- (U) \$3,864	Begin developing propulsion components for existing	g and future launch vehicles. Initiate fabrication and	assembly of combustion chamber
- (U) \$3.000	and injector for use in large liquid engines. Continue testing of oxygen and hydrogen turbopump	assemblies and preburner components for integration	on into an advanced liquid booster
(0) \$0,000	engine. Testing will demonstrate a 1% increase in pe	erformance of cryogenic engines.	
– (U) \$2,593	Develop propulsion technologies for existing and fut	ure upper stage and orbit transfer vehicles. Complet	e integration of components into
- (U) \$9,457	Total		
(U) FY 2001 (\$ in Tho	isands):		
- (U) \$7,374	Initiate the Phase II cryogenic booster engine demonst	stration by performing engine concept selection. Th	is engine has the goal of reducing
(II) ¢1,000	costs by 50%, reducing weight by 40%, and increasing	g thrust to weight by 60%.	
-(U) \$1,000 (U) \$1,000	Begin preliminary design of Phase II cryogenic boost Begin investigating new materials and fabrication pre	er engine.	rania hoostar
= (U)  \$1,000 = (U)  \$9.374	Total	cesses that can reduce the cost of the Phase II cryos	genic booster.
(U) B. <u>Project Change Sun</u> within the Science and Techn	<b>nmary - Description of Significant Changes:</b> Chang ology (S&T) Program.	es to this program since the previous President's Bu	dget are due to higher priorities
(U) C. Other Program Fun	nding Summary:		
(U) Related Activities:			
- (U) PE 0602601F,	Phillips Laboratory.		
– (U) PE 0603853F,	Evolved Expendable Launch Vehicle Program.		
– (U) This project ha	s been coordinated through the Reliance process to h	armonize efforts and eliminate duplication.	
(U) D. Acquisition Strateg	<u>y</u> : Not Applicable.		
(U) E. Schedule Profile: N	lot Applicable.		
(-, _, <u></u> , 1	·····		
Project 1373	Dage	6 of 10 Pages Evhi	hit R-24 (PF 0603302F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE Fe	DATE February 1999		
BUDGET ACTIVITY 3 - Advance	d Techr	nology Developm	ent		PE N <b>06</b>	UMBER AND	TITLE Space an	d Missile	Rocket	Propulsi	on	PROJECT 6339
	COST (\$ /	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
6339         Tactical Propulsion Technology         144         292         288         0								) TBD				
developed in this identified through increase, and 21% (U) <u>FY 199</u> – (U) – (U)	nozzles v project. 7 h the Integ 6 reductio <u>8 (\$ in Th</u> \$144 \$144	<ul> <li>viii be developed. Tech</li> <li>The emphasis in this prograted High Payoff Rock</li> <li>n in time-to-target.</li> <li><u>ousands</u>):</li> <li>Developed and evalu</li> <li>future tactical missile</li> <li>exhaust signature cha</li> <li>In conjunction with F</li> <li>quantities for further</li> <li>formulations and ingr</li> <li>Total</li> </ul>	nology such ject is on roo et Propulsio ated advance systems. T gracteristics. France, Gern evaluation. redient samp	ed solid prop cket propulsi n Technolog chese propell After prope nany, and the Initiated pro ples to the Fr	ctor control, ion system a cy Initiative bellants, in s ants have ac ellant develo e United Kin opellant scal cance, Germ	thrust modu ffordability a (IHPRPT), in mall quantiti cceptable haz pment, bega agdom, down e-up for rhea any, and the	ies, that can zards, higher n to character selected to Dogical and United King	ture charact eduction. A 6 range incre be incorpora performanc erize solid p two propella hazards pro gdom for the	erization, ar nticipated p ease, 50% si ated into the e, lower env ropellant for nt formulati perties. Pro cir internal e	design and reduction design and reduction vironmental i crmulations ir ons and scal vided initial valuation.	manufacturi impact, and lab-size qu propellant	ng of reduced iantities.
(U) <u>FY 199</u> – (U) – (U) – (U)	<u>9 (\$ in Th</u> \$283 \$9 \$292	ousands): Begin scale-up of sel- systems for the U.S., lower environmental hazards properties. C their internal evaluati Identified as a source Total	ected solid p France, Ger impact, and Complete bal ion. for SBIR.	propellant for many, and the reduced exh llistic perform	rmulations t ne United K naust signatu mance evalu	hat can be in ingdom. The ure character ation in U.S	corporated i ese propellan istics. Comj . test motors	nto the desig its will have plete solid pr (15 lbs.) an	gn and manu acceptable l ropellant sca d manufactu	ifacture of fu hazards, high ale-up and fin ire initial Eu	iture air-to-a ner performa nalize rheol ropean test	air missile ance, ogical and motors for
Project 6339					Page 7 of	10 Pages			Exhibi	it R-2A (PE	0603302F	)

RDT&E BUDGET ITEM JUSTIFICATION	<b>February 1999</b>	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603302F Space and Missile Rocket	PROJECT 6339
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:         <ul> <li>(U) \$288 Integrate component technologies and an advanced t signatures. Manufacture European test motors and s hazards, low environmental impact, and reduced sign Germany, and the United Kingdom) and participate properties.</li> <li>(U) \$288 Total</li> </ul> </li> </ul>	actical missile propellants that improve missile thrust elected propellant samples incorporating an advanced nature propellant. Ship these rocket test motors to ou in their evaluations of performance, signature, hazard	and reduce plume exhaust high performance, acceptable r European partners (France, s, mechanical, and aging
(U) <u>FY 2001</u> : Not Applicable.		
<ul> <li>(U) B. <u>Project Change Summary - Description of Significant Changes</u>: Chan, within the Science and Technology (S&amp;T) Program.</li> <li>(U) C. <u>Other Program Funding Summary</u>:</li> </ul>	ges to this program since the previous President's Bud	lget are due to higher priorities
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0602303A, Missile Technology.</li> <li>(U) PE 0603313A, Missile and Rocket Advanced Technology.</li> <li>(U) PE 0603792N, Advanced Technology Transition.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul>	armonize efforts and eliminate duplication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.		
(U) E. <u>Schedule Profile</u> : Not Applicable.		
Project 6339 Page	e 8 of 10 Pages Exhib	it R-2A (PE 0603302F)

RDT&E	<b>BUDGET ITEI</b>	N JUS	TIFICAT	ION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 3 - Advanced Technold	ogy Developmei	nt		PE N 060	UMBER AND	TITLE Space and	d Missile	Rocket	Propulsic	on (	PROJECT 6 <b>340</b>
COST (\$ In The	ousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
6340 Satellite Control and Maneuvering Propulsion 1,415 1,508 Technology					1,489	1,495	1,503	1,535	1,567	Continuing	Continuinę
conversion systems (derived fro Payoff Rocket Propulsion Techn 25% reduction in orbit transfer (U) <u>FY 1998 (\$ in Thousa</u> - (U) \$215 Fl - (U) \$200 Pe - (U) \$1,000 In w fe - (U) \$1,415 Te	and the second s	standing o RPT) inclu a 15% inclu esistojet fo water resis active Eva level. The	or use on the stojet were s luation (NDI NDE project	first flight c uccessfully o E) data proc ct will avoid	of the Might e in satellite d. of the Might evaluated fo essing techn l the current	ySat space d r use on the ologies proje	emical prop e, a 50% inc emonstration first flight of ect to predict condemning	n. t solid rocke g an entire po	Sat space den t motor servi	nonstration. ce life to ter motors whe	ed High ility, a n years n only a
(U) <u>FY 1999 (\$ in Thousa</u>	<u>inds)</u> : amplete plume diagna	atia avaa	imant flight	qualificatio	n tasting an	a a a superior to the superior	anation and	tast of a wa	ton magistaist	for the Mig	hter
– (U) \$500 Co sp	bace demonstration.	stic experi	iment, ingni	quanneatio	on testing, sp	acecraft inte	gration, and	test of a wa	ter resistojet	for the Mig	ntySat
– (U) \$175 La da	aunch the high power ata to assess on-orbit r	30kW Cla erformanc	ss ammonia and space	arcjet thrus craft interac	ter aboard th tion. Evalua	ne ARGOS s ate possibilit	atellite, colle es of using	ect flight dat arciet in flig	ta, and correl ht systems.	ate with gro	ound test
– (U) \$410 Co	omplete Critical Desig	gn Review	(CDR) and	fabricate a h	nigh perform	ance Hall th	ruster system	n for ground	l demonstrati	on of system	n life.
– (U) \$380 Co	ontinue the developme	ent of NDI	E data proces	ssing techno	logies proje	ct to predict	solid rocket	motor servic	the life to ten	years with a	90%
– (U) \$43 Id	entified as a source fo	or SBIR.	E system sp	eenneution,	initize the	test iniuger e	esign, and e	egni sorewa	ie developine		
– (U) \$1,508 To	otal										
Project 6340				Page 9 of	10 Pages			Exhibi	t R-2A (PE	0603302F)	)

RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE February	1999
BUDGET ACTIVITY		PE NUMBER AND TITLE		PROJECT
3 - Advanced Tech	nology Development	0603302F Space and Missile Rocket	Propulsion	6340
(U) <u>FY 2000 (\$ in Tl</u>	nousands):			
– (U) \$455	Launch the MightySat space flight experiment with v	water resistojet for primary propulsion. Perform in-f	light measurements of t	thruster
	performance and satellite contamination for compari	son to ground measurements.		
- (U) \$131	Complete component tests, integration of component	s, and scheduled ground demonstration of a flight-qu	alified high performan	ce Hall
	thruster system. Engine demonstration will prove 19	<sup>6</sup> performance specific impulse (Isp) improvement f	or integration into futur	e upper
– (II) – <b>8900</b>	Continue engine testing of the high-pressure cryogen	ic upper stage engine		
-(U) \$1.486	Total	ie upper sube engine.		
(-) +-,				
(U) <u>FY 2001 (\$ in Th</u>	nousands):			
– (U) \$517	Demonstrate solar electric propulsion technologies for	or satellite stationkeeping, repositioning, and orbit tr	ansfer. Analyze data fro	om
	MightySat space flight and validate against ground n	neasurements. Develop models for spacecraft interaction	ction with water resistoj	et
	propulsion exhaust.			
-(U) \$472	Complete engine testing of the high-pressure cryoger	nic upper stage engine.		
- (0) \$500	engine demonstrations	enc upper stage engine, focusing on potential impro-	rements for the Phase h	upper stage
- (U) \$1.489	Total			
(U) B. <u>Project Change St</u>	<b>ummary - Description of Significant Changes:</b> Not A	pplicable.		
(U) C. Other Program Fi	unding Summary:			
(U) <u>Related Activitie</u>	<u>s</u> :			
- (U) PE 0602601.	F, Phillips Laboratory.			
- (U) This project	has been coordinated through the Reliance process to h	armonize errorts and eliminate duplication.		
(U) D. <u>Acquisition Strat</u>	egy: Not Applicable.			
(U) E. <u>Schedule Profile</u> :	Not Applicable.			
Project 6340	Ρααρ	10 of 10 Pages Fyhi	bit R-2A (PE 0603302	PF)
110,000 00 10	Fuge			- ,

PE TITLE: Ballistic Missile Technology

RDT&E BUDGET I	EM JUS	STIFICA	TION S	HEET (R	-2 Exhi	bit)		DATE Fe	bruary 1	999	
BUDGET ACTIVITY 3 - Advanced Technology Developm	nent		PE N 06	IUMBER AND	TITLE Ballistic N	lissile Te	echnolog	Ю	F	<sup>v</sup> ROJECT <b>4091</b>	
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
4091 Missile Electronics	7,485	15,955	0	) 0	0	0	0	) 0 0			
Quantity of RDT&E Articles	0	0	0	) 0	0	0	0	0	0	0	
<ul> <li>(U) A. <u>Wission Description</u>. This Advanced Fee guidance, navigation, and control packages for ball strategic force sustainment, space force application is on technologies which increase safety, reduce ma life cycle cost. Future precision guidance and navig and hard and deeply buried target defeat capability Missile Technology Demonstration (MTD) flight te 1999.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) <u>State 1000000000000000000000000000000000000</u></li></ul></li></ul>	boost guidar precision nav olid state nav navigation te GPS)-based 1 ballistic missi hardened ana d a new seco ardened digi iation harder al computer p	. These tech navigation. nd improve r ologies are de needs. Note: idiation Hard nee technolog vigation syst vigation tech echnology to navigation pa iles and spac alog circuit to ond source su tal circuit fal ned computer performance.	also funded reliability of emonstrated This progr lened Electr gy to reduce rems for futur nology for l o support ran ackages cou re systems. echnology f ipplier for ra- brication pro- r componen	e flown as M d are upgrade f the currently l on sounding cam was elim ronics in FY e current oper ure ICBM-de ICBM and sp nge instrume upled directly for missile gu adiation hard ocesses to fac its. Initiated	issile Techn sissile Techn es for range y y deployed i grocket and inated at the 1998 and for rations costs livered conv pace applicat ntation and i with Inertia idance syste ened analog cilitate evolu design effort	and improved safe in tercontinen ICBM fligh end of FY () Ballistic M and improved rentional mu ions. mproved safe l Navigation ms. Design components tionary miss t to decrease	ne megrated onstration fli instrumentation tal ballistic ts that support 1997; howeve lissile Technologies fety requirer a Systems (II ed and fabric s. sile technologies digital circu	ghts. Efforts on for ballist missile (ICB ort convention ver, Congress tology and F and maintain gan developm nents. Fligh NS) to impro- cated a twelv gy. Establiss uit size by 50	ability of ex added fund ange Safety hability of ex nent, integra t tested Glob we the accur ve-bit analog shed new des D% while ke	sign tools eping	
Project 4091			Page 1 o	f 3 Pages			Exhib	oit R-2 (PE (	0603311F)		

RDT&E BU	DGET ITEM JUSTIFICATION	N SHEET (R-2 Exhibit)	February 1999		
BUDGET ACTIVITY 3 - Advanced Technology D	Development	PE NUMBER AND TITLE 0603311F Ballistic Missile Technolog	PROJECT <b>y 4091</b>		
<ul> <li>(U) <u>FY 1999 (\$ in Thousands)</u>: <ul> <li>(U) \$11,985</li> <li>Develop ballistic in advanced</li> <li>(U) \$2,980</li> <li>Enhance applying and exter</li> <li>(U) \$500</li> <li>Develop compone</li> <li>(U) \$490</li> <li>Identified</li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> </ul> </li> <li>(U) <u>FY 2001</u>: Not Applicable.</li> </ul>	technologies for integration of advanced GI missile guidance systems and range instrum d technologies into range qualification test p GPS-INS navigation technologies to impro- current GPS anti-jamming technologies to ba technologies for evaluating the service life ent polymeric materials. d as a source for SBIR.	obal Positioning System - Inertial Navigation System ( nentation to meet more stringent range safety requirem rograms. ve performance during the plasma blackout phase of ba ballistic missile technologies, developing advanced an allistic missile electronics systems. and aging properties of ballistic missile components ar	GPS-INS) technology into tents. Transition proven allistic missile reentry by ti-jamming antenna architectures, ad materials such as the		
Project 4091	Pag	e 2 of 3 Pages Exhib	it R-2 (PE 0603311F)		

RDT&E BUDGET ITEM JUS	DATE	February 1999				
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603311F	ID TITLE Ballistic N	lissile Tecl	nnology	PROJECT 4091
(U) B. <u>Budget Activity Justification</u> : This program is in Budg existing system upgrades and/or new system developments that h	get Activity 3, A ave military uti	dvanced Techno lity and address	logy Developm warfighter need	ent, since it dev s.	velops and demons	trates technologies for
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :						
	EV 1008	EV 1000	EV 2000	EV 2001	Total	
(II) Previous President's Budget/FY 1999 PB	<u>F 1 1998</u> 7 537	<u>F1 1999</u> 0	<u>F1 2000</u>	<u>F1 2001</u>	<u>Cost</u>	
(U) Appropriated Value	8,000	16 000	0	0	Cont	
(U) Adjustments to Appropriated Value	0,000	10,000				
a. Congressional/General Reductions	-262	-45				
b. SBIR	-202					
c. Omnibus/Other Above Threshold Reprogrammings	-51					
d. Below Threshold Reprogrammings	0					
(U) Adjustments to Budget Year Since FY 1999 PB						
(U) Current Budget Submit/FY 2000 PB	7,485	15,955	0	0	TBD	
(U) Significant Program Changes: Not Applicable.						
FY 1999: \$490 identified as a source for SBIR.						
(U) D. Other Program Funding Summary:						
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602204F, Aerospace Sensors.</li> <li>(U) This project has been coordinated through the Reli</li> </ul>	ance process to	harmonize effor	ts and eliminate	duplication.		
(U) E. <u>Acquisition Strategy</u> : Not Applicable.						
(U) F. <u>Schedule Profile</u> : Not Applicable .						
Project 4091	Pa	ge 3 of 3 Pages			Exhibit R-2 (PI	E 0603311F)
		291				

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PE TITLE: Advanced Spacecraft Technology

	RDT&E BUDGET I	FEM JUទ	<b>STIFICA</b>	TION SI	HEET (R	נ-2 Exhi	bit)		DATE Fe	February 1999		
BUDGF <b>3 - /</b>	DGET ACTIVITY - Advanced Technology Development 0603401F Advanced Spacecraft Technology											
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
	Total Program Element (PE) Cost	91,754	75,542	76,229	116,300	100,863	74,852	64,876	54,501	Continuing	Continuing	
1026	Space Structures and Controls Technology	1,520	1,773	3,700	4,390	3,953	4,134	4,220	4,308	Continuing	Continuing	
2181	Space Electronics and Software Technology	11,223	12,864	13,295	13,104	14,387	12,206	12,500	12,871	Continuing	Continuinç	
3784	Space Sensors and Satellite Communication Technology	2,410	1,745	4,702	5,913	4,080	3,426	3,473	3,544	Continuing	Continuinç	
3834	Integrated Space Technology Demonstrations	46,185	33,172	18,893	18,792	20,009	22,862	24,235	22,735	Continuing	Continuinç	
4400	Satellite Survivability Technology	5,353	5,779	2,616	3,859	4,773	4,661	4,340	4,006	Continuing	Continuinç	
4599	Reusable Launch Vehicle Technology	21,780	0	0	0	0	0	0	0	TBD	ТВС	
4782	Discoverer II	0	15,479	28,670	67,216	48,501	21,522	9,668	0	0	191,056	
682J	Space Power and Thermal Management Technology	3,283	4,730	4,353	3,026	5,160	6,041	6,440	7,037	Continuing	Continuine	
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	(	

Note: In FY 1998, the low-cost launch vehicle technology development program was moved from PE 0603302F, Project 4373, to this PE in Project 4599. Discoverer II funding has been moved from PE 0603856F to Project 4782 for FY 1999 and beyond. In FY 2000, the spectral sensing work in PE 0603605F, Project 3150, moves into this PE, Project 3784. Also in FY 2000, PE 0603302F, Project 0003, Launch Vehicle Technology, was combined with Project 1026 in this PE.

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops advanced spacecraft technologies such as structures, electronics, thermal management systems, power, and sensors and demonstrates them in an appropriate fashion (i.e., component or system, ground, or flight). The broad goals of the program are to decrease the time for innovative space technology to be transitioned to the warfighter and to reduce the associated development costs and risks of future Air Force space-based systems. Developmental efforts are focused on six high-payoff, satellite technology areas: (1) reusable and low-cost launch vehicle technologies; (2) advanced space structures and structural controls; (3) radiation hardened space electronics, satellite control software, and intelligent satellite systems; (4) advanced passive/active

Page 1 of 23 Pages

Exhibit R-2 (PE 0603401F)

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RDT&E BUDGET ITEM JUS	STIFICATIO	N SHEET	(R-2 Exhib	it)	DATE Februar	y 1999
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603401F	ID TITLE Advanced	Spacecraft Te	chnology	-
space-based sensors; (5) compact, low-cost space power and the has been placed	rmal managemen	t; and (6) satellit	e survivability ar	nd protection. In F	Ys 1999 and out, additi	onal emphasis
on evolutionary growth in space technologies. Also starting in I navigation, and control packages for ballistic missiles is funded Launch Vehicle Technologies (previously funded in PE 060330 Reporting System (MSTRS), \$10 million for Reusable Launch in FY 1999 (\$2.5 million for Low-Cost Launch Vehicle Technol Threat Reporting System, and \$6 million for Microsat Technolo Congressional Add programs were funded in Project 4599 in F <sup>6</sup> (U) <b>B. <u>Budget Activity Justification</u>:</b> This program is in Bud existing system ungrades and/or new system dayalopments that	FY 1999, the tech by this PE. Note 2F/0634373), \$7. Vehicle (Military logies, \$4.5 milli ogy). The Low-C Y 1998, but were lget Activity 3, A	nology developm Congress adde 5 million for Sol Spaceplane), and on for Solar The Cost Launch Vehi shifted to Projec	hent work support d \$57.5 million i ar Thermionics ( 1 \$30 million for rmionics Orbital cele Technologies t 3834 in FY 199 logy Development	rting the integrated n FY 1998 (\$5 mil Orbital Transfer Ve Microsat Technole Transfer Vehicle ( s and Solar Thermi 99.	demonstrations of adva lion for Low-Cost chicle, \$5 million for M ogy (Clementine 2)), an SOTV), \$5 million for 1 onics Orbital Transfer Y s and demonstrates tech	anced guidance, iniature Threat d \$18 million Miniature Vehicle nologies for
existing system upgrades and/or new system developments that	nave mintary un	ity and address	warnighter needs.			
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					Total	
	FY 1998	FY 1999	FY 2000	FY 2001	Cost	
(U) Previous President's Budget/FY 1999 PB	54,899	42,571	47,005	50,961	Cont	
(U) Appropriated Value	98,346	60,571				
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-2,112	-508				
b. SBIR	-964					
c. Omnibus/Other Above Threshold Reprogrammings	-372	15,479				
d. Below Threshold Reprogrammings	-3,144		20.224	(5.220		
(U) Adjustments to Budget Fear Since FY 1999 PB (U) Current Budget Submit/FY 2000 PB	91 754	75 542	29,224 76,229	116 300	Cont	
	) 1, 1 U T	15,512	,0,229	110,000	Cont	
(U) Significant Program Changes: FY 2000 and FY 2001 function the development of two satellites and associated technologies to	ding adjustments be ready for lau	continue the Disenches in FYs 200	coverer II demor 3 and 2004.	nstration and risk re	eduction program. Fund	ding will begin
FY 1999: \$1,215 identified as a source for SBIR.						
FY 1999: \$15,479 for Discover II is being executed under PE (	)603856F, but is l	being reported he	ere for continuity	purposes.		
	Pa	ge 2 of 23 Pages		E	hibit R-2 (PE 060340	1F)
		DATE February 1999				
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Space	cecraft Technology				

RDT	&E BUDGET ITI	EM JUS	TIFICAT	ION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 3 - Advanced Tech	BUDGET ACTIVITY 3 - Advanced Technology Development			PE N <b>06</b>	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Tecl				PROJECT 1026		PROJECT 1026
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
1026 Space Structures and	Controls Technology	1,520	1,773	3,700	4,390	3,953	4,134	4,220	4,308	Continuing	Continuing
(U) A. <u>Mission Description</u> : This project demonstrates advanced composite structures and structural control technologies for future Air Force space and missile systems. Prior to FY 1995, the Air Force relied on Ballistic Missile Defense Organization (BMDO) funding to address its needs in this technology area. As BMDO budgets have declined, so has their funding in this area, necessitating an increased Air Force investment to maintain critical spacecraft structures and controls technologies. Advanced space structure component efforts focus on the demonstration of new composite structure technologies. The goal is to significantly improve the payload mass fraction and reduce overall spacecraft fabrication time and cost. This project also pays for the development of advanced passive and active spacecraft structural control technologies. Structural vibration and shock suppression technologies are intended to significantly enhance space platform stability, improving the focusing/imaging ability of space-based optical components such as focal plane arrays developed in Project 3784 or solar cells developed in Project 682J.         (U) <u>FY 1998 (\$ in Thousands)</u> :       – (U) \$676       Developed composites for launch vehicle and spacecraft structures for applications such as the MightySat experimental spacecraft.         – (U) \$524       Developed advanced launch vehicle vibration isolation and payload isolation systems; demonstrated the first whole spacecraft isolation systems.         – (U) \$1,520       Total         (U) <u>FY 1999 (\$ in Thousands)</u> :       – (U) \$1,520         – (U) \$785       Developed advanced launch vehicle and spacecraft structures for applications such as the lightweight space antenna. Develop spacecraft to demonstrate multifunctional structures technologies.											
Project 1026				Page 3 of	23 Pages			Exhibi	t R-2A (PE	0603401F)	

	RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	I SHEET (R-2A Exhi	bit)	DATE February 1999
BUDGET ACTIVIT	Y		PE NUMBER AND TITLE	• • • •	PROJECT
3 - Advance	ed lechi	nology Development	0603401F Advanced	Spacecraft Tech	nology 1026
(U) <u>FY 20</u>	00 (\$ in Th	iousands):			
– (U)	\$1,101	Develop composites for launch vehicle and spacecra to demonstrate multifunctional structures technologi	ft structures for applications success.	ch as the lightweight spa	ace antenna. Develop spacecraft
– (U)	\$288	Develop and demonstrate revolutionary spacecraft's power solar array subsystems, sensitive payload isol systems.	tructural control and mechanism ation systems, and miniature pa	ns technologies for appl yload isolation systems	ications such as advanced high for sensors and communications
– (U)	\$1,256	Develop launch vibration isolation and primary and	secondary payload isolation sys	stems to meet specific la	unch vehicle requirements.
- (U)	\$1,055	Develop advanced composite launch vehicle structu structures for reusable launch vehicles. Define tech	res such as grid stiffened shroud nological needs for future milita	ds for launch vehicles an ary launch vehicles.	nd lightweight thermal protection
– (U)	\$3,700	Total	-	-	
(U) <u>FY 20</u>	01 (\$ in Th	ousands):			
– (U)	\$1,249	Develop composites for launch vehicle and spacecra to demonstrate multifunctional structures technologi	off structures for applications success.	ch as the lightweight spa	ace antenna. Develop spacecraft
– (U)	\$239	Develop and demonstrate revolutionary spacecraft s power solar array subsystems, sensitive payload isol systems.	tructural control and mechanism ation systems, and miniature pa	ns technologies for appl yload isolation systems	ications such as advanced high for sensors and communications
– (U)	\$1,584	Develop launch vibration isolation and primary and	secondary payload isolation sys	stems to meet specific la	unch vehicle requirements.
- (U)	\$1,318	Develop advanced composite launch vehicle structu lightweight acoustically damped launch vehicle stru	res such as lightweight thermal ctures. Define technological ne	protection structures for eds for future military 1	reusable launch vehicles and aunch vehicles.
– (U)	\$4,390	Total	C	-	
Project 1026		Pag	e 4 of 23 Pages	Exhibit	R-2A (PE 0603401F)
			297		

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft	PROJECT Technology 1026
<ul> <li>(U) B. Project Change Summary - Description of Significant Changes: In F move into this project.</li> <li>(U) C. Other Program Funding Summary: <ul> <li>(U) Related Activities:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0603218C, Research and Support.</li> <li>(U) PE 0603302F, Space and Missile Launch Technology.</li> <li>(U) This project has been coordinated through the Reliance process to F</li> </ul> </li> <li>(U) D. Acquisition Strategy: Not Applicable.</li> <li>(U) E. Schedule Profile: Not Applicable.</li> </ul>	Y 2000, efforts currently in PE 0603302F, Project	0003 (Launch Vehicle Technology),
Project 1026 Pag	<u>e 5 of 23 Pages</u>	xhibit R-2A (PE 0603401F)

BUDGET ACTIVITY         PENUMEER AND TITLE         PENUME           3 - Advanced Technology Development         PEODE         2181           COST (§ In Thousands)         FY 1998         FY 1999         FY 2001         FY 2002         FY 2003         FY 2004         FY 20	RDT&E BUDGET IT	DATE February 1999									
COST (\$ In Thousands)         FY 1998 Actual         FY 1998 Estimate         FY 2000 Estimate         FY 2001 Estimate         FY 2002 Estimate         FY 2004 Estimate         FY 2005 Estimate         FY 2005 Estimate         FY 2005 Estimate         FY 2005 Estimate         FY 2005 Estimate         FY 2004 Estimate         FY 2005 Estimate         FY 2004 Estimate         FY 2005 Estimate         FY 2005 Estimate         FY 2005 Estimate         FY 2005 Estimate         FY 2004 Estimate         FY 2005 Estimate         FY 2005 Estima	BUDGET ACTIVITY 3 - Advanced Technology Developm		PE N 06	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Techr				PROJECT nology 2181		PROJECT 2181	
2181       Space Electronics and Software Technology       11.223       12.864       13.295       13.104       14.387       12.206       12.801       12.811       Continuing	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This project funds the development, demonstration, and evaluation of radiation hardened space electronic hardware, and satellite control hardware for advanced satellite surveillance operations. Improved space-qualifiable electronics and software for data and signal processing are to be more interchangeable, interoperable, and standardized. In the near-term, this project's work concentrates on converting (i.e., hardening) commercial data and signal process technologies for use in Air Force space systems. Advanced electronic packaging technologies that reduce weight and volume are being developed for military space applications. Space data processor technologies like the Advanced Technology Insertion Module (ATIM 32-bit) technology are developed and demonstrated. The Advanced Spaceborne Computer Module (ASCM), ATIM's 16-bit predecessor, is currently baselined into 65 DoD, National Aeronautics and Space Administration (NASA), and commercial programs. Also developed and demonstrated are space signal processor technologies like the Hardened Ada Signal Processor (HASP) program For mid-term applications, the Improved Space Computer Program (ISCP) will merge advanced, radiation-hardened space processor, memory, and interconnect technologies with commercially-derived, open system architectures to develop and demonstrate robust, on-board processing capabilities for 21st century DoD satellites. Additionally, this project demonstrates very low-power electronics allowing dramatic size, weight, and power reductions future Air Force space applications. Low-ceasily modifiable software and hardware architectures for enhanced satellite ground control and intelligent, autonomous satellite operations to support the space sarveillance mission are also developed. The Multi-mission Advanced Forcium to the space is active tore of satellite control and mission operations. In the long-term, this project area focuses on developing fully autonomous constellations of intelligent satellite capable</li></ul>	2181 Space Electronics and Software Technology	11,223	12,864	13,295	13,104	14,387	12,206	12,500	12,871	Continuing	Continuing
<ul> <li>(U) \$8,603 Developed and demonstrated affordable, space-qualifiable, radiation hardened, low-power, high performance microelectronic devices such as data processors and digital signal processors.</li> <li>(U) \$1,453 Developed space-qualifiable, high density advanced packaging technology for micro-electro-mechanical systems (MEMS) and microelectronics. Developed MEMS components and applications.</li> <li>(U) \$1,167 Developed reusable, standardized satellite operations software for applications such as intelligent satellite ground control workstations and an autonomous satellite operations software testbed.</li> <li>(U) \$11,223 Total</li> </ul>	technologies for use in Air Force space systems. A applications. Space data processor technologies li Advanced Spaceborne Computer Module (ASCM (NASA), and commercial programs. Also develop For mid-term applications, the Improved Space C technologies with commercially-derived, open sys Additionally, this project demonstrates very low-p easily modifiable software and hardware architect surveillance mission are also developed. The Mul architecture for satellite control and mission opera capable of performing all mission related function (U) FY 1998 (\$ in Thousands):	Advanced elec ke the Advan ), ATIM's 16- ped and demo omputer Prog tem architectu ower electron ures for enhan ti-mission Ac tions. In the s without ope	ctronic packa ced Technol bit predecess onstrated are ram (ISCP) ures to devel tics allowing nced satellite lvanced Groo long-term, t erator interve	aging techno ogy Insertio sor, is curre space signa will merge a op and dem dramatic si e ground con und Intelligo his project a ention.	ologies that r n Module (A ntly baseline l processor to advanced, rao onstrate robu ze, weight, a ntrol and inte ent Control ( area focuses of	educe weigh TIM 32-bit) d into 65 Do echnologies diation-hardo ist, on-board nd power re elligent, auto MAGIC) pro on developin	t and volum technology D, National like the Hard ened space p processing ductions for nomous sate ogram in this g fully autor	e are being o are develop Aeronautics dened Ada S processor, mo capabilities future Air F ellite operations s project dev nomous cons	developed fo ed and demo s and Space . Signal Proces emory, and i for 21st cent Force space a ons to suppo reloped a low stellations of	r military sp onstrated. Th Administrat (HASP) nterconnect ury DoD sat pplications. rt the space -cost, flexib intelligent s	he he program. rellites. Low-cost, ble satellites
<ul> <li>(U) \$1,167 Developed reusable, standardized satellite operations software for applications such as intelligent satellite ground control workstations and an autonomous satellite operations software testbed.</li> <li>(U) \$11,223 Total</li> </ul>	<ul> <li>(U) \$8,603 Developed and demonstration as data processors a</li> <li>(U) \$1,453 Developed space-que microelectronics D</li> </ul>	onstrated affo nd digital sig alifiable, high eveloped ME	rdable, space nal processo density adv MS compon	e-qualifiable rs. anced packa	e, radiation h aging technol	ardened, low logy for mic	v-power, hig ro-electro-m	h performan echanical sy	ce microelec vstems (MEN	ctronic devic IS) and	ces such
– (U) \$11,223 Total	– (U) \$1,167 Developed reusable, an autonomous satel	standardized lite operation	satellite ope s software te	erations soft estbed.	ware for app	lications suc	h as intellige	ent satellite	ground contr	ol workstati	ons and
	– (U) \$11,223 Total										
Project 2181         Page 6 of 23 Pages         Exhibit R-2A (PE 0603401F)	Project 2181			Page 6 of	23 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0603401F)</u>	

	RDT	<b>&amp; E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A E	xhibit)	February 1999		
BUDGET ACTIVIT	Υ		PE NUMBER AND TITLE		_	PROJECT	
3 - Advance	ed Techi	nology Development	0603401F Advance	ced Spacecraft Tech	nology	2181	
			ļ				
(U) FY 19	99 (\$ in Th	ousands):					
– (U)	\$8,389	Develop and demonstrate affordable, space-qualifia advanced data processors, and integrated and next s	ble, radiation hardened, low	v-power, high performance m	nicroelectronic dev	vices such as	
– (U)	\$1,148	Develop space-qualifiable, high density advanced p micro-electro-mechanical systems (MEMS) comport	ackaging technology for dig	gital, analog, and mixed-sign	al electronic devic	es. Develop	
– (U)	\$2,182	Develop enhanced, standardized satellite operations	s software for application in	a satellite health and status ve	erification and an a	autonomous	
– (U)	\$885	Develop modeling and simulation applications for s	pace-based surveillance and	d distributed satellite system	payloads.		
- (U)	\$260	Identified as a source for SBIR.	1	<b>5</b>	1 5		
– (U)	\$12,864	Total					
FY 2000 (S	s in Thousa	nds):					
– (U)	\$8,844	Develop and demonstrate affordable, space-qualifia	ble, radiation hardened, lov	v-power, high performance m	nicroelectronic dev	vices such as	
		advanced data processors and next generation digita	al signal processors.				
–(U)	\$1,440	Develop space-qualifiable, high density advanced p	ackaging technology for dia	gital, analog, and mixed-sign	al electronic devic	es. Develop	
	¢0 115	and demonstrate MEMS components and application	ons.	autonomous sotallito comm	and and control au	stame and an	
- (0)	\$2,113	autonomous satellite operations software testbed	software for application in	autonomous satenne comma	and and control sy	sterns and an	
– (U)	\$896	Develop modeling and simulation applications for s	pace-based surveillance. di	stributed satellite system pay	loads, and		
	<i><b>4</b>070</i>	autonomous/intelligent satellite systems.		sale acea sale inte system pay			
– (U)	\$13,295	Total					
Droject 2191		Dea	a 7 of 23 Pagas	Evhihit	R-24 (PE 0602)	101E)	
10/00/2101		Pag	e / 0/ 25 Fuges		N-2A (FE 00034		

	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							
BUDGET ACTIVIT	Ϋ́		PE NUMBER AND TITLE	<b>.</b>		PROJECT		
3 - Advance	ed Techn	ology Development	0603401F Advanced S	pacecraft Techi	nology	2181		
			1					
<u>FY 2001 (</u>	§ in Thousar	nds):						
– (U)	\$8,086	Develop and demonstrate affordable, space-qualific advanced data processors and next generation digit	able, radiation hardened, low-power tal signal processors.	, high performance m	icroelectronic dev	ices such as		
– (U)	\$1,317	Develop next generation high density packaging te and demonstrate MEMS components and applicati	chnology for digital, analog, and mi	ixed signal devices in	space environmer	ıt. Develop		
– (U)	\$2,099	Develop enhanced, standardized satellite operation	is software for application in autonomic	mous satellite comma	and and control sys	stems and an		
– (U)	\$1,207	Enhance modeling and simulation applications for autonomous/intelligent satellite systems.	space-based surveillance, distribute	d satellite system pay	loads, and			
– (U)	\$395	Develop and test software architecture for the Space	e Hazards Analysis Workstation sof	ftware.				
– (U)	\$13,104	Total						
(U) C. Other  (U) Relate - (U) Pl - (U)	Program Fu	MILSTAR Satellite Communications System. Defense Meteorological Satellite Program (DMSP). Phillips Laboratory. Ballistic Missile Technology. , Limited Defense System. , Research and Support. , Experimental Evaluation of Major Innovative Tech , Reliability and Maintainability Technology Insertio	nologies. n Program (RAMTIP).	lication				
(U) <b>D.</b> <u>Acquis</u>	ition Strates	<b><u>zy</u>:</b> Not Applicable.	narmonize errorts and eminiate dup	pheation.				
(U) E. <u>Schedu</u>	le Profile: 1	Not Applicable.						
Project 2181		Pa	ge 8 of 23 Pages	Exhibit	<u>R-2A (PE 06034</u>	01F)		
			301					

F	RDT&E BUDGET IT	EM JUS	TIFICAT	ION SH	IEET (R·	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603401F Advanced S					l Spacec	raft Tech	nology	F	PROJECT 3784		
CC	DST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3784 Space Sensors Technology	1,745	4,702	5,913	4,080	3,426	3,473	3,544	Continuing	Continuing		
<ul> <li>space-based applications of commercial sensors while improving the performance, schedule, maturity, cost, and/or risk reduction. The focus of the space sensor effort is to meet spaceborne sensor needs for national missile defense and intelligence, surveillance, and reconnaissance missions.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>- (U) \$1,339</li> <li>Developed space-based reconnaissance/surveillance sensor technologies for reliable, large format focal plane arrays and advanced mid-wave infrared detectors.</li> <li>- (U) \$810</li> <li>Developed technologies for Space-Based Radar (SBR) including the Transmit and Receive Antenna Module (TRAM) and a Radio Frequency (RF)/mechanical characterization laboratory for investigating structure and antenna performance.</li> <li>- (U) \$261</li> <li>Developed SBR models and clutter database for SBR system antenna simulation.</li> <li>- (U) \$2,410</li> <li>Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>: <ul> <li>- (U) \$286</li> <li>Develop and demonstrate space-based reconnaissance/surveillance sensor technologies for advanced mid-wave infrared detectors and hybrid detector arrays.</li> <li>- (U) \$1,234</li> <li>Develop technologies for SBR such as the next iteration TRAM module, antenna beamsteering algorithms for improved detection and tracking, and antenna vibration compensation schemes.</li> <li>- (U) \$10</li> <li>Develop models for the SBR system. Model five antenna designs to simulate their performance in a wargaming environment.</li> <li>- (U) \$1745</li> <li>Total</li> </ul> </li> </ul>									nid-wave und und		
Project 3784				Page 9 of	23 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0603401F)</u>	

	RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A E)	(hibit)	February 1999	
BUDGET ACTIVITY 3 - Advanced	l Techn	ology Development	PE NUMBER AND TITLE 0603401F Advanc	ed Spacecraft Tech	nology	PROJECT 3784
(I) EV 2000	(¢ in Th	anconde).				
- (U) S	<u>\$1,916</u>	Develop space-based reconnaissance/surveillance se hyperspectral quantum well photodetectors, and dete backgrounds.	nsor technologies such as a ector and readout arrays for	dvanced long wavelength in dual waveband infrared det	frared focal plane a ection in moderate	arrays, optical
- (U) S	\$2,067	Develop and demonstrate technologies for Space-Ba integrated TRAM/multifunctional technologies, and	sed Radar (SBR) such as th antenna vibration compens	e Transmit and Receive An ation schemes. Extend SBB	tenna Module (TRA R system models.	AM) II panel,
– (U)	\$719	Develop and refine technologies for spectral remote methodology and for ultra-spectral imaging concept	sensing data collection and s.	exploitation to validate sate	ellite precision orbi	t-prediction
– (U) S	\$4,702	Total				
(U) <u>FY 2001</u>	<u>(\$ in The</u> \$2 303	Dusands): Develon space-based reconnaissance/surveillance se	nsor technologies such as a	dvanced long wavelength in	frared focal plane	arrays
- (0)	ψ2,505	hyperspectral quantum well photodetectors, and mul hyperspectral imaging applications.	ti-waveband focal plane arr	ays for operation in low opt	tical backgrounds a	nd
- (U) S	\$2,283	Develop and demonstrate technologies for SBR such improve target discrimination, and integrated advan-	n as a larger scale TRAM paced processing algorithms.	anel for extended performan Extend SBR system models	ice testing, clutter a s.	lgorithms to
- (U) S	\$1,327	Develop and demonstrate technologies for spectral r spectropolarimeter for realistic military applications	emote sensing using an ultr	a-spectral imaging sensor a	nd an airborne rem	ote sensing
– (U) S	\$5,913	Total				
Project 3784		Page	10 of 23 Pages	Exhibit	R-2A (PE 06034	01F)

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 199	99	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft	PR Technology 37	PROJECT <b>3784</b>
<ul> <li>(U) B. <u>Project Change Summary - Description of Significant Changes</u>: In F<sup>*</sup> Project 3150, move into this project.</li> <li>(U) C. <u>Other Program Funding Summary</u>:</li> </ul>	Y 2000, spectral sensing (hyperspectral technolo	gy) efforts currently in PE 060360	05F,
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0303601F, MILSTAR Satellite Communications System.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0602702F, Command/Control/Communication Technology.</li> <li>(U) PE 0603226E, Experimental Evaluation of Major Innovative Techn</li> <li>(U) PE 0604711F, Extremely High Frequency Satellite Communication</li> <li>(U) This project has been coordinated through the Reliance process to 1</li> </ul>	nologies. ns Research and Development. harmonize efforts and eliminate duplication.		
(U) <b>D.</b> <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 3784	a 11 of 23 Pages	Evhibit R-24 (PE 0603401E)	
	304	$= \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{j=1}^{n} \sum_{j=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_{i=1}^{n} \sum_$	

RD	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							DATE Fe	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Tec	udget activity 3 - Advanced Technology Development					TITLE Advanced	l Spacec	raft Tech	PROJECT 3834		
COST	(\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3834 Integrated Space Tec	hnology Demonstrations	46,185	33,172	18,893	18,792	20,009	22,862	24,235	22,735	Continuing	Continuing
L         L <thl< th=""> <thl< th=""> <thl< th=""> <thl< th=""></thl<></thl<></thl<></thl<>											a ated space , will of the nous h National oruary e ISTD guidance, onstration ds for the fer vehicle ground
Project 3834				Page 12 of	f 23 Pages			Exhibi	t R-2A (PE	0603401F)	

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RDT	<b>&amp; E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	DATE Febru	uary 1999
BUDGET ACTIVITY		PE NUMBER AND TITLE		PROJECT
3 - Advanced Techr	nology Development	0603401F Advanced Space	craft Technology	3834
(II) <b>EV</b> 1000 (\$ in Th	ousands).			
$(0) \frac{F1}{F1} \frac{1999}{9} (3 \text{ III 1 III})$	<u>Develop</u> and integrate components for the Warfighte	er-1 Integrated Space Technology Demor	estration Program including r	avload and
-(0) \$10,402	mobile ground station components and the modified	data exploitation algorithms.	istration i rogram, merading p	ayload and
– (U) \$100	Define concept and develop acquisition strategy for	Warfighter-2 Integrated Space Technolog	y Demonstration Program.	
- (U) \$1,235	Develop advanced precision ballistic missile navigat	ion technologies to support range instrum	nentation and safety requirem	ents, improve
	accuracy after reentry, and support conventional wea	pon delivery systems.		-
– (U) \$5,862	Develop technologies for autonomous and manual or	n-orbit control of microsatellites and for	autonomous microsatellite nav	vigation and
	inspection. Conduct the XSS-10 flight demonstratio	n of a microsatellite to demonstrate the "	proof of principle".	
- (U) \$2,443	Develop the two-stage near-orbital demonstrator for	low-cost liquid launch vehicle technolog	ies.	
- (U) \$4,398	Develop and test technologies for solar orbital transf	er vehicles (SOTV) such as high perform	ance thermionic energy conv	erters and high
	technologies such as thermionic energy converters.	ightweight solar concentrators and cryot	ale key solar orbital transfer v	enicle
– (II) <b>\$67</b> 2	Identified as a source for SBIR	ightweight solar concentrators, and cryog	genie propenant systems.	
-(U) \$33.172	Total			
(0) \$00,172				
(U) <u>FY 2000 (\$ in Th</u>	ousands):			
– (U) \$11,382	Complete development of the Warfighter-1 mission	data center and mobile ground station. F	erform pre-operations testing	, launch satellite,
	conduct early orbit checkout, and begin data exploita	ation analysis and assessment.		
- (U) \$5,990	Develop Warfighter-2 Integrated Space Technology	Demonstration Program system.		
- (U) \$491	Develop an end-to-end performance prediction mode	el for a generalized, user-specified hypers	spectral imaging (HSI) sensor	applicable to a
(ID \$1.020	Variety of different operating environments.	ion tachnologias to improve accuracy du	ring reantry and in plasma an	diamming
- (0) \$1,030	environments and to support application on convent	ional weapon delivery systems	ing reentry and in plasma and	u janning
- (U) \$18.893	Total	ional weapon derivery systems.		
(-) +10,070				
				· · · · · · · · · · · · · · · · · · ·
Project 3834	Page	13 of 23 Pages	Exhibit R-2A (PE 060	J3401F)

RDT8	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							
BUDGET ACTIVITY 3 - Advanced Techn	ology Development	PE NUMBER AND TITLE 0603401F Advanced S	Spacecraft Technology	PROJECT 3834				
<ul> <li>(U) <u>FY 2001 (\$ in The</u> - (U) \$3,822</li> <li>(U) \$13,851</li> <li>(U) \$13,851</li> <li>(U) \$139</li> <li>(U) \$1839</li> <li>(U) \$980</li> <li>(U) \$18,792</li> </ul> (U) B. <u>Project Change Sur</u> in this PE. The low-cost lat (U) C. <u>Other Program Fu</u> <ul> <li>(U) <u>Related Activities</u></li> <li>(U) <u>PE 0602601F</u></li> <li>(U) PE 0603605F</li> <li>(U) This project h</li> </ul> (U) D. <u>Acquisition Strateg</u> <ul> <li>(U) E. <u>Schedule Profile</u>:</li> </ul>	<ul> <li><u>ousands</u>): Conduct Warfighter-1 satellite operations, include analysis and assessment. Continue Warfighter-2 system development. Co- requirements and plan; coordinate and design us Develop an end-to-end performance prediction in variety of different operating environments. Develop advanced precision ballistic missile nave environments, and to support application on com- Total</li> <li><u>mmary - Description of Significant Changes</u>: In unch vehicle and orbital transfer vehicle efforts, bo</li> <li><u>mding Summary</u>:</li> <li>Advanced Weapons Technology.</li> <li>as been coordinated through the Reliance process ty: Not Applicable.</li> <li>Not Applicable.</li> </ul>	ding user utility demonstrations, satel ontinue design of Warfighter-2 system ser utility demonstrations. model for a generalized, user-specified vigation technologies to improve accu- ventional weapon delivery systems. h FY 1999, the Modeling and Simulat oth funded by Congressional Adds, we to harmonize efforts and eliminate du	lite technology validation, and data exp t; begin fabrication of payload. Define to d hyperspectral imaging (HSI) sensor ap tracy during reentry and in plasma and j ion efforts transition from this project to ere moved to this project from Project 4 uplication.	loitation user oplicable to a amming o Project 2181 599 in this PE.				
Project 3834	Р	Page 14 of 23 Pages	Exhibit R-2A (PE 06034	401F)				

RDT&E BUDGET	ITEM JUS	TIFICAT		EET (R	-2A Exh	ibit)		DATE Fe	bruary 19	999		
BUDGET ACTIVITY 3 - Advanced Technology Develo	oment		PE N <b>06</b>	UMBER AND	TITLE Advanced	l Spacec	raft Tech	nology	F	PROJECT <b>400</b>		
COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2000 EstimateFY 2001 EstimateFY 2002 EstimateFY 2003 EstimateFY 2004 EstimateFY 2005 EstimateCost to Complete										Total Cost		
4400 Satellite Survivability Technology	5,353	5,779	2,616	3,859	4,773	4,661	4,340	4,006	Continuing	Continuing		
<ul> <li>(U) A. <u>Mission Description</u>: This project funds the development and demonstration of technologies required to assure operation of U.S. space assets in potentially hostile warfighting environments. Work performed includes assessment of critical components, subsystems, and systems' threat susceptibility and vulnerability. This project also develops technologies to mitigate identified vulnerabilities. Further, technology options are developed and demonstrated to support balanced satellite protection strategies for detecting, avoiding, and operating in a hostile space environment. Efforts under this project will be closely integrated with exploratory space technologies such as those developed under PE 0602601F, Project 8809, and advanced space technologies developed under this PE in Projects 1026, 2181, 3784, and 682J. Where appropriate, end products include integrated demonstrations with technologies developed in Project 3834. Through this project, the Air Force assumes responsibility for critical spacecraft survivability technology from the Ballistic Missile Defense Organization (BMDO).</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) \$180</li> <li>Completed state-of-the-art technology assessment of hostile/stressing environments.</li> <li>(U) \$184</li> <li>Refined multi-threat sensor performance modeling tool to include natural radiation environments.</li> <li>(U) \$185</li> <li>Initiated countermeasure analysis task to examine countermeasure payoffs with respect to weight and power improvements.</li> <li>(U) \$150</li> <li>Complete ountermeasure analysis task, examining weight and power improvements.</li> <li>(U) \$150</li> <li>Complete countermeasure analysis task, examining weight and power improvements.</li> <li>(U) \$150</li> <li>Complete fabrication and begin testing of the radio frequency (RF) threat warning/attack reporting (TW/AR) rece</li></ul></li></ul>												
Project 4400			Page 15 of	23 Pages			Exhibi	t R-2A (PE	0603401F)			

	RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 199	99
BUDGET ACTIVITY 3 - Advanced	d Techn	ology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecra	ft Technology 44	OJECT <b>-00</b>
(U) <u>FY 2000</u>	) (\$ in The	ousands):			
- (U)	\$1,270	Use the multi-threat assessment tool to assess electo- wavelength countermeasure development.	-optical sensor response for various candidate $ng(TW/AP)$ receiver brasshoard	e laser countermeasures. Begin fixed	d
-(0)	\$30U \$786	Integrate and test radio frequency (RE) TW/AR rece	iver on the host space experiment platform		
- (U)	\$2,616	Total	iver on the nost space experiment platorni.		
(U) <u>FY 2001</u>	1(\$ in Tho	<u>usands)</u> :			
– (U)	\$1,983	Complete development and test of fixed wavelength	laser countermeasure.		
– (U)	\$1,091	Optimize sensor suite for combined RF/laser threat	warning/TW/AR receiver.		
– (U)	\$785	Complete payload/spacecraft integration for RF TW/	AR receiver space experiment.		
- (U)	\$3,859	Total			
(U) B. Project C	Change Su	mmary - Description of Significant Changes: Not A	Applicable.		
(U) C. Other Pro	ogram Fu	inding Summary:			
(U) <u>Related</u>	Activities:				
- (U) PE 0	0602102F	, Materials.			
- (U) PE 0	0602601F,	, Phillips Laboratory.			
- (U) PE 0	0603410F,	, Space Systems Environmental Interactions Technolog	gy.		
- (U) PE (	0603605F,	Advanced Weapons Technology.	amonize efforts and eliminate duplication		
- (U) This	s project n	as been coordinated through the Remance process to h	armonize errors and errminate duplication.		
(U) D. <u>Acquisitio</u>	on Strateg	<b><u>y</u>:</b> Not Applicable.			
(U) E. <u>Schedule</u> P	Profile: N	lot Applicable.			
		••			
Project 4400		Page	16 of 23 Pages	Exhibit R-2A (PE 0603401F)	
			309		

BUDGET ACTIVITY       PROJECT         3 - Advanced Technology Development       PENUMBER AND TITLE       PROJECT         4599       COST (\$ In Thousands)       FY 1988       FY 1988       FY 2000       FY 2001       FY 2002       FY 2003       FY 2005       Control       Control       Complete       Total Cost         4599       Reusable Launch Vehicle Technology       21.780       0	RDT&E BUDGET IT		DATE February 1999									
COST (\$ In Thousands)       FY 1998       FY 1998       FY 2001       FY 2001       FY 2003       FY 2004       FY 2005       Cost to       Total         4599       Reusable Launch Vehicle Technology       21.780       0	BUDGET ACTIVITY 3 - Advanced Technology Developm	ent		PE N 060	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Tech					PROJECT 4599		
COST (\$ In Thousands)       PY 1998       PY 1998       PY 2000       PY 2003		5)( ( 000	<b>F</b> )( (2000	5.40000	540004	51/ 0000	E) ( 0000	514 0000 4	5) ( 0005	0.11	<b>T</b> ( ) <b>O</b> (	
4599       Reusable Launch Vehicle Technology       21,780       0<	COST (\$ In Thousands)	FY 1998 Actual	Estimate	Estimate	Estimate	Estimate	FY 2003 Estimate	Estimate	Estimate	Cost to Complete	Total Cost	
<ul> <li>(U) A. <u>Mission Description</u>: This project currently funds the development of technology for reusable, long-life space vehicles, advanced and innovative low-cost launch vehicles, and orbital transfer vehicles. The Military Spaceplane technology project (previously designated the Reusable Launch Vehicle (RLV) program, With the goal of developing responsive, reusable space access systems such as the Space Maneuver Vehicle (SMV). The Space Launch Modernization Plan (SLMP) chartered the DoD to be the lead in Expendable Launch Vehicle (ELV) systems and technologies. The technologies being developed in this project are in support of this charter. The development of the low- cost expendable launch technology is being conducted jointly with Ballistic Missile Defense Organization (BMDO).</li> <li>(U) <u>FY 1998 (S in Thousands)</u>: <ul> <li>(U) <u>S3,882</u> Developed low-cost launch vehicle technologies and conducted suborbital flight tests using a testbed vehicle.</li> <li>(U) <u>S3,082</u> Developed low-cost launch vehicle technologies for reusable, long-life space vehicles such as the Space Maneuver Vehicle (SMV). Conducted flight experiments to demonstrate an advanced concept upperstage engine and to collect X40A SMV vehicle performance data in a critical operational regime.</li> <li>(U) <u>S1,080</u> Total</li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> </ul> </li> <li>Project 4599 Page 17 of 23 Pages Explored Space Space</li></ul>	4599 Reusable Launch Vehicle Technology	0	0	0	0	0	0	TBD	TBD			
	<ul> <li>raunch venicies, and orbital transfer venicies. The complements and leverages off of the National Aer access systems such as the Space Maneuver Vehicl Vehicle (ELV) systems and technologies. The tech launch technology is being conducted jointly with I</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$3,882</li> <li>Developed low-cost I</li> <li>(U) \$3,882</li> <li>Developed low-cost I</li> <li>(U) \$7,068</li> <li>Developed technolog</li> <li>(U) \$4,500</li> <li>Developed technolog demonstrate an advar</li> <li>(U) \$5,500</li> <li>Enhanced the capabil unique mission capat</li> <li>(U) <u>FY 1999</u>: Not Applicable.</li> </ul> </li> <li>(U) <u>FY 2000</u>: Not Applicable.</li> <li>(U) <u>FY 2001</u>: Not Applicable.</li> </ul>	onautics and e (SMV). T inologies bei Ballistic Mis aunch vehicl preburner lic ies for upper ies for reusal iced concept ities of the N bilities.	ceptane tech l Space Adm he Space La ng develope sile Defense le technologi puid propella stages that of ble, long-life upperstage JASA Pathfi	Page 17 of	ect (previou NASA)-led i mization Pla ject are in su on (BMDO). ucted subort echnology. as orbit trans cles such as i to collect X4 to improve	siy designate RLV program n (SLMP) ch ipport of this bital flight tes sfer vehicles. the Space Ma 0A SMV vei the military	a the Reusa n, with the g artered the charter. Th sts using a to meuver Veh hicle perform utility of the	Exhibi	t R-2A (PE	v) program nsive, reusab pendable La w- cost expe flight exper perational ro hese Air For 0603401F)	iments to egime. rce-	

RDT&E BUDGET ITEM JUS	bit) DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced	Spacecraft Technology 4599
<b>B.</b> <u><b>Project Change Summary - Description of Significant (</b> Congressional Adds, were moved to Project 3834 in this PE.</u>	Changes: In FY 1999, the low-cost launch vehicle	and orbital transfer vehicle efforts, both funded by
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602269F, Hypersonic Technology Program</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0603302F, Space and Missile Launch Techn</li> <li>(U) PE 0603853F, Evolved Expendable Launch Veffert</li> <li>(U) UPN 242, National Aeronautics and Space Adm</li> <li>(U) This project has been coordinated through the R</li> </ul> (U) D. <u>Acquisition Strategy</u> : Not Applicable. (U) E. <u>Schedule Profile</u> : Not Applicable.	nology. hicle Program. hinistration (NASA) Reusable Launch Vehicle Prog teliance process and with NASA to harmonize effor	ram. ts and eliminate duplication.
Project 4599	Page 18 of 23 Pages	Exhibit R-2A (PE 0603401F)

RDT&E BUDGET IT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										
BUDGET ACTIVITY 3 - Advanced Technology Developm	ent		PE NI 06(	JMBER AND <b>3401F</b>	TITLE Advanced	d Spacec	raft Tech	nology	F 2	'ROJECT <b>1782</b>	
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
4782 Discoverer II	0	15,479	28,670	67,216	48,501	21,522	9,668	0	0	191,056	

(U) A. <u>Mission Description and Budget Item Justification</u>: Discoverer II (D II) is a space-based radar/ground moving target indicator (SBR/GMTI) risk reduction demonstration. Air Force participation in this effort begins with FY 1999 RDT&E funds appropriated in PE 0603856F and defined in the FY 1999 President's Budget PE 0603856F Descriptive Summary as, "Conduct joint demonstrations, operations, and space activities in support of the Air Force/National Reconnaissance Office (AF/NRO) Integration Planning Group (ANIPG)." Discoverer II is a two-satellite technical demonstration recommended by the Defense Science Board which develops and demonstrates the technologies that would be inherent to an SBR/GMTI tactical surveillance architecture. The cost goal of the program is to enable an affordable acquisition of an operational SBR architecture for worldwide surveillance and targeting by mitigating the technical risks in the D II demonstration. NRO is an investment partner in this project and submits their budget request under the "Discoverer II MTI Demo." Defense Advanced Research Projects Agency (DARPA) is also a funding partner due to the technical innovation and development nature of D II. DARPA submits its budget request under the "Aerospace Surveillance Technologies, Project SGT-02." The Air Force also budgets for the launch integration and vehicle costs under PE 0305953F, Evolved Expendable Launch Vehicle. A senior oversight group consisting of SAF/AQ, NRO, and DARPA oversees D II. The Air Force has the Senior Acquisition Executive responsibilities and DARPA has program management responsibilities.

(U) FY 1998 (\$ in Thousands): Not Applicable.

#### (U) <u>FY 1999 (\$ in Thousands)</u>:

- (U) \$7,696 Support jointly funded effort to conduct design trades and analyses leading to candidate objective system and demonstration system designs by awarding approximately four System Integration contracts. Core activities will focus on cost/performance trades and completion of an Integrated Master Plan/Schedule. An initial Interim Evaluation Review will be conducted.
- (U) \$7,033 Support jointly funded risk reduction efforts in key risk areas to include antenna design and fabrication, and exploitation software. Complete Thinned Transmitter/Receiver (T/R) Module Electronically Scanned Array Design.
- (U) \$750 Conduct mission utility analysis and conops studies.
- (U) \$15,479 Total

Pro	iect	4782
110	ιuu	<b>T</b> /02

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RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999		
BUDGET ACTIVITY	PE NUMBER AND TITLE		PROJECT
3 - Advanced Technology Development	0603401F Advan	ced Spacecraft Techi	nology 4782
	1		
(U) <u>FY 2000 (\$ in Thousands)</u> :			
– (U) \$12,500 Support jointly funded effort to complete objective systemeters and the systemeters of the sys	em and demonstration sys	tem preliminary designs throu	gh conduct of a competitive
downselect process culminating in selection of a single	System Integrator contrac	ctor's design.	and signal measuring and
- (U) \$4,005 Support jointy lunded fisk reduction efforts in key fisk exploitation software. Conduct mission utility analyses	areas to include antenna	design and fabrication, advand	ted signal processing, and
– (II) \$12,165 Support jointly funded effort to begin detailed design at	and long lead procurement	for selected demonstration sys	stem.
- (U) \$28.670 Total	ie iong iene processionen		
(U) <u>FY 2001 (\$ in Thousands)</u> :			
– (U) \$31,469 Support jointly funded development of detailed demons	tration design culminatin	g in Critical Design Review.	
- (U) \$22,574 Support jointly funded construction and component test	ing of spacecraft bus and	payload.	
- (U) \$9,966 Support jointly funded software testing, integration, tes	t, and data reduction.	1	
- (U) \$3,207 Support jointly funded risk reduction efforts in key risk	areas to include antenna	design and fabrication, advand	ced signal processing, and
- (II) \$67.216 Total	and conops studies.		
(0) \$07,210 Total			
B. Project Change Summary - Description of Significant Changes: Discovered	er II funding has been mov	ved from PE 0603856F to Proj	ect 4782 in this PE for FY 1999
and beyond.	-	·	
(U) C. <u>Other Program Funding Summary</u> :			
(II) Related Activities:			
- (U) PE 0305953F. Evolved Expendable Launch Vehicle.			
<ul> <li>(U) National Reconnaissance Office (NRO) MTI Radar Technology Pro</li> </ul>	ject.		
<ul> <li>(U) SGT-02, DARPA Aerospace Surveillance Technologies.</li> </ul>			
(U) D. <u>Acquisition Strategy</u> : All major contracts awarded within this program v	vill be awarded following	full and open competition.	
(II) E. Schodule Profiles Not Applicable			
(0) E. <u>Scheume Frome</u> : Not Applicable			
Project 4782 Page	20 of 23 Pages	Exhibit	R-2A (PE 0603401F)
	313		· · · · · · · · · · · · · · · · · · ·

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Techn	ology Developm	ent		PE N 060	UMBER AND <sup>-</sup>	TITLE Advanced	l Spacec	raft Tech	nology	PROJECT 682J		
COST (\$ Ir	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cos	
682J Space Power and Therma Technology	4,730	4,353	3,026	5,160	6,041	6,440	7,037	Continuing	Continuii			
<ul> <li>vorce space programs. This</li> <li>vower conversion, conditional</li> <li>ubsystem performance, lifet</li> <li>Aissile Defense Organization</li> <li>vassive (e.g., infrared focal p</li> <li>(U) <u>FY 1998 (\$ in Tho</u></li> <li>- (U) \$2,401</li> <li>- (U) \$322</li> <li>- (U) \$322</li> <li>- (U) \$560</li> <li>- (U) \$3,283</li> </ul>	project also funds the o ing, and power system ime, survivability, and n's (BMDO) goal to de blane array) sensors in l <u>busands)</u> : Developed and demo solar-to-electric conv Developed and perfor Experiment flown on Developed advanced for space-based infran Total	levelopment thermal man safety while welop spaced low-light bac nstrated space erter solar ce rmance tested shuttle fligh cryocooler to red concepts.	and demons agement. Ir reducing cor craft thermal ekgrounds th econvention ills. d space conv t STS-87. echnology fo	tration of the addition, in sts/risks are managemen rough this p nal power ge rentional ene or application	e non-nuclea nvestigations conducted. nt technologi project. eneration tec ergy storage n to a 10K cr	ar technologi into alterna In FY 1995, ies. Example hnologies su technologies	tive technol- tive technol- the Air For- es of this are ach as advan such as the pable of mee	d with space ogies to incr ce assumed i e cryogenic o ced multijur Sodium Sul eting the load	e nuclear pow rease space v responsibility coolers neces nction solar c fur Battery ( d, weight, an	ver systems a ehicle power y for the Bal ssary to main cells and Cell Flight d power requ	such as r listic ntain uirements	

BUDGET ACTIVITY 3 - Advance	d Techr					,
3 - Advance	n lechr	a la mu Daviala numant				PROJECT
		lology Development	U603401F Advanced	Spacecraft Tech	nology	682J
(U) <u>FY 199</u>	9 (\$ in Th	ousands):				
– (U)	\$1,772	Develop and evaluate performance of space convent film solar cells, and a solar-to-electric converter pow	ional power generation techno ver system for space operation.	logies such as advanced i	multijunction solar	cells, thin
– (U)	\$1,768	Develop space conventional energy storage technolo	gies such as the lightweight fly	wheel integrated power	and attitude contro	l system.
- (U)	\$951	Develop advanced cryocooler technology for applica for space-based infrared concepts.	tion to a 10K cryocooler capal	ble of meeting the load, w	veight, and power 1	equirements
– (U)	\$144	Develop spacecraft thermal management systems such	ch as advanced capillary pump	ed loop systems.		
– (U)	\$95	Identified as a source for SBIR.				
– (U)	\$4,730	Total				
(U) <u>FY 200</u>	0 (\$ in Th	ousands):				
– (U)	\$1,707	Develop and evaluate performance of space convent	ional power generation techno	logies such as multi-junc	tion solar cells, ad	vanced thin
		film solar cells, lightweight flexible arrays of thin fil	lm solar cells, and radiation re	sistant solar cell modules	5.	
– (U)	\$1,392	Develop space conventional energy storage technolo	gies such as the lightweight fly	wheel integrated power	and attitude contro	l system.
– (U)	\$910	Complete development of the advanced cryocooler to	echnology for application to a	10K demonstration.		
– (U)	\$344	Complete development of an advanced capillary pun	nped loop system. Develop th	ermal management system	ms such as thermal	control
		systems using high density electronics technologies.				
– (U)	\$4,353	Total				
(U) <u>FY 200</u>	01(\$ in The	ousands):				
– (U)	\$1,758	Develop and test space conventional power generation	on technologies such as next g	eneration thin film solar	cells, integrated po	ower cells, and
	¢1 122	Develop space conventional energy storage technologic	gies such as the lightweight fly	wwheel integrated power	and attitude contro	l system and
- (0)	φ1,123	advanced energy storage systems for geosynchronou	s orbit spacecraft applications	ywneer megrateu power		i system and
(U) –	\$145	Develop spacecraft thermal management systems su	ch as thermal control systems	using high density electro	onics technologies.	
- (U)	\$3.026	Total				
(-)	, - , - ,					
Project 6821		Ρααρ	22 of 23 Pages	Exhibit	R-2A (PF 06034	.01F)

BUDGET ACTIVITY       PENUMBER AND TITLE       PROJECT         3 - Advanced Technology Development       0603401F Advanced Spacecraft Technology       682J         8. Project Change Summary - Description of Significant Changes: Not Applicable.       682J       682J         (U) C. Other Program Funding Summary:       (U) Related Activities:       682J       682J         (U) PE 0602203F, Acrospace Propulsion.       (U) PE 0602203F, Acrospace Propulsion.       682J       682J         (U) PE 0603202F, Space and Missile Launch Technology.       (U) PE 0603202F, Space and Missile Launch Technology.       682J         (U) PE 0603202F, Experimental Evaluation of Major Innovative Technologies.       682J       682J         (U) DE 0603202F, Experimental Evaluation of Major Innovative Technologies.       682J       682J         (U) DE 0603202F, Experimental Evaluation of Major Innovative Technologies.       682J       682J         (U) D. Acquisition Strategy: Not Applicable.       682J       682J         (U) E. Schedule Profile: Not Applicable.       682J       682J	RDT&E BUDGET ITEM JUSTIFICATION	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							
<ul> <li>B. <u>Project Change Summary - Description of Significant Changes</u>: Not Applicable.</li> <li>(U) C. <u>Other Program Funding Summary:</u> <ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 060320F, Space and Missile Launch Technology.</li> <li>(U) PE 0603302F, Space and Missile Launch Technology.</li> <li>(U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603401F Advanced Spacecraft	t Technology	PROJECT 682J					
<ul> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0603203CF, Space and Missile Launch Technology.</li> <li>(U) PE 0603218C, Research and Support.</li> <li>(U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	<ul> <li>B. Project Change Summary - Description of Significant Changes: Not Appl</li> <li>(U) C. Other Program Funding Summary:</li> <li>(U) <u>Related Activities</u>:</li> </ul>	icable.							
<ul> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	<ul> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) PE 0603302F, Space and Missile Launch Technology.</li> <li>(U) PE 0603218C, Research and Support.</li> <li>(U) PE 0603226E, Experimental Evaluation of Major Innovative Techn</li> <li>(U) This project has been coordinated through the Reliance process to here.</li> </ul>	ologies. armonize efforts and eliminate duplication.							
	<ul> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>								
Project 682J Page 23 of 23 Pages Exhibit R-2A (PE 0603401F)	Project 682J Page	23 of 23 Pages	Exhibit R-2A (PE 0603	401F)					

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PE TITLE: Space Systems Environmental Interactions Technology

RDT&E BUDGET IT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										
BUDGET ACTIVITY 3 - Advanced Technology Developm	PE NI 060 Inte	PE NUMBER AND TITLE 0603410F Space Systems Environmental Interactions Technology						PROJECT <b>2822</b>			
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
2822 Space Environmental Impact Tests	2,828	3,436	3,677	4,021	4,361	4,845	4,925	5,006	Continuing	Continuing	
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0	

(U) A. <u>Mission Description</u>: This Advanced Technology Development program's objectives are to improve the survivability and reliability of current and future DoD space systems, and develop and demonstrate cost-effective solutions to mitigate hazardous space-environmental interactions. These hazards include dangerous electrical discharges due to excess charge buildup on spacecraft components, degradation, and failure of structures and electronics due to long-term radiation doses, and single-event upsets (processor errors, memory corruption, etc.) due to high-energy penetrating radiation. As DoD dependence on space systems for mission critical operations and the use of unhardened commercial components increase, these effects will become more prevalent and serious. Advanced technology goals of this program are: (1) develop and demonstrate small, low-power, high performance space environmental monitoring systems; (2) provide improved specifications and analysis tools for design and application of advanced components and systems in DoD space systems; and (3) develop an autonomous on-board space-environmental hazard detection and control system to provide real-time warning and mitigation of space-environmental conditions likely to cause degraded satellite performance. These goals will be achieved through continued analysis and exploitation of data from current and past space experiments and through space flight of new experiments and prototype systems that investigate areas of concern to DoD spacecraft operations.

#### (U) <u>FY 1998 (\$ in Thousands)</u>:

– (U)	\$2,316	Launched prototype sensor and fabricated and tested upgraded sensors to improve Air Force Space Command environment specification and
		forecast systems for improved space system design and operations.
	1	

- (U) \$181 Conducted joint National Aeronautics and Space Administration (NASA)-Air Force flight experiment to specify and predict the radiation environment and associated spacecraft charging hazards to enhance spacecraft survivability.

- (U) \$331 Delivered three first-generation on-board radiation and charging hazard-warning detectors for test flights to enhance spacecraft survivability and situational awareness.

– (U) \$2,828 Total

Project 2822

Page 1 of 3 Pages

	RDT	&E BUDGET ITEM JUSTIFICATION	N SHEET (R-2 Exhibit)		DATE February 1999			
BUDGET ACTIVIT 3 - Advance	y ed Techi	nology Development	PE NUMBER AND TITLE 0603410F Space Syster Interactions Technology	ns Environme V	PROJECT 2822			
(U) FY 19	99 (\$ in Th	ousands).						
-(U)	\$2,014	Launch upgraded space plasma sensor and begin dev	velopment of a third-generation ser	nsor for a flight with	the Communications/Navigation			
		Outage Forecast System (C/NOFS) to support Air Fo	orce Space Command environment	specification and fo	recast systems.			
– (U)	\$662	Execute joint program with National Aeronautics an	d Space Administration (NASA) to	o improve high-volta	age spacecraft charging hazard			
– (II)	\$679	Support joint United States/British Space Test Progr	am to provide on-board hazard det	ection of space envi	conmental conditions that			
(0)	ψΟΓΣ	degrade satellite performance. Begin design of smal	1 passive spacecraft charge control	system to eliminate	spacecraft charging hazards.			
– (U)	\$81	Identified as a source for SBIR.		•				
– (U)	\$3,436	Total						
(II) EV 20	00 (\$ in Th	oueands).						
$(0) \frac{1120}{-(11)}$	<u>\$1 215</u>	Complete design and fabrication of environmental se	nsors to support flight systems suc	h as the C/NOFS an	d the National Polar-orbiting			
(0)	Operational Environmental Satellite System (NPOESS) to specify and forecast scintillation and other hazardous space environmental							
	conditions that degrade satellite systems and communications.							
– (U)	\$1,341	Support joint NASA-Air Force space initiatives to im	prove capability to specify and pre-	edict space environm	ental impacts on operational			
	<b>.</b>	space systems.		. 1				
- (U)	\$1,121	Develop systems to warn of spacecraft charging and	other hazards for DoD and comme	rcial spacecraft and	investigate possibilities for			
– (ID	\$3 677	Total						
(0)	<i>\$3,077</i>							
(U) <u>FY 20</u>	01 <u>(\$ in Th</u>	<u>ousands)</u> :						
– (U)	\$1,441	Complete ground testing of space environmental sense	sor for flight with the C/NOFS. Su	pport launch and on	-orbit operations of Air Force			
	¢1 105	and Joint Air Force-NASA instrumentation to provid Support joint NASA Air Force space initiative to adu	le improved space radiation hazard	specification and fo	periments and design tool			
- (0)	- (U) $$1,105$ Support joint NASA-Air Force space initiative to advance spacecraft survivability, infough conadorative experiments and design tool development							
– (U)	- (U) \$1.475 Develop systems to warn of spacecraft charging and other hazards to DoD and commercial spacecraft and begin design of systems to alter							
	the space particle environment.							
– (U)	\$4,021	Total						
(II) R Budget	Activity T	ustification. This program is in Budget Activity 3 Ad	vanced Technology Development	since it develops and	demonstrates technologies for			
existing system	upgrades a	nd/or new system developments that have military utility	ty and address warfighter needs.	since it develops and				
	-	· - ·	-					
Project 2822		Pag	e 2 of 3 Pages	Exhibi	t R-2 (PE 0603410F)			
			318					

RDT&E BUDGET ITEM JUS	TIFICATIC	N SHEET	(R-2 Exhib	it)	DATE Febru	ary 1999
BUDGET ACTIVITY 3 - Advanced Technology Development		PE NUMBER AN 0603410F Interaction	ID TITLE Space Syst ns Technolo	ems Environ gy	imental	PROJECT 2822
<ul> <li>(U) C. Program Change Summary (\$in Thousands):</li> <li>(U) Previous President's Budget/FY 1999 PB</li> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value</li> <li>a. Congressional General Reductions</li> <li>b. SBIR</li> <li>c. Omnibus/Other Above Threshold Reprogrammings</li> <li>d. Below Threshold Reprogrammings</li> </ul>	<u>FY 1998</u> 3,012 3,151 -102 -39 -20 -162	<u>FY 1999</u> 3,457 3,457 -21	<u>FY 2000</u> 3,718	<u>FY 2001</u> 3,755	Total <u>Cost</u> Cont	
<ul> <li>(U) Adjustments to Budget Year Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> <li>(U) Significant Program Changes: Not Applicable.</li> <li>FY 1999: \$81 identified as a source for SBIR.</li> <li>(U) D. Other Program Funding Summary: <ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) This project has been coordinated through the Re</li> </ul> </li> <li>(U) E. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) F. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	2,828 liance process to	3,436 harmonize effort	-41 3,677	4,021	Cont	
Project 2822	Pa	ige 3 of 3 Pages		E	xhibit R-2 (PE 0603	3410F)
		319				

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PE TITLE: Conventional Weapons Technology

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									February 1999		
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603601F Conventional Weapons Technology											
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
Total Program Element (PE) Cost	22,406	22,791	21,479	22,077	21,792	23,880	24,479	25,088	Continuing	Continuing	
670A Ordnance Technology	8,724	9,786	11,263	11,882	10,205	10,177	10,701	11,758	Continuing	Continuing	
670B Guidance Technology	13,682	13,005	10,216	10,195	11,587	13,703	13,778	13,330	Continuing	Continuing	
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	C	

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates conventional weapons technologies including advanced guidance and ordnance technologies for conventional weapons. This program includes development of: (1) conventional ordnance technologies, including warheads, fuzes, explosives, munition integration, and lethality and vulnerability assessments; and (2) advanced guidance technologies, including seekers, navigation and control, signal and image processing/algorithms, and simulation assessments for low-cost precision and adverse weather autonomous seekers for use on manned and unmanned aerospace vehicles. Payoff from this program is increased warhead penetration effectiveness, enhanced blast and fragmentation weapons, and precision fuze control for increased probability of target kill; and precision terminal guidance and the capability to operate autonomous weapons in adverse weather.

(U) B. <u>Budget Activity Justification</u>: This program is in the Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Page 1 of 11 Pages

Exhibit R-2 (PE 0603601F)

RDT&E BUDGET ITEM JUS	DATE February 1999				
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE		
3 - Advanced Technology Development	0603601F	Conventior	nal Weapons	Technology	
<ul> <li>(U) C. <u>Program Change Summary (\$ in Thousands)</u>:</li> <li>(U) Previous President's Budget/FY 1999 PB</li> </ul>	<u>FY 1998</u> 21.622	<u>FY 1999</u> 23.244	<u>FY 2000</u> 23.983	<u>FY 2001</u> 23.848	Total <u>Cost</u> Cont
<ul><li>(U) Appropriated Value</li><li>(U) Adjustments to Appropriated Value</li></ul>	24,687	23,244	23,903	23,040	Cont
<ul><li>a. Congressional/General Reductions</li><li>b. SBIR</li><li>c. Omnibus/Other Above Threshold Reprogrammings</li></ul>	-1,072 -468 -147	-453			
<ul> <li>d. Below Threshold Reprogrammings</li> <li>(U) g. Adjustments to Budget Years Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> </ul>	-594 22,406	22,791	-2,504 21,479	-1,771 22,077	Cont

(U) Significant Program Changes: Changes to this program since the previous President's are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$685 identified as a source for SBIR.

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							date <b>Fe</b> l	bruary 19	999	
BUDGET ACTIVITY PE NUMBER AND TITLE							Р	ROJECT		
3 - Advanced Technology Developm	ent		06	03601F (	Conventio	onal Wea	pons Tee	chnology	6	670A
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
670A Ordnance Technology	8,724	9,786	11,263	11,882	10,205	10,177	10,701	11,758	Continuing	Continuing

(U) A. <u>Mission Description</u>: This project develops and demonstrates the operational effectiveness and utility of conventional (non-nuclear) ordnance technologies for current and future weapons delivered from manned and unmanned aerospace vehicles. The project includes development of conventional ordnance, including warheads, fuzes, explosives, sensitive explosives; hard target warheads; bombs, submunitions, and their dispensing mechanisms; weapon airframes and carriage; smart submunitions; munition integration; and lethality and vulnerability assessments.

#### (U) <u>FY 1998 (\$ in Thousands)</u>:

- (U) \$4,297	Developed and demonstrated advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead
	technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.
- (U) \$1,108	Developed and demonstrated advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.
- (U) \$3,319	Integrated advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.
- (U) \$8,724	Total

Project 670A

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Exhibit R-2A (PE 0603601F)

BUDGET ACTIVITY         PE NUMBER AND TITLE         PROJECT           3 - Advanced Technology Development         0603601F Conventional Weapons Technology         670A           (U) FY 1999 (\$ in Thousands):         - (U) \$3,418         Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.           - (U) \$1,974         Develop and demonstrate advanced conventional armament trechnologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.           - (U) \$294         Identified as a source for SBIR.           - (U) \$3,705         Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetration, spowed warhead shapes for improved prehetrator, improved warhead stages for improved prehetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration improved warhead stesign for high impact	RD	<b>T&amp;E BUDGET ITEM JUSTIFICATION</b>	I SHEET (R-2A E	xhibit)	DATE Februa	ry 1999
3 - Advanced Technology Development         0603601F         Conventional Weapons Technology         670A           (U)         FY 1999 (s in Thousands):         - (U) \$3,18         Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetration inproved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.         - (U) \$1,974         Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.         - (U) \$4,100         Integrate advanced for SBIR.         - (U) \$294         Identified as a source for SBIR.         - (U) \$9,786         Total           (U) FY 2000 (S in Thousands):         - (U) \$3,705         Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetration explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved warhead technologies including heavy metal liners, less sensitive, high blast areotypical mathematical as source for SBIR.           - (U) \$3,705         Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetration explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved warhead shapes for improved warhead backs for high impact	BUDGET ACTIVITY		PE NUMBER AND TITLE			PROJECT
<ul> <li>(U) <u>FY 1999 (\$ in Thousands):</u> <ul> <li>(U) \$3,418 Develop and demonstrate advanced conventional armament warhead technologies, including hard target penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation, low-cost proximity for surface targets, and target imaging detection devices for air target defaat.</li> <li>(U) \$4,100 Integrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the acrospace vehicle and the weapons.</li> <li>(U) \$294 Identified as a source for SBIR.</li> <li>(U) \$4,705 Develop and demonstrate advanced conventional armament warhead technologies, including hard target penetrators, advanced warhead technologies will provide the capability of multiple carriage of small weapons, and allow communication between the acrospace vehicle and the weapons.</li> <li>(U) \$294 Identified as a source for SBIR.</li> <li>(U) \$5,375 Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>(U) \$5,387 Develop and demonstrate advanced conventional armament twarhead technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$5,387 Develop and demonstrate advanced conventione a</li></ul></li></ul>	3 - Advanced Tec	chnology Development	0603601F Conve	ntional Weapons Teo	hnology:	670A
<ul> <li>(U) \$3,418 Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>(U) \$1,974 Develop and demonstrate advanced conventional armament twe technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$4,100 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide better target penetration of thick-walled penetrators, advanced warhead shapes for improved methed aerospace vehicle and the weapons.</li> <li>(U) \$294 Identified as a source for SBIR.</li> <li>(U) \$294 Identified as a source for SBIR.</li> <li>(U) \$27000 (\$ in Thousands):</li> <li>(U) \$3,705 Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>(U) \$5,387 Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target</li></ul>	(U) <u>FY 1999 (\$ in</u>	Thousands):	-			
<ul> <li>(U) \$1,974 Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$4,100 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$294 Identified as a source for SBIR.</li> <li>(U) \$4,00 Evelop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator scylosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>(U) \$5,387 Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$2,171 Integrate advanced conventional armament fuze technologies, including hard target metation. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability against fragmentation sensitive t</li></ul>	- (U) \$3,418	Develop and demonstrate advanced conventional arr penetrator explosives, dense metal warhead cases, fr penetration, improved warhead metals and design for technologies will provide better target penetration ca	mament warhead technolo agmentation of thick-wall or high impact loading, and apabilities, enhanced kill p	gies, including heavy metal l ed penetrators, advanced war d directional mass focus warl probability against fragmenta	iners, less sensitiv head shapes for in heads. Advanced tion sensitive targe	e, high blast nproved warhead ets.
<ul> <li>(U) \$4,100 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$294 Identified as a source for SBIR.</li> <li>(U) \$9,786 Total</li> <li>(U) \$9,786 Total</li> <li>(U) \$3,705 Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$2,171 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$2,171 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration between the aerospace vehicle and the weapons.</li> <li>(U) \$11,263</li></ul>	- (U) \$1,974	Develop and demonstrate advanced conventional arr surface targets, and target imaging detection devices	mament fuze technologies, s for air target defeat.	, including hard target penetr	ation, low-cost pro	oximity for
<ul> <li>(U) \$294 Identified as a source for SBIR.</li> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:</li> <li>(U) \$3,705 Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>(U) \$5,387 Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$2,171 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$11,263 Total</li> </ul>	- (U) \$4,100	Integrate advanced conventional armament technolo concepts for small weapons, compact fin folding and Munition integration technologies will provide the c aerospace vehicle and the weapons.	ogies, including innovative d deployment mechanisms apability of multiple carria	aerospace vehicle carriage a , and compact airframe desig age of small weapons, and all	nd release equipm n and subsystem i ow communicatio	ent, release ntegration. n between the
<ul> <li>- (U) \$9,786 Total</li> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:         <ul> <li>- (U) \$3,705 Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>- (U) \$5,387 Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>- (U) \$2,171 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>- (U) \$11,263 Total</li> </ul> </li> </ul>	- (U) \$294	Identified as a source for SBIR.				
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:         <ul> <li>(U) \$3,705</li> <li>Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>(U) \$5,387</li> <li>Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$2,171</li> <li>Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$11,263</li> </ul> </li> </ul>	- (U) \$9,786	Total				
<ul> <li>(U) \$3,705 Develop and demonstrate advanced conventional armament warhead technologies, including heavy metal liners, less sensitive, high blast penetrator explosives, dense metal warhead cases, fragmentation of thick-walled penetrators, advanced warhead shapes for improved penetration, improved warhead metals and design for high impact loading, and directional mass focus warheads. Advanced warhead technologies will provide better target penetration capabilities, enhanced kill probability against fragmentation sensitive targets.</li> <li>(U) \$5,387 Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$2,171 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$11,263</li> </ul>	(U) <u>FY 2000 (\$ in</u>	Thousands):				
<ul> <li>(U) \$5,387 Develop and demonstrate advanced conventional armament fuze technologies, including hard target penetration, low-cost proximity for surface targets, and target imaging detection devices for air target defeat.</li> <li>(U) \$2,171 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$11,263 Total</li> </ul>	– (U) \$3,705	Develop and demonstrate advanced conventional arman penetrator explosives, dense metal warhead cases, fragr penetration, improved warhead metals and design for h technologies will provide better target penetration capa	ment warhead technologies nentation of thick-walled igh impact loading, and di bilities, enhanced kill prob	s, including heavy metal line penetrators, advanced warhea rectional mass focus warhea pability against fragmentatior	rs, less sensitive, h d shapes for impro ds. Advanced war sensitive targets.	iigh blast oved head
<ul> <li>(U) \$2,171 Integrate advanced conventional armament technologies, including innovative aerospace vehicle carriage and release equipment, release concepts for small weapons, compact fin folding and deployment mechanisms, and compact airframe design and subsystem integration. Munition integration technologies will provide the capability of multiple carriage of small weapons, and allow communication between the aerospace vehicle and the weapons.</li> <li>(U) \$11,263 Total</li> </ul>	- (U) \$5,387	Develop and demonstrate advanced conventional arman targets, and target imaging detection devices for air target	nent fuze technologies, ind get defeat.	cluding hard target penetratio	n, low-cost proxir	nity for surface
– (U) \$11,263 Total	- (U) \$2,171	Integrate advanced conventional armament technologie concepts for small weapons, compact fin folding and de Munition integration technologies will provide the capa aerospace vehicle and the weapons.	s, including innovative aer eployment mechanisms, ar bility of multiple carriage	rospace vehicle carriage and ad compact airframe design a of small weapons, and allow	release equipment nd subsystem integ communication b	, release gration. etween the
	- (U) \$11,263	Total				
Project 670A Exhibit D 2A (DE 0602601E)	Droiget 670 A	Daa	a A of 11 Pages	Evhihit	P-24 (PE 06024	S01E)
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RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhibit)	February 1999
BUDGET ACTIVITY			PROJECT
3 - Advanced Tech	nology Development	0603601F Conventional Weapons Tec	chnology 670A
(U) <u>FY 2001 (\$ in T</u>	housands):		
- (U) \$4,003	Develop and demonstrate advanced conventional arr penetrator explosives, dense metal warhead cases, fr penetration, improved warhead metals and design for technologies will provide better target penetration ca	mament warhead technologies, including heavy metal l ragmentation of thick-walled penetrators, advanced war or high impact loading, and directional mass focus wark apabilities, enhanced kill probability against fragmenta	iners, less sensitive, high blast head shapes for improved heads. Advanced warhead tion sensitive targets.
- (U) \$5,990	Develop and demonstrate advanced conventional arr surface targets, and target imaging detection devices	mament fuze technologies, including hard target penetres for air target defeat.	ation, low-cost proximity for
- (U) \$1,889	Integrate advanced conventional armament technolo concepts for small weapons, compact fin folding and Munition integration technologies will provide the c aerospace vehicle and the weapons	gies, including innovative aerospace vehicle carriage a d deployment mechanisms, and compact airframe desig apability of multiple carriage of small weapons, and all	nd release equipment, release n and subsystem integration. ow communication between the
- (U) \$11,882	Total		
Project 670A	Page	e 5 of 11 Pages Exhibit	R-2A (PE 0603601F)
		325	

RDT&E BUDGET ITEM JUSTIFIC	CATION SHEET (R-2A Exhib	it) DATE Februa	ary 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Convention	al Weapons Technology	PROJECT 670A
(U) B. <u>Project Change Summary - Description of Significant Chan</u>	nges: Not Applicable.		
(U) C. Other Program Funding Summary:			
<ul> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0602602F, Conventional Munitions.</li> <li>(U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technologies</li> <li>(U) PE 0603792N, Advanced Technology Demonstrations.</li> <li>(U) PE 0604407D, Joint Standoff Weapon.</li> <li>(U) This project has been coordinated through the Reliance</li> </ul>	ogy. process to harmonize efforts and eliminate du	uplication.	
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 670A	Page 6 of 11 Pages	Exhibit R-2A (PE 0603	601F)
	326		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit) February 1999									999		
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603601F Conventional Weapons Te									chnology	F 7 (	PROJECT 670B
COST (\$ In Thousand	ls)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
670B Guidance Technology 13,682 13,005 10,216 10,195 11,587 13,703 13,778 13,330 Continuing Co								Continuing			
<ul> <li>(U) A. <u>Mission Description</u>: This project develops and demonstrates affordable, autonomous, and adverse-weather advanced guidance technologies for air-to-air and air-to-ground conventional armament delivered from manned and unmanned aerospace vehicles. This project develops the following technologies: precision terminal seekers for enhanced target destruction; autonomous seekers for operation in adverse weather for increased accuracy; midcourse navigation sensors for standoff delivery weapons; and target detection and identification processing algorithms for reducing target location error and false alarm rates, while improving target kill probability.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) \$6,504</li> <li>Developed and demonstrated advanced conventional armament seeker technologies, including laser radar, millimeter wave, synthetic autonomously detect, acquire, and guide to targets of interest in adverse weather conditions while increasing probability of kill.</li> <li>(U) \$2,964</li> <li>Developed and demonstrated advanced conventional armament navigation and control technologies, including weapon guidance laws, state vector estimators, autopilots, inertial navigation, aerodynamic control, and anti-jam global positioning system techniques. These technologies will provide increased armament navigation accuracy and enhanced weapon control and operation in a electronic jamming environment.</li> <li>(U) \$4,214</li> <li>Integrated advanced conventional armament guidance capabilities. This guidance capability will provide better adverse weather performance, faster processing of target information, higher probability of target detection, and an operationally acceptable target false alarm rate.</li> <li>(U) \$13,682</li> <li>Total</li> </ul> </li> </ul>											
Project 670B				Page 7 of	11 Pages			Exhibi	t R-2A (PE	0603601F)	

		DATE February 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventio	onal Weapons Technology

					Γ	February 1999
BUDGET ACTIVITY	PE NUMBER AND TITLE					
3 - Advanced Tec	0603601F Conventional Weapons Technology					
(U) <u>FY 1999 (\$ in</u>	Thousands):					
- (U) \$7,823	Develop and demonstrate advanced conventional arr radar and conformal seeker arrays for multi-mode ar autonomously detect, acquire, and guide to targets o	mament seeker oplications. The f interest in adv	technologies, ese affordable verse weather	, including laser e seeker technol conditions whi	radar, milli logies will pr le increasing	meter wave, synthetic aperture rovide the capability to g probability of kill.
- (U) \$1,002	Develop and demonstrate advanced conventional arr vector estimators, autopilots, inertial navigation, aer technologies will provide increased armament navig environment.	mament navigat odynamic contr gation accuracy	tion and contr ol, and anti-j and enhanced	rol technologies jam global posit d weapon contro	s, including v ioning syste ol and opera	weapon guidance laws, state m techniques. These tion in a electronic jamming
- (U) \$3,789	Integrate advanced conventional guidance technolog technologies, laser radar algorithms, super resolution techniques, and demonstrated advanced conventiona weather performance, faster processing of target info false alarm rate.	gies including so n techniques for al armament gui ormation, highe	eekers, navig r millimeter v dance capabi r probability	ation and contr waves and synth ilities. This gui of target detect	ol, signal and tetic aperture dance capab ion, and an o	d image processing/algorithm e radar, optical processing ility will provide better adverse operationally acceptable target
- (U) \$391	Identified as a source for SBIR.					
- (U) \$13,005	Total					
(U) <u>FY 2000 (\$ in</u>	<u>Thousands)</u> :				1 .11.	
- (U) \$2,699	radar and conformal seeker arrays for multi-mode appli- autonomously detect, acquire, and guide to targets of in	cations. These terest in adverse	affordable se e weather co	eker technologi nditions while in	es will provi ncreasing pr	ide the capability to obability of kill.
- (U) \$1,438	Develop and demonstrate advanced conventional armar estimators, autopilots, inertial navigation, aerodynamic provide increased armament navigation accuracy and e	ment navigation control, and an nhanced weapor	and control ti-jam global n control and	technologies, in positioning sys l operation in a	cluding wea stem technique electronic ja	pon guidance laws, state vector ues. These technologies will umming environment.
– (U) \$6,079	Integrate advanced conventional guidance technologies technologies, laser radar algorithms, super resolution te techniques, and demonstrated advanced conventional ar weather performance, faster processing of target inform alarm rate.	chniques for mi mament guidan nation, higher pr	ers, navigatio illimeter wav ice capabilitio cobability of t	on and control, so and synthetic res and synthetic es. This guidan target detection,	signal and in c aperture ra ce capability , and an oper	nage processing/algorithm dar, optical processing y will provide better adverse rationally acceptable target false
- (U) \$10,216	Total					
RDT&E BUDGET ITEM JUSTIF	February 1	999				
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BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Convention	nal Weapons Te	chnology 6	PROJECT 670B		
Project 670B	Page 8 of 11 Pages	Exhibi	t R-2A (PE 0603601F)			
	330					

RI	DT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT
3 - Advanced Te	chnology Development	0603601F Conventional Weapons Tee	chnology 670B
(U) <u>FY 2001 (\$ i</u>	n Thousands):		
- (U) \$2,570	Develop and demonstrate advanced conventional armar radar and conformal seeker arrays for multi-mode appli autonomously detect, acquire, and guide to targets of in	nent seeker technologies, including laser radar, millim cations. These affordable seeker technologies will pro terest in adverse weather conditions while increasing p	eter wave, synthetic aperture vide the capability to probability of kill.
- (U) \$2,782	Develop and demonstrate advanced conventional arman estimators, autopilots, inertial navigation, aerodynamic provide increased armament navigation accuracy and e	nent navigation and control technologies, including we control, and anti-jam global positioning system techni nhanced weapon control and operation in a electronic j	apon guidance laws, state vector ques. These technologies will jamming environment.
- (U) \$4,843	Integrate advanced conventional guidance technologies technologies, laser radar algorithms, super resolution te techniques, and demonstrated advanced conventional ar weather performance, faster processing of target inform alarm rate.	including seekers, navigation and control, signal and chniques for millimeter waves and synthetic aperture r mament guidance capabilities. This guidance capabili ation, higher probability of target detection, and an op	image processing/algorithm radar, optical processing ty will provide better adverse erationally acceptable target false
- (U) \$10,195	Total		
Project 670B	Page	e 9 of 11 Pages Exhibi	t R-2A (PE 0603601F)
		331	

BUDDET PACTWINY       PE NUMBER AND TITLE       PROJECT         3 - Advanced Technology Development       0603601F Conventional Weapons Technology       670B         (U) C. Other Program Funding Summary:       (U) Related Activities:       0603601F Conventional Weapons Technology       670B         - (U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology.       - (U) PE 0602119X, Advanced Technology Demonstrations.       - (U) PE 0602119X, Advanced Technology Demonstrations.       - (U) PE 0604618F, Joint Direct Attack Munitions.       - (U) Diff 0603792N, Advanced Technology Demonstrations.       - (U) Diff 0603792N, Advanced Technology Demonstrations.       - (U) Diff 0603792N, Advanced Technology Demonstrations.       - (U) Diff 0603192N, Advanced Technology Demonstrations.       - (U) Pi 0603192N, Advanced Technology Demonstrations.       - (U) Pi 0603192N, Advanced Technology Demonstrations.         (U) D. Acquisition Strategy: Not Applicable.       - (U) Pi 0603192N, Advanced Technology Demonstrations.       - (U) Pi 0603192N, Advanced Technology Demonstrations. <th>RDT&amp;E BUDGET ITEM JUSTIFICATION</th> <th colspan="8">RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)</th>	RDT&E BUDGET ITEM JUSTIFICATION	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)							
<ul> <li>(U) C. <u>Other Program Funding Summary:</u> <ol> <li>(U) <u>Related Activities:</u> <ol> <li>(U) PE 0603171N, Anti-Air/Anti-Surface Warfare Technology.</li> <li>(U) PE 0604018F, Joint Direct Attack Munitions.</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> </ol> </li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ol></li></ul>	BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603601F Conventional Weapons Te	PROJECT echnology 670B						
Project 670B Page 10 of 11 Pages Exhibit R-2A (PE 0603601F)	<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0602111N, Anti-Air/Anti-Surface Warfare Technology.</li> <li>(U) PE 0603792N, Advanced Technology Demonstrations.</li> <li>(U) PE 0604618F, Joint Direct Attack Munitions.</li> <li>(U) This project has been coordinated through the Reliance process to F</li> </ul> </li> <li>(U) D. Acquisition Strategy: Not Applicable.</li> <li>(U) E. Schedule Profile: Not Applicable.</li> </ul>	armonize efforts and eliminate duplication.							
	Project 670B Page	e 10 of 11 Pages Exhit	bit R-2A (PE 0603601F)						

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PE TITLE: Advanced Weapons Technology

RDT&E BUDGET IT	DATE February 1999									
BUDGET ACTIVITY 3 - Advanced Technology Developm	PE N <b>06</b>	PE NUMBER AND TITLE 0603605F Advanced Weapons Technology								
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	51,753	53,317	38,995	34,225	38,911	41,763	47,703	50,995	Continuing	Continuin
3150 Advanced Optics Technology	16,976	14,769	925	1,175	1,296	1,352	4,895	5,776	Continuing	Continuin
3151 High Power Semiconductor Laser Technology	5,556	9,783	10,975	4,907	9,597	10,418	12,855	13,540	Continuing	Continuin
3152 High Power Microwave Technology	6,601	7,327	7,581	8,916	9,561	10,020	8,770	8,953	Continuing	Continuin
3647 High Energy Laser Technology	22,620	21,438	19,514	19,227	18,457	19,973	21,183	22,726	Continuing	Continuin
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	

(U) A. <u>Mission Description</u>: This Advanced Technology Development program demonstrates advanced directed energy and optical imaging concepts. Speed-of-light weapons and long-range, high resolution optical imaging through the turbulent atmosphere offer significant payoffs for many Air Force missions, such as theater missile defense, suppression of enemy air defenses, and control of space. This program has already demonstrated many major technological breakthroughs such as removing significant atmospheric distortions from optical transmissions (e.g., laser beams) and producing small, relatively high power laser diode phased arrays. Major emphasis areas include: high power microwave and high energy laser technologies; long-range optical imaging; and high power laser diodes and diode arrays. Because of the unique effects associated with high power microwaves there are many potential applications ranging from low power disruptions to high power destruction of electronic devices. Thus, a wide range of high power microwave technologies are being developed. Within high energy lasers the emphasis is on developing methods to increase the power on target. This is done by continuing to remove more of the atmospheric degradations and to develop more efficient laser devices. Long-range optical imaging offers high resolution images of space objects from the ground for applications such as satellite status assessments. High power diodes offer great potential for very small optical sources at many wavelengths for applications such as infrared illuminators and infrared countermeasure sources as well as high data rate secure communications. This PE will continue to develop a wide range of directed energy technologies for many DoD applications. Note: Congress added \$10 million for space laser imaging and \$6 million for Field Laser Radar upgrades plus \$7.5 million for Geo Space Object Imaging in FY 1999 which explains the perceived decrease in FYs 2000 and out.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Page 1 of 12 Pages

Exhibit R-2 (PE 0603605F)

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RDT&E BUDGET ITEM JUS	DATE Fet	February 1999				
BUDGET ACTIVITY		PE NUMBER AN	ND TITLE	-		
3 - Advanced Technology Development		0603605F	Advanced	Weapons Tec	hnology	
(U) C. Program Change Summary (\$ in Thousands):		·				
					Total	
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost	
(U) Previous President's Budget/FY 1999 PB	50,832	40,153	40,138	39,975	Cont	
(U) Appropriated Value	55,238	53,653				
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-3,629	-336				
b. SBIR	-454					
c. Omnibus/Other Above Threshold Reprogrammings	-343					
d. Below Threshold Reprogrammings	941					
(U) Adjustments to Budget Year Since FY 1999 PB			-1,143	-5,750		
(U) Current Budget Submit/FY 2000 PB	51,753	53,317	38,995	34,225	Cont	

(U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$1,654 identified as a source for SBIR.

Page 2 of 12 Pages

Exhibit R-2 (PE 0603605F)

RDT	DATE Fe	DATE February 1999									
BUDGET ACTIVITY 3 - Advanced Techi	nology Developm		PE N <b>06</b>	UMBER AND	TITLE Advanced	l Weapoi	ns Techn	PROJECT 3150			
COST (\$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3150 Advanced Optics Techn	14,769	925	1,175	1,296	1,352	4,895	5,776	Continuing	Continuing		
high energy laser technolog time damage assessment. S high quality optical image r significant application to as $(U) \frac{FY 1998 (\$ in Th}{- (U) \$829}$ $- (U) \$637$ $- (U) \$356$ $- (U) \$356$ $- (U) \$9,441$ $- (U) \$5,713$ $- (U) \$16,976$	ties because an imaging Several advanced technol reconstruction, concentra stronomy research. <u>nousands)</u> : Developed and demon missions such as spac Developed nonlinear Developed and demon Developed and demon Developed technologi Upgraded the Field L sensing of the atmosp Total	subsystem is ogies includ ting on remo- nstrated adva e object ider optics techn nstrated sign es for active aser Demon- here.	anced, very ntification an ologies for r ature techno imaging of strator for in	r target verif ar optics, ada ent atmosphe long-range o nd ground ta ion-mechani logy for ide geosynchror creased sens	fication, acc aptive optics ere-induced optical imaging triget identifical correction entifying and nous space of sitivity to ob	urate and sus s, and special distortions. ing technolog cation from ons in optical assessing he bjects. tain very acc	stainable lass ized signal j Many of the gies which in space. I imaging. ealth and sta	er beam plac processing a technologie ncrease resol tus of satelli n space obje	cement on ta re being dev es developed lution and da tes out to geo ct and techni	rget, and nea eloped. The /being devel ata fusion to osynchronou iques for rer	ar-real- e goal is loped have support us orbit. note
<ul> <li>(U) <u>FY 1999 (\$ in Th</u></li> <li>(U) \$721</li> <li>(U) \$721</li> <li>(U) \$101</li> <li>(U) \$7,196</li> <li>(U) \$5,756</li> <li>(U) \$447</li> <li>(U) \$14,769</li> </ul>	nousands): Develop and demonst missions such as spac Develop nonlinear op Develop and demonst Develop technologies Upgrade the Field Las sensing of the atmosp Identified as a source Total	rate advance e object ider tics technolo rate signatur for active ir ser Demonst here. for SBIR.	ed technolog ntification ar ogies for nor re technolog naging of ge rator for inc	ies which in nd ground ta n-mechanica y for identif osynchronou reased sensit	acrease resol arget identifi al corrections ying and ass us space obju- tivity to obta	ution and da cation from s s in optical in sessing health ects. ain very accu	ta fusion for space. naging. n and status o rate data on	very long-ra of satellites o space objec	ange optical out to geosyn t and technic	imaging to s nchronous o jues for rem	support rbit. ote
Project 3150				Page 3 of	12 Pages			Exhibi	t R-2A (PE	0603605F)	)

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603605F Advanced Weapons Techn	ology 3150
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:         <ul> <li>(U) \$330 Develop nonlinear optics technologies for non-mech</li> <li>(U) \$50 Investigate advanced concepts to deploy and use ver and laser projection.</li> <li>(U) \$545 Investigate novel signature techniques for assessing</li> <li>(U) \$925 Total</li> </ul> </li> </ul>	nanical corrections to optical imaging and beam project ry large optical mirrors in orbit for applications that sup the operational status of satellites out to geosynchronor	ions. port missions such as imaging us orbit.
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:         <ul> <li>(U) \$1,005</li> <li>Develop nonlinear optics technologies for non-mech</li> <li>(U) \$85</li> <li>Investigate concepts/technologies to allow projection</li> <li>(U) \$85</li> <li>Investigate novel signature techniques for assessing</li> <li>(U) \$1,175</li> <li>Total</li> </ul> </li> <li>(U) B. <u>Project Change Summary - Description of Significant Changes</u>: Not A</li> </ul>	nanical correction to beam projection and optical imagin in through orbiting optical telescopes for applications su the operational status of satellites out to geosynchronor Applicable	ng. Ich as imaging and laser beam us orbit.
<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) <u>Related Activities</u>: <ul> <li>(U) PE 0305910F Spacetrack.</li> <li>(U) PE 0305160F, Defense Meteorological Satellite Program.</li> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602601F, Phillips Laboratory.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul> </li> </ul>	armonize efforts and eliminate duplication.	
<ul> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>		
Project 3150 Page	e 4 of 12 Pages Exhibit	r R-2A (PE 0603605F)

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603605F Advanced Weapons Technology				F	<sup>,</sup> ROJECT 3151		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
3151 High Power Semiconductor Laser Technology	5,556	9,783	10,975	4,907	9,597	10,418	12,855	13,540	Continuing	Continuing	

(U) A. <u>Mission Description</u>: This project continues to yield revolutionary breakthroughs in compact, robust, and affordable laser system technology for a wide range of military applications requiring small compact laser sources with low to moderate optical power. This is a long-term technology development project with both near-term and long-term goals. Near-term goals include developing compact, reliable infrared sources for a range of applications including night vision systems, landing zone markers, remote sensing, and covert communication systems. Longer-term goals focus on producing compact, significantly higher power sources for military applications including aircraft protection. This project leads the development of, and builds upon, a wide range of commercial advancements. Commercially available semiconductor lasers are widely used due to their low-cost, small size and weight, high reliability, and high efficiency in converting electricity to laser energy. This project preserves these attractive features while continually scaling output to higher powers/efficiencies and/or to military application-specific wavelengths. The project is divided into three technology areas. The first area investigates methods to increase output power from individual laser diodes while increasing power density onto a small spot. Secondly, semiconductor laser array integration methods, which produce a single, high quality laser beam at significantly higher power levels, are developed. Thirdly, wavelength-specific laser diodes for military applications are developed. Project scientists/managers also work directly with field users to develop proof-of-capability demonstrations and field tests for these revolutionary laser sources. This technology has many commercial applications, especially for eye-safe lasers.

#### (U) FY 1998 (\$ in Thousands):

) <u>I I I))(</u> (4	m mousuit	<u>13)</u> .
– (U)	\$1,157	Developed laser diodes for improved performance/higher power as sources in near-term applications such as infrared countermeasures,
		illumination, designation, and communication and for incorporation into laser diode array architectures.
– (U)	\$969	Developed coherent laser diode arrays for improved performance/higher power as sources in applications requiring power levels beyond
		those available from single diodes.
– (U)	\$1,674	Developed semiconductor diode lasers and optically-pumped semiconductor lasers to support current advanced infrared countermeasures
		system upgrades for tactical fixed and rotary-wing aircraft. Development focused on concepts with the potential for high efficiency,
		compact infrared laser sources covering Bands 2 and 4.
– (U)	\$1.756	Developed the basic laser source and target coupling technology needed to damage/destroy missile seeker components of next generation
(-)	+-,	advanced imaging infrared-guided air-to-air and surface-to-air missiles.
– (II)	\$5 556	Total
(0)	ψ5,550	

Project 3151

Page 5 of 12 Pages

Exhibit R-2A (PE 0603605F)

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RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)									
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603605F Advar	ced Weapons Techno	PROJECT DIOGY 3151						
(U) FY 1999 (\$ in T	nousands):									
– (U) \$1,869	Develop laser diodes for improved performance/hig	ther power as sources in n	ear-term applications such as	illumination, designation, and						
– (U) \$1,127	Develop scaleable laser arrays (fiber/diode) for imp designating/tracking sources for the airborne laser a aircraft self-protection applications.	the array architectures. roved performance in app and ground-based laser app	lications requiring high power plications and as weapon sour	levels and beam quality such as ces for degrade and damage in						
- (U) \$3,908	Develop semiconductor diode lasers and optically- system upgrades to tactical fixed and rotary-winged compact infrared laser sources covering Bands 2 and	umped semiconductor las aircraft. Development with d 4.	ers to support current advance ill focus on concepts with the	d infrared countermeasures potential for high efficiency,						
– (U) \$2,576	Develop the basic laser source and target coupling t advanced imaging infrared-guided air-to-air and su	echnology needed to dama rface-to-air missiles.	age/destroy missile seeker con	ponents of next generation						
- (U) \$303	Identified as a source for SBIR.									
– (U) \$9,783	Total									
(U) FY 2000 (\$ in Thousa	nds):									
- (U) \$895	Develop and demonstrate high brightness solid state	e/semiconductor lasers rec	uiring unique properties such	as wavelength agility or long						
- (U) \$1,533	Develop and demonstrate, scaleable, solid state lase (high power levels and improved beam quality), such and as weapon sources for factical applications such	er arrays (fiber/diode) for i ch as designation/tracking	mproved performance in appl sources for airborne laser and ft protection programs	ications requiring high brightness ground-based laser applications						
- (U) \$4,174	Develop and demonstrate semiconductor diode lase countermeasures system upgrades to tactical fixed a high efficiency, compact infrared laser sources cove	rs and optically-pumped s nd rotary-winged aircraft.	emiconductor lasers to suppor Development will focus on c	t advanced infrared oncepts with the potential for						
- (U) \$4,373	Develop and demonstrate the laser source, beam co advanced infrared-guided air-to-air and surface-to-	ntrol, and target coupling	technology needed to damage	destroy next generation imaging						
- (U) \$10,975	Total									
Project 3151	Pag	e 6 of 12 Pages	Exhibit	R-2A (PE 0603605F)						
		337								

RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exl	nibit) DATE	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603605F Advance	d Weapons Technology	PROJECT 3151		
(U) <u>FY 2001 (\$ in Th</u> - (U) \$1,448 - (U) \$1,224 - (U) \$2,235 - (L) \$4,907	<u>iousands</u> ): Develop and demonstrate high brightness solid state/ coherence length for applications such as remote sen Develop and demonstrate, scaleable, solid state laser (high power levels and improved beam quality), such and as weapon sources for tactical applications such Develop and demonstrate semiconductor diode laser countermeasures (IRCM) system upgrades to tactical potential for high efficiency, compact infrared laser	/semiconductor lasers requiri using/identification of chemic arrays (fiber/diode) for impu- h as designation/tracking sou as damage/destroy aircraft p s and optically-pumped semi l fixed and rotary-winged airc sources covering Bands 2 and	ng unique properties such as wavele als or structures. voved performance in applications re rces for airborne laser and ground-b rotection programs. conductor lasers to support advanced craft. Development will focus on co d 4.	ength agility or long equiring high brightness ased laser applications d infrared ncepts with the		
<ul> <li>(U) B. <u>Project Change S</u></li> <li>(U) C. Other Program I</li> </ul>	Summary - Description of Significant Changes: Not A	Applicable.				
<ul> <li>(U) <u>Related Activitie</u></li> <li>(U) PE 06021021</li> <li>(U) PE 06022041</li> <li>(U) PE 06032701</li> <li>(U) PE 06026011</li> <li>(U) PE 06022341</li> <li>(U) Representati government revia</li> <li>(U) Joint field de Guard; and the U</li> <li>(U) This project</li> </ul>	<ul> <li>s:</li> <li>F, Materials.</li> <li>F, Aerospace Avionics.</li> <li>F, Electronic Combat Technology.</li> <li>F, Phillips Laboratory.</li> <li>N, Systems Support Technology.</li> <li>ves from Army, Navy, Ballistic Missile Defense Organiew team for this technology.</li> <li>emonstrations of this technology are ongoing with: the AUS. Customs Service.</li> <li>has been coordinated through the Reliance process to have</li> </ul>	zation, National Laboratories Air Force Pararescue Schools armonize efforts and elimina	s, and Air Force using commands are the Air Force Special Operations C te duplication.	e members of the ommand; the U.S. Coast		
(U) D. <u>Acquisition Strate</u>	<b><u>egy</u>:</b> Not Applicable.					
(U) E. <u>Schedule Profile</u> :	Not Applicable.					
Project 3151	Page	e 7 of 12 Pages	Exhibit R-2A (PI	E 0603605F)		

RDT&	LE BUDGET IT	EM JUS	TIFICAT		IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVITY 3 - Advanced Techr	nology Developm	ent		PE NUMBER AND TITLE 0603605F Advanced Weapons Techn				PROJECT ology 3152			
COST <i>(\$ 1</i>	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
3152 High Power Microwave	7,327	7,581	8,916	9,561	10,020	8,770	8,953	Continuing	Continuin		
base to identify potential vul U.S. and foreign assets will technologies are being devel destroy electronic systems a (U) FY 1998 (\$ in Th)- (U) \$2,811- (U) \$2,216- (U) \$1,143- (U) \$431- (U) \$431- (U) \$6,601 $(U) FY 1999 ($ in Th)- (U) $3,081- (U) $3,081- (U) $1,172- (U) $1,172- (U) $490- (U) $227- (U) $7,327$	Inerabilities of U.S. syste be tested to understand loped. The technologies nd subsystems for missi <u>ousands</u> ): Developed and demon adversary's Integrated Developed HPM tech all types. Developed and demon Developed and demon Total <u>ousands</u> ): Develop and demonst Integrated Air Defens Develop HPM techno Develop and demonst Identified as a source Total	ems to HPM real system : s developed ons such as instrated HPM d Air Defens nologies to sunstrated HPM instrated HPM instrated non crate HPM such blogies to sup trate HPM to trate nonleth for SBIR.	threats and susceptibiliti in this project suppression A suppression e System. support advand A technolog lethal active uppression o oport advand schnologies al active der	to provide a tes. Both wi ct will demo of enemy ai on of enemy unced tactica ies to render denial techr f enemy air red tactical a to render inc hial technolo	basis for fui deband (wic nstrate the a r defense, co air defense t l application noperative nology. defense tech pplications. operative cor	ture offensiv le frequency pplicability o ommand and eechnologies as to defend l command and nologies to r nmand and c	e and defens range) and r of high powe control warf to render ind arge aircraft nd control w render inopen control warfa	ive weapons harrowband er microwav fare, and aire operative ele from attack arfare techn rative electro are technolog	s system deci (very small f es that can d craft self-pro ectronic comp by precision ologies.	isions. Repr frequency ra amage/degra tection. ponents of a a guided mis	resentative nge) ade/deny/ n siles of dversary's
Project 3152				Page 8 of	12 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0603605F)</u>	)

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)				
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603605F Advanced We	apons Techn	PROJECT Ology 3152	
(U) <u>FY 2000 (\$ in Th</u> - (U) \$4,061 - (U) \$2,932 - (U) \$588 - (U) \$7,581	nousands): Develop and demonstrate high power microwave (H Integrated Air Defense System. Develop and demonstrate HPM technologies to rend Develop and demonstrate nonlethal directed energy assignments. Total	IPM) technologies to render inoperat der inoperative sample command and weapons and data for multiple missi	ive sample electron control componen on applications inc	ic components of an adversary's ts of an adversary. luding future peacekeeping	
(U) FY 2001 (\$ in Th- (U) \$4,720- (U) \$3,460- (U) \$736- (U) \$8,916	<u>nousands</u> ): Develop and demonstrate HPM technologies to rend Develop and demonstrate HPM technologies to rend Develop and demonstrate nonlethal directed energy assignments. Total	ler inoperative electronic component der inoperative command and control weapons and data for multiple missi	s of an adversary's components of an on applications inc	Integrated Air Defense System. adversary. luding future peacekeeping	
(U) B. <u>Project Change S</u> (U) C. Other Program F	ummary - Description of Significant Changes: Not A	Applicable.			
(U) <u>Related Activitie</u> – (U) PE 06022021 – (U) PE 06022021 – (U) PE 06021202 – (U) PE 06021202 – (U) PE 06021111 – (U) This project	<ul> <li><u>s:</u></li> <li>F, Human Systems Technology.</li> <li>F, Phillips Laboratory.</li> <li>A, Electronic Survivability and Fuzing Technology.</li> <li>N, Anti-Air Warfare, Anti-Surface Warfare Technology has been coordinated through the Reliance process to h</li> </ul>	y. armonize efforts and eliminate dupli	cation.		
(U) D. <u>Acquisition Strate</u>	egy: Not Applicable.				
(U) E. <u>Schedule Profile</u> :	Not Applicable.				
Project 3152	Pag	e 9 of 12 Pages	Exhibit	R-2A (PE 0603605F)	
		340			

RDT&E BUDGET IT!	EM JUS	TIFICAT	ION SH	IEET (R·	-2A Exh	ibit)		DATE February 1999			
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603605F Advanced Weapons Technolo				ology	PROJECT 9 <b>gy 3647</b>		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
3647 High Energy Laser Technology	22,620	21,438	19,514	. 19,227	18,457	19,973	21,183	22,726	Continuing	Continuing	
(U) A. <u>Mission Description</u> : This project provide Near-term focus is on ground-based and airborne hi laser applications. Critical technologies demonstra	s for the dev gh energy la ted include:	elopment, de ser missions	emonstratio , although t er devices.	n, and detaile he technolog with near-ter	ed assessmer y developed m emphasis	it of technol for this proj on the Cher	ogy needed f ect is direct	for high ener ly applicable n-Iodine Las	gy laser weat to most highter (COIL): (	apons. h energy optical	

laser applications. Critical technologies demonstrated include: scaleable laser devices, with near-term emphasis on the Chemical Oxygen-Iodine Laser (COIL); optical components; and laser beam control to efficiently compensate and propagate laser radiation through the atmosphere to a target. Detailed computational models to establish high energy laser weapon effectiveness and satellite and missile vulnerability will be developed. Correcting the laser beam for distortions induced by propagation through the turbulent atmosphere is the key technology in most high energy laser applications. The beam control technology developed in this project has a significant benefit to the astronomy community.

#### (U) <u>FY 1998 (\$ in Thousands)</u>:

- (U) \$2,516 Developed and demonstrated the technology for scaleable, high efficiency, high energy laser devices for potential weapon applications.

- (U) \$1,645 Performed vulnerability assessments on potential high energy laser targets to provide critical data for designing laser systems which can defeat a range of targets and to provide critical data for designing systems protected against laser threats.
- (U) \$881 Investigated and developed advanced, high energy laser optical components.
- (U) \$9,632 Performed atmospheric compensation and laser beam control experiments from ground-based platforms to support applications ranging from weaponization to space object identification.
- (U) \$7,946 Characterized atmospheric attenuation and distortion on laser beam propagation, conducted atmospheric compensation and beam control experiments, and developed an airborne ultra-precision inertial pointing brassboard to enhance boost phase theater ballistic missile tracking.
- (U) \$22,620 Total

Project 3647

Page 10 of 12 Pages

Exhibit R-2A (PE 0603605F)

RD	<b>F&amp;E BUDGET ITEM JUSTIFICATION</b>	I SHEET (R-2A Ex	hibit)	February 1999
BUDGET ACTIVITY		PE NUMBER AND TITLE		PROJECT
3 - Advanced Tec	hnology Development	0603605F Advance	ed Weapons Techno	blogy 3647
(U) FY 1999 (\$ in '	Thousands):			
- (U) \$2,185	Develop and demonstrate the technology for scaleab	le, high efficiency, high ene	rgy laser devices for potenti	al weapon applications.
– (U) \$1,693	Perform vulnerability assessments on potential high a range of targets and to provide critical data for des	energy laser targets to provi signing systems protected ag	de critical data for designin ainst laser threats.	g laser systems which can defeat
– (U) \$746	Investigate and develop advanced, high energy laser	optical components.		
– (U) \$10,388	Perform atmospheric compensation and laser beam weaponization to space object identification.	control experiments from gr	ound-based platforms to su	pport applications ranging from
– (U) \$5,749	Characterize atmospheric attenuation and distortion experiments, and develop an airborne ultra-precisio	on laser beam propagation, n inertial pointing brassboar	conduct atmospheric comp d to enhance boot phase the	ensation and beam control eater ballistic missile tracking.
– (U) \$677	Identified as a source for SBIR.			
- (U) \$21,438	Total			
(U) <u>FY 2000 (\$ in</u>	<u>Thousands)</u> :			
– (U) \$2,300	Develop and demonstrate the technology for scaleab	le, high efficiency, high ener	rgy laser devices for potenti	al weapon applications.
– (U) \$960	Perform vulnerability assessments on potential high a range of targets and to provide critical data for des	energy laser targets to provi igning systems protected ag	de critical data for designin ainst laser threats.	g laser systems which can defeat
– (U) \$200	Investigate and develop advanced, high energy laser	optical components for futu	re weapon systems.	
– (U) \$9,014	Perform atmospheric compensation/beam control ex weaponization to space object identification.	periments from ground-base	d platforms to support appl	ications ranging from
– (U) \$7,040	Characterize atmospheric attenuation and distortion concepts for atmospheric compensation and beam co and beam control field tests to develop and demonst missile defense.	on laser beam propagation f ontrol in modeling and labor rate feasibility and performa	rom airborne platforms, inv atory experiments, and cond nce in realistic environment	estigate and evaluate advanced luct atmospheric compensation ts for applications such as theater
– (U) \$19,514	Total			
Project 3647	Dago	11 of 12 Pages	Fyhihit	R-2A (PE 0603605E)
110/001 5077		3/2	EXHIBIT	

RDT&E BUDGET	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)						
BUDGET ACTIVITY 3 - Advanced Technology Develo	opment	PE NUMBER AN 0603605F	D TITLE Advanced Weapons	Technology	PROJECT <b>3647</b>		
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>: <ul> <li>(U) \$2,101</li> <li>Develop and der</li> <li>(U) \$702</li> <li>Perform vulnera a range of target</li> <li>(U) \$202</li> <li>Investigate and o</li> <li>(U) \$9,301</li> <li>Perform atmospic weaponization to the concepts for atm and beam controm missile defense.</li> <li>(U) \$19,227</li> </ul> </li> </ul>	nonstrate the technology for scaleabl bility assessments on potential high e s and to provide critical data for desi develop advanced, high energy laser of heric compensation/beam control exp o space object identification. nospheric attenuation and distortion of ospheric compensation and beam co ol field tests to develop and demonstr	e, high efficience energy laser targ gning systems p optical compone periments from on laser beam p ntrol in modelin ate feasibility a	cy, high laser devices for pote gets to provide critical data for protected against laser threats, ents for future weapon system ground-based platforms to sup ropagation from airborne plat ng and laboratory experiments nd performance in realistic en	ntial weapon applications r designing laser systems s. oport applications ranging forms, investigate and ev s, and conduct atmospheri vironments for applicatio	which can defeat g from aluate advanced c compensation ns such as theater		
<ul> <li>B. Project Change Summary - Description</li> <li>(U) C. Other Program Funding Summary</li> <li>(U) Related Activities: <ul> <li>(U) PE 0602601F, Phillips Laborate</li> <li>(U) PE 0603319F, Airborne Laser I</li> <li>(U) PE 0305910F, Spacetrack.</li> <li>(U) PE 0603217C, Ballistic Missile</li> <li>(U) This project has been coordinate</li> </ul> </li> <li>(U) D. Acquisition Strategy: Not Applicab</li> </ul>	of Significant Changes: Not Appli : ory. Demonstration. Defense, Advanced Development (H ed through the Reliance process to ha le.	cable. ligh Altitude Ba armonize efforts	alloon Experiment). s and eliminate duplication.				
(U) E. <u>Schedule Profile</u> : Not Applicable. Project 3647	Page	12 of 12 Pages		Exhibit R-2A (PE 060	)3605F)		

PE TITLE: Weather Systems Technology

RDT&E BUDGET	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Develo	pment		PE N <b>06</b>	UMBER AND	TITLE Veather \$	Systems	Technol	ogy	F	PROJECT 2688		
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost		
2688 Weather Support Technology	Weather Support Technology         1,869         1,564         0						0	0	TBD			
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0		
Note: This project will be terminated at the end (U) A. <u>Mission Description</u> : This Advanced weather support forces to enable full spectrum of planning systems to optimize tactics and preciss development. Initiatives are also planned to im Technologies delivered will enhance informatic by improving space environmental forecasts. (U) <u>FY 1998 (\$ in Thousands)</u> : – (U) \$500 Developed and d (AFSOC) and Ai ranges due to nig – (U) \$709 Transitioned infr- planning sorties of – (U) \$319 Initiated developed weapon and navi – (U) \$246 Delivered validat forecasts of aviat – (U) \$95 Developed and d the Air Force Spa – (U) \$1,869 Total	l of FY 1999. Technology Dev dominance. Tec ion guided muni prove the accura on superiority by elivered Night V r Combat Comm ht illumination a ared scene visua employing infran ment of new targ gation systems. ed thunderstorm ion hazards. elivered module ace Command.	velopment pr hnologies de tions selectio cy of enviro improving t 'ision Goggle and (ACC) : and weather. lization syste red guided m get acquisitio t, aircraft icin for Coupled	rogram demo eveloped incl on. Other te nmental fore ailored weat e Operations for evaluation em to the Air unitions. on software a ng, and turbu Ionospheric	onstrates and lude new im chnologies v ecasts produc ther forecasts weather Scon. Software r Force Miss and mission is alence algori -Thermosph	I transitions pact decision vill support of ced by the A s in data den oftware Vers improves fl ion Support impact modu thms to Air eric Forecas	new technol n aids that w operational 1 ir Force We ied areas. C ion 4.0 to Ai ight safety b System Prog iles for calcu Force Weath t Model for	ogies for wa ill be incorp aser system ather Agenc Other models ir Force Spe- by predicting gram Office alating impa- her Agency - predicting sa	arfighters and orated into a design and c y and Air Fo will enhance cial Operation changes in y at Electronic ct of weathe (AFWA) for atellite comm	d their associ- poperational c poperational c prece Space C e satellite su ons Comman goggle detec c Systems Co r on electro-o- tailored ope nunication of	iated ission oncept ommand. urvivability d tion enter for optical erational utages to		
Project 2688			Page 1 of	f 3 Pages			Exhib	oit R-2 (PE	0603707F)			

# 344

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)				
BUDGET ACTIVITY 3 - Advanced Techr	ology Development	PE NUMBER AND TITLE 0603707F Weather Systems T	echnology	PROJECT 2688	
(U) FY 1999 (\$ in Th	ousands):				
- (U) \$814	Develop and transition Target Acquisition Weather S impact of weather on precision suided munitions du	Software V1.0 to Air Combat Command (A ring mission execution planning	CC). Software will be	used in predicting	
– (U) \$614	Develop and demonstrate software that incorporates Tasking Order (Weather Automated Mission Plannin	the impact of weather on precision guided ng Software) to ACC.	munitions during prepa	aration of the Air	
- (U) \$104	Transition, for operational use, upgraded software th on performance of Night Vision Goggle Operations	at incorporates ACC and Air Force Special Weather Software.	Operations Command	(AFSOC) feedback	
- (U) \$32	Identified as a source for SBIR.				
– (U) \$1,564	Total				
(U) <u>FY 2000</u> : Not A <sub>f</sub>	plicable.				
(U) <u>FY 2001</u> : Not Ap	plicable.				
Droiget 2699	n	2 of 2 Darage	Evhihit D 2 (DF	06032075)	

RDT&E BUDGET ITEM JUS	TIFICATIO	ON SHEET	(R-2 Exhib	it)	DATE Febru	uary 1999
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE		2	PROJECT
3 - Advanced Technology Development		0603707F	Weather Sy	stems Techn	ology	2688
(U) C. Program Change Summary (\$ in Thousands):						
					Total	
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost	
(U) Previous President's Budget/FY 1999 PB	1,943	1,568	1,562	1,361	Cont	
(U) Appropriated Value	2,036	1,568				
(U) Adjustments to Appropriated Value						
a. Congressional General Reductions	-66	-4				
b. SBIR	-29					
c. Omnibus/Other Above Threshold Reprogrammings	-13					
d. Below Threshold Reprogrammings	-59					
(U) Adjustments to Budget Year Since FY 1999 PB			-1,562	-1,361		
(U) Current Budget Submit/FY 2000 PB	1,869	1,564	0	0	Cont	
<ul> <li>(U) D. Other Program Funding Summary:</li> <li>(U) <u>Related Activities</u>:</li> <li>(U) PE 0305160F, Defense Meteorological Satellite Program (U) PE 0305111F, Weather Service.</li> <li>(U) PE 0602601F, Phillips Laboratory Exploratory Deteored (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been coordinated through the Relational Statement (U) This project has been (U)</li></ul>	rogram. evelopment. iance process to	harmonize effort	s and eliminate c	luplication.		
(U) E. <u>Acquisition Strategy</u> : Not Applicable.						
(U) F. <u>Schedule Profile</u> : Not Applicable.						
Project 2688	Ра	age 3 of 3 Pages		Ex	(hibit R-2 (PE 060	3707F)
		346				

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#### **PE NUMBER: 0603723F**

PE TITLE: Environmental Engineering Technology

BUDGET ACTIVITY <b>3 - Advanced Technology Develo</b> COST (\$ <i>In Thousands</i> ) 2103 Environmental Quality Technology	FY 1998 Actual 3,562	FY 1999 Estimate	PE N 06	UMBER AND <sup>•</sup> 03723F E	title Environm	ental End			F	<b>PROJECT</b>
COST (\$ In Thousands) 2103 Environmental Quality Technology	FY 1998 Actual 3,562	FY 1999 Estimate	FY 2000	5140004			gineering	Techno	logy 2	2103
2103 Environmental Quality Technology	3,562		Estimate	Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2103 Environmental Quality Technology 3,562 2,579				0	0	0	0	0	Continuing	Continuing
Quantity of RDT&E Articles	Quantity of RDT&E Articles 0 0			0	0	0	0	0	0	0
<ul> <li>Environmental Quality Technology. In FY 199</li> <li>(U) A. <u>Mission Description</u>: This Advanced environmental compliance, site remediation, ar emissions from weapon systems, minimize Air Environmental Policy Act, and solve environm preparing timely responses to public concerns,</li> <li>(U) <u>FY 1998 (\$ in Thousands</u>): <ul> <li>(U) <u>FY 1998 (\$ in Thousands</u>):</li> <li>(U) § 828</li> </ul> </li> <li>Demonstrated te environmental ir development of i initiating adaptat</li> <li>(U) \$1,594</li> <li>Demonstrated tea comply with the (VOCs) emission forming foam (A</li> <li>(U) \$1,140</li> <li>Conducted study mammals expose Assessment Syst</li> <li>(U) \$3,562</li> </ul>	99, the Noise and I Technology De d pollution preve Force industrial ental reclamation preparing accura chnologies and d npact of Air Force mmunochemical ion of environme chnologies to red Clean Air Act. On s control technol FFF) in waste way to determine the ed to military airce em for Aircraft N	Sonic Boon velopment p ention proble waste, elimi a problems. Ite environm esign criteria e operations systems to p ental sensor i uce/destroy i Continued de logy and dev ater. effect of an graft noise ar loise (ASAN	n Impact Te rogram deve ems. Specif nate toxic p Improving ental impac a for monito by evaluati provide inex networks to wastes and nevelopment reloped cher imal sleep-or ad developed N to Air For	chnology por elops and der ic projects de ollutant relea these capabil t statements, oring, charact ng chemical pensive, acci monitor air reduce conta of a recircula nical/physica disturbance h d baseline no rce Center fo	rtions of Pro- monstrates ac evelop and d ases from Air lities aids the and minimiz- terization, as fate and env urate, and ro toxicity. mination of the ating paint be al processes to abituation fr pise levels foor r Environme	ject 2103 are dvanced tech emonstrate a Force opera Air Force i zing unfavor sessment, pr ironmental t bust measure he environm ooth with bio o treat oil/w om aircraft n r Air Force u ntal Excelle	e eliminated. anologies to advanced tec ations as dire n maintainir able legal cl cocess contro cransport of A ements of Ai nent by Air H ofilter and V ater wastes, noise. Chara use. Comple nce and Air	address Air hnologies to ected by the genvironment allenges to al, and disport Air Force co r Force toxic Force materia olatile Organ emulsions, a acterized the ted and tran Combat Cor	Force-unique reduce haz National ental quality Air Force of sal to reduce mpounds; in c wastes; an als and oper nic Compou ind aqueous habitat of n sitioned the nmand.	e ardous ', perations. itiating d ations to inds film narine

R	DI&E BUDGET TIEM JUSTIFIC	CATION SHEET (R-2 EXHIBIT)	February	1999
UDGET ACTIVITY 3 - Advanced Tec	hnology Development	PE NUMBER AND TITLE 0603723F Environmental En	gineering Technology	PROJECT <b>2103</b>
(U) <u>FY 1999 (\$ in</u> – (U) \$ 732 – (U) \$1,590 – (U) \$ 200 – (U) \$ 57 – (U) \$2,579	Thousands): Develop and demonstrate technologies and de environmental impact of Air Force operations with horizontal directional drilling technology Develop scientific and engineering tools to re recovery unit operations with treatment syster Demonstrate technologies to reduce/destroy v the Clean Air Act by completing developmen Identified as a source for SBIR. Total	esign criteria for monitoring, characterization, assess s by integrating real-time Dense Non-Aqueous Phase y. Complete development and demonstration of pro educe weapon system sustainment costs by initiating ms for Air Force operations, including Air Logistics vastes and reduce contamination of the environment at of the recirculating paint booth with biofilter.	sment, process control, and dispos e Liquid (DNAPL) sensing instru- tocol for intrinsic remediation of I integration of energy generation a Centers. by Air Force operations and to co	eal to reduce mentation DNAPLs. and water mply with
<ul> <li>(U) <u>FY 2000</u>: Not</li> <li>(U) <u>FY 2001</u>: Not</li> </ul>	Applicable			
b) <b>B.</b> <u>Budget Activit</u>	y Justification: This program is in Budget Acti Air Force-unique environmental problems.	ivity 3, Advanced Technology Development, since in	t develops and demonstrates advar	nced
J) <b>B. <u>Budget Activit</u></b> chnologies to address	y Justification: This program is in Budget Acti Air Force-unique environmental problems.	ivity 3, Advanced Technology Development, since in	t develops and demonstrates advar	nced
J) B. <u>Budget Activit</u> chnologies to address	y Justification: This program is in Budget Acti Air Force-unique environmental problems.	ivity 3, Advanced Technology Development, since in	t develops and demonstrates advar	nced
U) <b>B. <u>Budget Activit</u></b> cchnologies to address	y Justification: This program is in Budget Acti Air Force-unique environmental problems.	ivity 3, Advanced Technology Development, since in	t develops and demonstrates advar	nced
U) <b>B. <u>Budget Activit</u></b> echnologies to address	y Justification: This program is in Budget Acti Air Force-unique environmental problems.	ivity 3, Advanced Technology Development, since in	t develops and demonstrates advar	nced

RDT&E BUDGET ITEM JUS	TIFICATIO	N SHEET	(R-2 Exhib	it)	DATE February	/ 1999
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE			PROJECT
3 - Advanced Technology Development		0603723F	Environme	ntal Engineer	ing Technology	2103
(U) C. Program Change Summary (\$ in Thousands):						
					Total	
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Cost	
(U) Previous President's Budget/FY 1999 PB	3,786	2,663	3,202	1,431	Cont	
(U) Appropriated Value	4,084	2,663				
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-217	-84				
b. SBIR	-64					
c. Omnibus/Other Above Threshold Reprogrammings	-26					
d. Below Threshold Reprogrammings	-215					
(U) Adjustments to Budget Year Since FY 1999 PB			-3,202	-1,431		
(U) Current Budget Submit/ FY 2000 PB	3,562	2,579	0	0	Cont	

(U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$57 identified as a source for SBIR.

Project 2103

Page 3 of 3 Pages

Exhibit R-2 (PE 0603723F)

RDT&E BUDGET ITEM JUSTIFICATION	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)					
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603723F Environmental Enginee	ring Technology	PROJECT 2103			
<ul> <li>(U) D. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0602102F, Materials.</li> <li>(U) PE 0602203F, Aerospace Propulsion.</li> <li>(U) PE 06032112F, Aerospace Propulsion.</li> <li>(U) PE 0603211F, Aerospace Structures.</li> <li>(U) PE 0603211F, Crew Systems and Personnel Protection Technology.</li> <li>(U) PE 0603716D, Strategic Environmental Research and Development</li> <li>(U) PE 0604706F, Life Support Systems.</li> <li>(U) PE 0604708F, Other Operational Equipment.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul> </li> <li>(U) E. Acquisition Strategy: Not Applicable.</li> <li>(U) F. Schedule Profile: Not Applicable.</li> </ul>	Program. ogram. armonize efforts and eliminate duplication.					
Project 2103 Pag	e 4 of 4 Pages E	xhibit R-2 (PE 0603723F	-)			
	351					

PE TITLE: C3 Subsystem Integration

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								February 1999		
BUDGET ACTIVITY 3 - Advanced Technology Development				PE NUMBER AND TITLE 0603726F C3 Subsystem Integration						
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	7,591	10,993	9,122	4,920	5,852	6,752	6,893	7,036	Continuing	Continuing
2810 Advanced Image/Information/Optical Memory Technology Applications	3,890	5,832	3,562	4,920	5,852	6,752	6,893	7,036	Continuing	Continuing
2863 Integrated Photonics	3,701	5,161	5,560	0	0	0	0	0	0	TBC
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	(

Note: Beginning in FY 1998, Project 2810, Advanced Image/Information Applications, and Project 3192, Advanced Optical Memory Technology, were combined into Project 2810, Advanced Image/Information/Optical Memory Technology Applications. In FY 2001, the efforts in Project 2863, Integrated Photonics, will be conducted in Project 69CK, PE 0603203F.

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates Command, Control, and Communications (C3) technologies in the areas of processing and fusion of digital databases, photonics technology, optical disk storage/processing of digital information, and distributed processing technology for interoperability between dispersed command centers. These technologies provide increased storage, processing, and transmission of digital data received from a broad variety of sensors and sources.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have a military utility and address warfighter needs.

Page 1 of 8 Pages

RDT&E BUDGET ITEM JUS	DATE February 1999				
BUDGET ACTIVITY		PE NUMBER AN	D TITLE		
3 - Advanced Technology Development		0603726F	C3 Subsyst	on	
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :					Tetal
	FV 1998	FV 1999	EV 2000	FY 2001	l otal Cost
(U) Previous President's Budget/FY 1999 PB	9.364	$\frac{11.025}{11.025}$	11.295	6.606	Cont
(U) Appropriated Value	9,922	11,025	,_,_	-,	2
(U) Adjustments to Appropriated Value					
a. Congressional/General Reductions	-324	-32			
b. SBIR	-239				
c. Omnibus/Other Above Threshold Reprogrammings	-63				
d. Below Threshold Reprogrammings	-1,705				
e. Rescissions					
(U) Other Adjustments to Budget Years Since FY 1999 PB			-2,173	-1,686	
(U) Current Budget Submit/FY 2000 PB	7,591	10,993	9,122	4,920	Cont

(U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$322 identified as a source for SBIR.

Page 2 of 8 Pages

Exhibit R-2 (PE 0603726F)

BUDGET ACTIVITY         PE NUMBER AND TITLE         PROJECT           3 - Advanced Technology Development         PE NUMBER AND TITLE         PE OUNDER AND TITLE         PROJECT           2810         COST (\$ In Thousands)         FY 1998         FY 1998         FY 2001         FY 2002         FY 2002         FY 2004         FY 2004         FY 2004         FY 2005         Cost to         Total Cost           2810         Advanced Image/Information/Optical Memory         3.880         5.832         3.562         4.920         5.852         6.752         6.893         7.038         Continuing         Continuing           (U) A. Mission Description:         This project develops and demonstrates techniques and algorithms to meet weapon systems requirements for processed and fused multi-source information necded for mission planning, navigation, targeting, and terrain analysis. It provides generic language translation processing techniques, state-of-the-art algorithms for Air Force exploitation of digitally processed image and spatial (i.e., latitude, longitude, and elevation) database products, automated capabilities to reference and display hypermedia (multi-media) information, and defering operational mission planning requirements, and large data sorage requirements (i.e., high-volume, soft-corp., digital imager exploitation). Algorithms will be developed to a unomate the selection, retrieval, and downloading of information stored on mass storage devices that are distributed across the data network. An array of optical disk drives will be developed for high-throughput speed and fault-tolerant requirements. Three-dimensional (3-D) o	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										DATE February 1999	
COST (\$ In Thousands)FY 1998FY 1998FY 2000FY 2001FY 2001	BUDGET ACTIVITY 3 - Advance	ץ d Technology Developm:	nent		PE N <b>06</b>	UMBER AND 03726F 0	TITLE C3 Subsy	stem Inte	egration		F	PROJECT 2810
2810       Advanced image/information/Optical Memory       3.890       5.832       3.562       4.920       5.852       6.752       6.893       7.036       Continuing       Continuing         (U) A. <u>Mission Description</u> : This project develops and demonstrates techniques and algorithms to meet weapon systems requirements for processed and fused multi- source information needed for mission planning, navigation, targeting, and terrain analysis. It provides generic language translation processing techniques, state-of-the-art algorithms for Air Force exploitation of digitally processed image and spatial (i.e., latitude, longitude, and elevation) database products, automated capabilities to reference and display hypermedia (multi-media) information, and defensive information warfare technologies. This project also develops erashee optical data storage systems with high capacity and fast input/output speed for fighter aircraft (to provide fast airborne access to mission-oriented data and the digital terrain system) and electronic surveillance aircraft (for on-board sensor data recording, operational mission planning requirements, and large data storage tradies dorage devices that are distributed across the data network. An array of optical disk drives will be developed for bigh-throughput speed and fault-tolerant requirements. Three-dimensional (3-D) optical memory systems will be developed of ouronmet the selection, retrieval, and downloading of information storage devices that are distributed across the data network. An array of optical disk drives will be developed for high-throughput speed and fault-tolerant requirements. Three-dimensional (3-D) optical memory systems will be developed and demonstrated advanced imagery information, spatial data base, and information correlation technologies to enhance warfighter mission planning, navigation, targeting, and terr		COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This project develops and demonstrates techniques and algorithms to meet weapon systems requirements for processed and fused multi- source information needed for mission planning, navigation, targeting, and terrain analysis. It provides generic language translation processing techniques, state-of-the-art and display hypermedia (multi-media) information, and defensive information warfare technologies. This project also develops erasable optical data storage systems with high capacity and fast input/output speed for fighter aircraft (to provide fast airborne access to mission-oriented data and the digital terrain system) and electronic surveillance aircraft (for on-board sensor data recording, operational mission planning requirements, and large data storage requirements (i.e., high-volume, soft-copy, digital imagery exploitation). Algorithms will be developed to automate the selection, retrieval, and downloading of information stored on mass storage devices that are distributed across the data network. An array of optical disk drives will be developed for high-throughput speed and fault-tolerant requirements. Three-dimensional (3-D) optical memory systems will be developed for volumetric digital data storage. This new mass storage technologies will demonstrate ultra-high data density and fast, parallel data access within a low-cost, compact system.</li> <li>(U) <u>FY 1998 (\$ in Thousands):</u> <ul> <li>(U) <u>\$155</u> Developed and demonstrated advanced imagery information, spatial data base, and information correlation technologies to enhance warfighter mission planning, navigation, targeting, and terrain analysis.</li> <li>(U) <u>\$155</u> Developed and demonstrated advanced imagery kaploit relationships between data available to the field commander in a timely manner.</li> <li>(U) \$330</li> <li>Developed and demonstrated optical. 3-D information data handling, storage, and access technologies for strategic and tactical appl</li></ul></li></ul>	2810 Advanced I Technology	mage/Information/Optical Memory / Applications	3,890	5,832	3,562	4,920	5,852	6,752	6,893	7,036	Continuing	Continuing
Project 2810 Page 3 of 8 Pages Exhibit R-24 (PE 0603726E)	(U) A. <u>Mission</u> source informatic algorithms for Ai and display hype: high capacity and surveillance aircr digital imagery e distributed across optical memory s data access within $(U) \frac{FY 199}{-}(U)$ - (U) - (U) - (U) - (U) - (U) - (U)	Description:This project developon needed for mission planning, nir Force exploitation of digitally prmedia (multi-media) informationd fast input/output speed for fighterraft (for on-board sensor data reconvection).Algorithms will bes the data network. An array of opsystems will be developed for voluenn a low-cost, compact system.98 (\$ in Thousands):\$3,000Developed and demonstration\$155Developed and demonstration\$430Systems, developed\$3,890Total	ps and demo avigation, tar rocessed ima , and defensiver er aircraft (to rding, operat developed to optical disk dri umetric digitation onstrated adve obstrated adve obstrated auto formation wh onstrated opti l, and demon	nstrates tech regeting, and ge and spatia ve informatio provide fast ional missio automate th ives will be o il data storag anced image igation, targ omated capal ich fully exp acal, 3-D info strated optic	niques and a terrain analy al (i.e., latitu on warfare to airborne aco n planning r e selection, developed fo e. This new ry informati eting, and to polities to co ploit relation ormation dat al disk and i	algorithms to vsis. It provi ide, longitud echnologies. cess to missi equirements retrieval, and or high-throu v mass storag on, spatial d errain analys llect, integra ships betwee ta handling, nterface tecl	o meet weapo ides generic e, and elevat This projec on-oriented , and large d d downloadin ghput speed ge technolog ata base, and is. ite, extract, a en data avail storage, and mologies tha	on systems re language tra ion) databas et also develo data and the ata storage r ng of inform and fault-to y will demon al information nd dissemin able to the fi access techr at can be imp	equirements inslation pro- ie products, is ops erasable digital terra equirements ation stored lerant requin instrate ultra- n correlation ate hyperme held comman hologies for blemented in	for processe cessing tech automated ca optical data in system) a s (i.e., high-v on mass stor rements. The high data de t technologie dia (integrat of the the technologie dia (integrat of the the technologie dia trategic and of joint the technologie	d and fused niques, state pabilities to storage syste and electronic olume, soft- rage devices ree-dimension nsity and fast es to enhance ed text, imagely manner. tactical approperations.	multi- e-of-the-art oreference ems with c -copy, that are onal (3-D) st, parallel e gery, lications.

RDT8	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT
3 - Advanced Techn	ology Development	0603726F C3 Subsystem Integration	2810
(II) EV 1000 (\$; m Th	augunda):		
(0) FI 1999 (\$ III 1 III)- (II) \$574	<u>Dusanus)</u> . Develon and demonstrate advanced imagery informa	tion sensor fusion and spatial database technologies t	o enhance warfighter mission
(0) 4074	planning, navigation, targeting, and terrain analysis.	alon, sensor rusion, and spatial database teennorogies t	o ominance warngitter mission
– (U) \$1,657	Design, develop, and demonstrate automated capabil	ities to harvest, process, disseminate, and display intel	ligence and sensor data to
	improve the sensor exploitation process.		-
– (U) \$2,396	Continue to develop and demonstrate three-dimension	onal (3-D) optical information data handling, storage, a	and access technologies including
	erasable and read-only memories.		
– (U) \$361	Continue to design, develop, and demonstrate optica	I disk and interface technologies that can be implemen WORM) 3 D memory and lukabox Padundant Array of	ted in joint theater operations,
– (U) \$673	Design develop and demonstrate mission planning	and rehearsal canabilities for theater battle management	nt including semi-automated
(0) \$015	objectives-based planning and assessment for Comm	and and Control requirements.	in moruaning source automatou,
– (U) \$171	Identified as a source for SBIR.		
– (U) \$5,832	Total		
(U) FY 2000 (\$ in The) (U) \$600	Dusands): Develop and demonstrate advanced imagery and sign	nal intelligence information sensor fusion engine and	spatial database technologies to
- (0) \$000	enhance warfighter mission planning navigation tar	reting and terrain analysis	spatial database technologies to
– (U) \$1,262	Develop and demonstrate automated capabilities to lo	ocate, retrieve, process, distribute, and display intellige	nce and sensor data to improve
	the sensor exploitation process.		Ĩ
– (U) \$600	Initiate development of Smart Memory/Associative R	Recall module optical information data handling, storag	e, and access technologies to
	enable advanced fusion processing techniques.		
– (U) \$300	Continue to develop and demonstrate optical disk and	d interface technologies that can be implemented in joi	nt theater operations, including
– (II) \$800	WORM develop and demonstrate mission planning	and rehearsal canabilities for theater battle managemer	at including the demonstration of
(0) \$000	software for joint Command and Control (C2) require	ements.	it, menualing the demonstration of
– (U) \$3,562	Total		
Project 2810	Page	e 4 of 8 Pages Exhibit	R-2A (PE 0603726F)
	1 02.		,

RDT	<b>&amp;E BUDGET ITEM JUSTIF</b>	ICATION SHEET (R-2A Exhi	ibit) DATE Fe	DATE February 1999		
BUDGET ACTIVITY 3 - Advanced Techr	nology Development	PE NUMBER AND TITLE 0603726F C3 Subsys	stem Integration	PROJECT 2810		
<ul> <li>(U) <u>FY 2001 (\$ in The</u></li> <li>(U) \$1,100</li> <li>(U) \$2,076</li> <li>(U) \$544</li> <li>(U) \$200</li> <li>(U) \$200</li> <li>(U) \$1,000</li> <li>(U) \$4,920</li> <li>(U) B. <u>Project Change Set</u></li> </ul>	<u>ousands</u> ): Develop and demonstrate advanced im technologies for transition to Theater F Develop and demonstrate automated ca improve the sensor exploitation proces Continue to develop Smart Memory ar applications. Initiate a DNA-based, for Design and develop optical disk and in be implemented and tested in joint the execution. Design, develop, and demonstrate Corr including the initial demonstration of f requirements. Total	hagery and signal intelligence information, ad Battle Management Core Systems. apabilities to access, extract, process, and dis s for near-real-time situational awareness. ad related optical information data handling, ur-dimensional, Petabyte memory brassboard tterface technologies for a three-dimensional, ater operations to provide information handling mmand and Control (C2) mission planning ar fully functional software for assessment again hanges: Changes to this program since the p	laptive sensor fusion engine, and sp play multi-source intelligence and s storage, and access technologies fo , self-organizing storage and manag ing, fusion, exploitation, dynamic p nd rehearsal capabilities for theater nst Air Force and joint Command a previous President's Budget are due	batial database sensor databases to r strategic and tactical gement system that can planning, and battle management, nd Control		
<ul> <li>(U) C. Other Program.</li> <li>(U) <u>Related Activities</u> <ul> <li>(U) <u>PE 0602702F</u></li> <li>(U) PE 0603789F</li> <li>(U) PE 0603728F</li> <li>(U) PE 0603728F</li> <li>(U) This project F</li> </ul> </li> <li>(U) D. <u>Acquisition Strate</u></li> <li>(U) E. <u>Schedule Profile</u>:</li> </ul>	<b>Sunding Summary:</b> C. Command, Control, and Communication C. C3 Advanced Development. C. Advanced Computing Technology. The seen coordinated through the Reliance <b>gy:</b> Not Applicable. Not Applicable.	ons (C3). re process to harmonize efforts and eliminate	duplication.			
Project 2810		Page 5 of 8 Pages	Exhibit R-2A (PE	0603726F)		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										DATE February 1999		
BUDGET ACTIVITY 3 - Advanced To	echnology Developm	ent		PE N <b>06</b>	UMBER AND 03726F	TITLE C3 Subsy	stem Inte	egration	• • • • • • • • • • • • • • • • • • • •		PROJECT 2863	
со	ST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost	
2863 Integrated Photor	nics	3,701	5,161	5,560	0	0	0	0	0	0	TBD	
Size constraints, speec will provide major imp survivable alternatives and nonlinear optical p (U) <u>FY 1998 (\$</u> - (U) \$3, - (U) \$1,14 - (U) \$2,2 - (U) \$2,2 - (U) \$3,74 (U) <u>FY 1999 (\$</u> - (U) \$1,4 - (U) \$1,4 - (U) \$1,4 - (U) \$2,1 - (U) \$2,1 - (U) \$5,1	<ul> <li>d, and reliability also limit trac provements in tactical and strast sto electronic-based systems.</li> <li>processing.</li> <li><u>in Thousands</u>):</li> <li>37 Developed and demon mission analysis, as v</li> <li>45 Developed and demon controlled radio frequing</li> <li>19 Developed and tested phased array antennast</li> <li>01 Total</li> <li><u>in Thousands</u>):</li> <li>05 Develop, demonstrate and post-mission analysis space).</li> <li>40 Develop and demonst reconfigurable RF systems</li> <li>65 Develop high perform performance, and anti- 51 Identified as a source</li> <li>61 Total</li> </ul>	ditional elect ategic Comr This projec nstrated anal vell as senso nstrated micr ency (RF) sy high perform s providing of e, and test an lysis, as well trate microw stems at incr nance optica i-jam capabi for SBIR.	log and digit ronic system nand, Contro t develops ar log and digit r integration rowave/milli ystems at inc mance optica extreme agilt halog and dig l as sensor in ave/millimet eased freque l control syst lity for satel	al optical com ad optical com ad automa meter-wave creased frequal control sys- ity, wide any gital hardene ategration ar cer-wave pho- ncies. tems for RF lite commun	omponents an atic target ide photonics cou uencies, band stems for RF gle coverage ed optical con nd automatic otonics comp (SHF) phase nications. St	and processing (C3) system and processing entification to components, p dwidth, and c (super high , broadband mponent pro target ident ponents, proceed array anter art developm	information s by enablin technology i g technology i using multisporocessing a dynamic ran frequency ( performance cessing tech ification usin teessing, and nnas providi- nent of a Tru	in the form a small-size in optical pro- tes to provide pectral surve nd subsystem ge. SHF) and ex e, and anti-ja unologies to p ng multispec subsystems ing extremel he Time Dela	of light (ph , high-perfo- pcessing, ada e real-time d sillance syste ns for advan tremely high am capability provide real- tral surveilla for advanced y wide angle ay processor	e (cov ) men otonic) sign rmance, hig aptive transr lata for pre- ems. ced, opticall n frequency 7. etime data fo ance system I, optically-o	als and h-capacity, nission, and post- y- (EHF)) or pre- s (air and controlled, proadband	
Project 2863				Page 6 of	f 8 Pages			Exhibi	<u>t R-2A (PE</u>	0603726F	)	
				357	7							

BUDGET ACTIVITY       PE NUMBER AND TITLE       PRO.         3 - Advanced Technology Development       0603726F       C3 Subsystem Integration       286         (U)       FY 2000 (\$ in Thousands):       - (U)       \$282       Develop, integrate, demonstrate, and test analog and digital optical micro-network processing technologies and components to provide time data for pre- and post-mission analysis, as well as sensor integration and automatic target identification using multispectral surveillance systems for air and space platforms.       - (U)       \$1,968       Develop and demonstrate microwave/millimeter-wave photonics processing and subsystems for advanced, optically-controlled, radio frequency (RF) systems at increased frequencies.         - (U)       \$700       Develop high performance control systems for RF Phased array antennas providing extremely wide angle coverage, broadband perform and anti-jam capability for Global Positioning System (GPS) applications. Continue to develop a photonics True Time Delay processo (In FY 2001, this effort will be conducted in Project 69CK, PE 0603203F.)       - (U)       \$2,610       Complete development and demonstration of three-dimensional optical information data handling, storage, and access technologies including erasable and read-only memories.       - (U)       \$5,560       Total	RDT		DATE February 1999		
3 - Advanced Technology Development       0603726F C3 Subsystem Integration       286         (U) FY 2000 (\$ in Thousands):       - (U) \$282       Develop, integrate, demonstrate, and test analog and digital optical micro-network processing technologies and components to provide time data for pre- and post-mission analysis, as well as sensor integration and automatic target identification using multispectral surveillance systems for air and space platforms.         - (U) \$1,968       Develop and demonstrate microwave/millimeter-wave photonics processing and subsystems for advanced, optically-controlled, radio frequency (RF) systems at increased frequencies.         - (U) \$700       Develop high performance control systems for RF phased array antennas providing extremely wide angle coverage, broadband perform and anti-jam capability for Global Positioning System (GPS) applications. Continue to develop a photonics True Time Delay processo (In FY 2001, this effort will be conducted in Project 69CK, PE 0603203F.)         - (U) \$2,610       Complete development and demonstration of three-dimensional optical information data handling, storage, and access technologies including erasable and read-only memories.         - (U) \$5,560       Total	BUDGET ACTIVITY		PE NUMBER AND TITLE		PROJECT
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>: <ul> <li>(U) \$282</li> <li>Develop, integrate, demonstrate, and test analog and digital optical micro-network processing technologies and components to provide time data for pre- and post-mission analysis, as well as sensor integration and automatic target identification using multispectral surveillance systems for air and space platforms.</li> <li>(U) \$1,968</li> <li>Develop and demonstrate microwave/millimeter-wave photonics processing and subsystems for advanced, optically-controlled, radio frequency (RF) systems at increased frequencies.</li> <li>(U) \$700</li> <li>Develop high performance control systems for RF phased array antennas providing extremely wide angle coverage, broadband perform and anti-jam capability for Global Positioning System (GPS) applications. Continue to develop a photonics True Time Delay processo (In FY 2001, this effort will be conducted in Project 69CK, PE 0603203F.)</li> <li>(U) \$2,610</li> <li>Complete development and demonstration of three-dimensional optical information data handling, storage, and access technologies including erasable and read-only memories.</li> <li>(U) \$5,560</li> </ul> </li> </ul>	3 - Advanced Tech	nnology Development	0603726F C3 Subsystem I	ntegration	2863
(U) <u>FY 2001</u> : Not Applicable.	(U) <u>FY 2000 (\$ in T</u> – (U) \$282 – (U) \$1,968 – (U) \$700 – (U) \$2,610 – (U) \$5,560 (U) <u>FY 2001</u> : Not <i>A</i>	<u>Chousands</u> : Develop, integrate, demonstrate, and test analog and time data for pre- and post-mission analysis, as well surveillance systems for air and space platforms. Develop and demonstrate microwave/millimeter-wa frequency (RF) systems at increased frequencies. Develop high performance control systems for RF p and anti-jam capability for Global Positioning Syste (In FY 2001, this effort will be conducted in Project Complete development and demonstration of three-tincluding erasable and read-only memories. Total Applicable.	l digital optical micro-network processi l as sensor integration and automatic ta ve photonics processing and subsystem hased array antennas providing extrem m (GPS) applications. Continue to de 69CK, PE 0603203F.) dimensional optical information data ha	ing technologies rget identification s for advanced, of ely wide angle c velop a photonic andling, storage,	and components to provide real- on using multispectral optically-controlled, radio overage, broadband performance, s True Time Delay processor. and access technologies
B. <u>Project Change Summary - Description of Significant Changes</u> : Changes to this program since the previous President's Budget are due to higher priorities we the Science and Technology (S&T) Program.	<b>B.</b> <u>Project Change Sum</u> the Science and Technolo	mary - Description of Significant Changes: Changes gy (S&T) Program.	to this program since the previous Pres	ident's Budget a	re due to higher priorities within
Project 2863 Page 7 of 8 Pages Exhibit R-2A (PE 0603726F)	Project 2863	Pag	ge / of 8 Pages	Exhibit	K-ZA (PE 0603726F)

RDT&E BUDGET ITEM JUSTIFICATIO	N SHEET (R-2A Exhibit)	DATE February 1999		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT		
3 - Advanced Technology Development	0603726F C3 Subsystem Integratio	n 2863		
<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) Related Activities: <ul> <li>(U) PE 0602702F, Command, Control, and Communications (C3).</li> <li>(U) PE 0603789F, C3 Advanced Development.</li> <li>(U) PE 0603203F, Advanced Computing Technology.</li> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) This project has been coordinated through the Reliance process to</li> </ul> </li> <li>(U) D. Acquisition Strategy: Not Applicable.</li> <li>(U) E. Schedule Profile: Not Applicable.</li> </ul>	harmonize efforts and eliminate duplication.			
Project 2863 Po	age 8 of 8 Pages Ext	ibit R-2A (PE 0603726F)		
	359			

PE TITLE: Advanced Computing Technology

	RDT&E BUDGET IT	DATE February 1999									
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603728F Advanced Computing Technology											
	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	7,520	7,748	4,507	5,932	6,782	8,349	8,522	8,701	Continuing	Continuinę
2527	Software Life Cycle Tools	2,218	2,267	340	789	981	2,412	2,462	2,513	Continuing	Continuinę
2530	Distributed Systems Reliability and Survivability	2,302	2,382	1,798	2,219	2,484	2,546	2,599	2,654	Continuing	Continuinç
2532	Knowledge-Based Systems	3,000	3,099	2,369	2,924	3,317	3,391	3,461	3,534	Continuing	Continuinę
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	(

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates technologies needed to control cost, reduce risk, and increase efficiency and effectiveness of software and computers required for Air Force mission critical combat systems. The Air Force has experienced a dramatic escalation in the cost of acquiring and maintaining embedded computer software for increasingly complex military systems which must be reliable and survivable in the battlefield environment. The requirement for survivable tactical and strategic computing systems has driven the need for automatic integration and interoperability of multiple processing elements, automatic redistribution of data and functions, and location-independent access to data. Distributed processing techniques, which can dynamically reconfigure Command, Control, Communications, and Computer (C4) systems to accommodate lost components or nodes, are required to ensure survivable mission critical command and control functions.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Page 1 of 8 Pages

Exhibit R-2 (PE 0603728F)

RDT&E BUDGET ITEM JUS	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)									
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE							
3 - Advanced Technology Development		0603728F	Advanced	Computing Te	echnology					
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :										
					Total					
	<u>FY 1998</u>	FY 1999	FY 2000	FY 2001	Cost					
(U) Previous President's Budget/FY 1999 PB	5,270	7,827	8,050	8,082	Cont					
(U) Appropriated Value	5,613	7,827								
(U) Adjustments to Appropriated Value										
a. Congressional/General Reductions	-214	-79								
b. SBIR	-129									
c. Omnibus/Other Above Threshold Reprogrammings	-36									
d. Below Threshold Reprogrammings	2,286									
e. Rescissions										
(U) Other Adjustments to Budget Years Since FY 1999 PB			-3,543	-2,150						
(U) Current Budget Submit/FY 2000 PB	7,520	7,748	4,507	5,932	Cont					

(U) Significant Program Changes: Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

FY 1999: \$216 identified as a source for SBIR.

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Exhibit R-2 (PE 0603728F)

BUDGET ACTIVITY         PENUMBER AUD ITTLE         PEOLECT           3 - Advanced Technology Development         0603728F Advanced Computing Technology         2527           cost (\$ in Thousands)         FY 1998         FY 1998         FY 2001         FY 2002         FY 2004         FY 2004         Cost (\$ in Thousands)         Total Cost           2527         Software Lile Cycle Tools         2.218         2.207         340         789         981         2.412         2.462         2.513         Continuing	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)										bruary 1	999
COST (\$ In Thousands)FY 1998 ActualFY 1999 EstimateFY 2001 EstimateFY 2003 EstimateFY 2004 EstimateFY 2004 EstimateContinuContinuity2527Software Life Cycle TosisA 2.2132.2673.047.999.812.4122.422.432.63Continuity(U)MateriaIdevelops software life cycle support environments which incorporate both laboratory and communercial off-the-shelf (COTS) products. This project proj	BUDGET ACTIVITY 3 - Advanced Techn	ology Developm	ent		PE N <b>06</b>	UMBER AND		I Compu	ting Tech	nnology	F	PROJECT 2527
2227 Software Life Cycle Tools         2,218         2,267         340         789         981         2,412         2,462         2,513         Continuing           (U) A. Mission Description:         Advanced computer systems in Air Force weapon systems require software life cycle tools and technology to reduce costs, improve quality, and enhance productivity. This project develops, evaluates, and transitions new software technology that reduces cost, while improving software, systems, and productivity. This project develops, evaluates, and transitions new software technology that reduces cost, while improving software, systems, and productivity. This project develops software life cycle support environments which incorporate both laboratory and commercial OfT-the-shelf (COTS) products. This project provides a vehicle for software echology integration, transition, and evaluation under operational and field conditions. Technologies for system requirements analysis, reuse of software components, software quality specification, measurement, assessment, and high performance (parallel) computer software engineering are also produced.           (U) FY 1998 (§ in Thousands):         - (U) \$1,406         Developed high performance, advanced parallel computer software and architecture for weapon and information system applications, including the Parallel Assessment Window System.         - (U) \$211         Designed the capability to integrate program code of dynamic and static languages within the same module, and designed dynamic language software development tools.           - (U) \$218         Total         Total         Demonstrate technology for the capture and exploitation of design information for building systems that readily and economically evolve. Decemonstra	COST (\$ Ir	n Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: Advanced computer systems in Air Force weapon systems require software life cycle tools and technology to reduce costs, improve quality, and enhance productivity. This project develops, evaluates, and transitions new software technology that reduces cost, while improving software, systems, and productivity factors. It develops software life cycle upport environments which incorporate both laboratory and commercial of the-sheft (COTS) products. This project provides a vehicle for software technology integration, transition, and evaluation under operational and field conditions. Technologies for system requirements analysis, reuse of software components, software quality specification, measurement, assessment, and high performance (parallel) computer software engineering are also produced.</li> <li>(U) <u>FY 1998 (5 in Thousands)</u>:         <ul> <li>(U) <u>S51</u></li> <li>Designed, developed, and tested technology for the capture and exploitation of design information for building systems that readily and economically evolve. Developed and tested technologies for packaging diverse software capabilities such as visualization, hyper-programming, and dynamic testing.</li> <li>(U) \$1,406</li> <li>Developed high performance, advanced parallel computer software and architecture for weapon and information system applications, including the Parallel Assessment Window System.</li> <li>(U) \$22.18</li> <li>Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>:         <ul> <li>(U) \$1,087</li> <li>Demonstrate technology for the capture and exploitation of design information for building systems that readily and economically evolve. Demonstrate technologies for packaging diverse software capabilities such as visualization, hyper-programming, dynamic testing, and object-oriented languages to reduce life cycle costs of software tapping systems that readily and economically e</li></ul></li></ul>	2527 Software Life Cycle Tools	3	2,218 2,267 340 789 981 2,412 2,462 2,513 Continuing Cor							Continuing		
	2527       Software Life Cycle Tools       2.218       2.267       340       789       991       2.412       2.462       2.513       Continuing       Continuing         (U) A. Mission Description:       Advanced computer systems in Air Force weapon systems require software life cycle tools and technology to reduce costs, improve quality, and enhance productivity. This project develops, evaluates, and transitions new software technology that reduces cost, while improving software, systems, and productivity factors. It develops software file cycle support environments which incorporate both laboratory and commercial off-the-sheft (COTS) products. This project provides a vehicle for software technology integration, transition, and evaluation under operational and field conditions. Technologies for system requirements analysis, reuse of software components, software quality specification, measurement, assessment, and high performance (parallel) computer software engineering are also produced.         (U) <u>FY 1998 (\$ in Thousands):</u> – (U) \$1.406       Deseloped, and tested technology for the capture and exploitation of design information for building systems that readily and conomically evolve. Developed and tested technologies for packaging diverse software capabilities such as visualization, hyperprogramming, and dynamic testing.       – (U) \$1.406       Develope high performance, advanced parallel computer software and architecture for weapon and information system applications, including the Parallel Assessment Window System.       – (U) \$2.218       Total         (U) <u>FY 1999 (\$ in Thousands):</u> – (U) \$1.087       Demonstrate technology for the capture and exploitation of design information for building systems that											
Project 2527 Page 3 of 8 Pages Exhibit R-2A (PE 0603728F)	Project 2527				Page 3 of	f 8 Pages			Exhibi	t R-2A (PE	0603728F)	)

RD	T&E BUDGET ITEM JUSTIFICAT	ION SHEET (R-2A E	xhibit)	DATE February 1999							
BUDGET ACTIVITY <b>3 - Advanced Tec</b>	hnology Development	PE NUMBER AND TITLE 0603728F Advan	ced Computing Tech	nology	PROJECT 2527						
(U) <u>FY 2000 (\$ in Thou</u>	sands):										
– (U) \$140	Continue to demonstrate technology for the captur	re and exploitation of design int	formation for building system	s that readily and e	conomically						
– (U) \$100	Continue to develop and demonstrate the ability to performance, reliability, security, fault tolerance, e	o mathematically represent archetec.) properties to enable autom	itectural, functional, and Qua atic design analysis and perfo	lity of Service (saf rmance evaluation	ety, of software						
- (U) \$100 Continue to demonstrate open-systems technology to reduce life cycle costs of Air Force software intensive systems.											
– (U) \$340 Total											
(U) FY 2001 (\$ in Thou	sands):										
- (U) \$481	Complete demonstration of technology for the cap economically evolve. Complete demonstration of programming dynamic testing, and object oriented	ture and exploitation of design technologies for packaging divided languages to reduce life cycle	information for building syste erse software capabilities such costs of Air Force software in	ems that readily and a svisualization, here a substantiation is a substantiation of the	nd nyper-						
<ul> <li>(U) \$200</li> <li>programming, dynamic testing, and object-oriented languages to reduce life cycle costs of Air Force software intensive systems.</li> <li>Complete development and demonstration of the ability to mathematically represent architectural, functional, and Quality of Service (safety, performance, reliability, security, fault tolerance, etc.) properties to enable automatic design analysis and performance evaluation of software systems.</li> </ul>											
- (U) \$108 - (U) \$789	Apply advanced evolution-based system/software Total	life cycle technologies and eval	uate effects on productivity, p	roduct quality, and	cost.						
(U) B. <u>Project Chang</u> within the Science and	e <b>Summary - Description of Significant Changes:</b> Fechnology (S&T) Program.	Changes to this program since	the previous President's Bud	get are due to high	er priorities						
(U) C. Other Program	n Funding Summary:										
<ul> <li>(U) <u>Related Activ</u></li> <li>(U) PE 060474</li> <li>(U) PE 070111</li> <li>(U) This proje</li> </ul>	ities: 10F, Computer Resource Management. 2F, Inventory Control Point Operation. ct has been coordinated through the Reliance process	s to harmonize efforts and elim	nate duplication.								
(U) D. Acquisition Str	ategy: Not Applicable.										
(U) E. <u>Schedule Profil</u>	e: Not Applicable.										
Project 2527		Page 4 of 8 Pages	Exhibit	<u>R-2A (PE 06037</u>	28F)						
		363									
BUDGET ACTIVITY         PE OUNSET         PE OUNSET         PE OUNSET         PE OUNSET           3 - Advanced Technology Development         COST (\$ In Thousands)         PY 1998         EY 1998         EY 1998         EY 1998         EY 1998         EY 2001         FY 2001         FY 2002         FY 2003         EY 2004         EX 2005         Cost to to to tack.         Total C         Ex 1014         Ex 1014         Ex 1014         Ex 1014         Ex 1014         Ex 1014         Ex 1014 </th <th>RDT&amp;E BUD</th> <th>GET ITEM JUS</th> <th>STIFICAT</th> <th>TION SH</th> <th>IEET (R</th> <th>-2A Exh</th> <th>ibit)</th> <th></th> <th>DATE Fe</th> <th>bruary 1</th> <th>999</th>	RDT&E BUD	GET ITEM JUS	STIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
---	---	--	--	--	---	--	---	---	--	---------------------	--
COST (§ In Thousands)FY 1998 ActualFY 1998 EstimateFY 2000 EstimateFY 2001 	BUDGET ACTIVITY 3 - Advanced Technology De	evelopment		PE N <b>06</b>	UMBER AND	TITLE Advanced	l Compu	ting Tech	nnology	F	PROJECT <b>2530</b>
Instructed Systems Reliability and Survivability       2.302       2.382       1.798       2.210       2.484       2.564       2.569       2.664       Continuing       Continuing         (U) A. Mission Description:       This project develops software technologies integrate numerous heterogeneous processing networks and provide secure, seamless access to information. Future C4 systems must be reconfigurable, operate in real-time, and be survivable, as well as capable of integrating the full spectrum of multimedia data. These systems will operate in an "information are" requests for information are survivable, as well as capable of integrating the full spectrum of multimedia data.         (1) FV 1998 (5 in Thousands):       - (U) \$1,533       Tested the design of mobile computing nodes in a heterogeneous distributed computing environment and demonstrated the utility of securit mechanisms.         - (U) \$327       Tested the design of techniques for managing multimedia data in distributed information systems.       - (U) \$327       Tested the design of techniques for managing multimedia data in distributed information systems.         - (U) \$327       Tested the design of techniques for managing multimedia data in distributed computing environments.       Demonstrate the ability or adapt to a survivability.         - (U) \$2,302       Total       - (U) \$2,302       Total         (U) FV1999 (6 in Thousands):       - (U) \$2,302       Total         - (U) \$2,302       Total         - (U) \$2,302       Total       - (U) \$2,302       Total	COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
<ul> <li>(U) A. <u>Mission Description</u>: This project develops software technology to provide distributed computer information handling for future Command, Control, Communications, and Computer (C4) systems. These technologies integrate numerous heterogeneous processing networks and provide secure, seamless access to information. Future C4 systems must be reconfigurable, operate in real-time, and be survivable, as well as capable of integrating the full spectrum of multimedia data. These systems will operate in an "information pull" mode where the user's requests for information are filled without explicit action on the part of the user to locate, retrieve, or merge data. An object-oriented architecture provides a common perspective which integrates the communications control system and the distributed computing environment.</li> <li>(U) <u>FY 1998 (§ in Thousands)</u>: <ul> <li>(U) <u>S15333</u> Tested the design of mobile computing nodes in a heterogeneous distributed computing environment and demonstrated the utility of securit mechanisms.</li> <li>(U) <u>S442</u> Tested the design of techniques for managing multimedia data in distributed information systems.</li> <li>(U) <u>S1537</u> Tested the dashive, reconfigurable distributed computing environments across heterogeneous networks to support crisis management and survivability.</li> <li>(U) <u>S142</u> Tosted adaptive, reconfigurable distributed computing environments. Demonstrate the ability to adapt to a limited bandwidth (low-speed) interconnection and to reconfigure the network in a distributed computing environment.</li> <li>(U) <u>S255</u> Demonstrate the utility of artificial intelligent agents for the retrieval of multimedia data across a wide area network.</li> <li>(U) <u>S255</u> Demonstrate adaptive, reconfigurable distributed computing environments across heterogeneous networks to support crisis management and survivability.</li> <li>(U) <u>S255</u> Demonstrate adaptive, reconfigurable distributed computing environments across heterogeneous networks to support crisis management an surv</li></ul></li></ul>	2530         Distributed Systems Reliability and Survivability         2,302         2,382         1,798         2,219         2,484         2,546         2,599         2,654         Continuing         Continuing										
Project 2530 Page 5 of 8 Pages Exhibit R-2A (PE 0603728F)	<ul> <li>(U) A. <u>Mission Description</u>: This pro-Communications, and Computer (C4) sy information. Future C4 systems must be These systems will operate in an "inform retrieve, or merge data. An object-orien environment.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>: <ul> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:</li> <li>(U) \$1,533 Tested the mechanisis</li> <li>(U) \$327 Tested the mechanisis</li> <li>(U) \$442 Tested ad survivabil</li> <li>(U) \$2,302 Total</li> </ul> </li> <li>(U) <u>FY 1999 (\$ in Thousands)</u>: <ul> <li>(U) \$1,179 Integrate in limited ba</li> <li>(U) \$525 Demonstrian (U) \$611 Demonstrian (U) \$67 Identified</li> <li>(U) \$2,382 Total</li> </ul> </li> </ul>	information warfare te andwidth (low-speed) i at the utility of artific at the utility of artific at the utility of artific at a source for SBIR.	chnologies integrate te in real-time re the users' r les a common puting nodes for managing distributed co	in a heterog multimedia mputing environment to multi-network agents for t	worked distr onfigure the hererieval ng environments a	ibuted comp ibuted comp ibuted comp ibuted inform cross hetero	uting enviro a distributed a data acros	nments. De computing a wide are us networks	e Command secure, seam l spectrum of he part of the stem and the lemonstrated oport crisis m monstrate th environment a network. to support cr	e ability to a	o a data. ate, computing of security and adapt to a ement and
	Project 2530			Page 5 of	f 8 Pages			Exhibi	<u>t R-2A (PE</u>	0603728F)	)

RDT	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT						
3 - Advanced Tech	nology Development	0603728F Advanced Computing Te	chnology 2530						
(U) <u>FY 2000 (\$ in TH</u> – (U) \$836 – (U) \$500 – (U) \$462 – (U) \$1,798 (U) <u>FY 2001 (\$ in Th</u> – (U) \$847	<u>nousands</u> ): Develop resource management techniques, quality-of- survivability, timeliness, and mobility for applications Develop technology that integrates offensive, defensiv order to provide dynamic functional and scaleable rec Develop multi-user collaborative interaction technolo Command and Control environments to integrate join Total	service metrics, and system-level modeling and simes by dynamically interacting with the global informative, and support forces into a cohesive model for plate onfiguration for mobile aerospace command centers gy for adaptive visualization and presentation within the force battle plan simulation, assessment, and implate sequality-of-service metrics, and system-level mode	ulation capability to provide tion grid. nning, execution, and assessment in n distributed air and space ementation.						
$\begin{array}{c} - & (U) & \$847 \\ - & (U) & \$700 \\ - & (U) & \$672 \\ - & (U) & \$2,219 \end{array}$	<ul> <li>(U) \$847 Continue to develop resource management techniques, quality-of-service metrics, and system-level modeling and simulation capability to provide survivability, timeliness, and mobility for applications by dynamically interacting with the global information grid.</li> <li>(U) \$700 Continue to develop technology that integrates offensive, defensive, and support forces into a cohesive model for planning, execution, and assessment in order to provide dynamic functional and scaleable reconfiguration for mobile aerospace command centers.</li> <li>(U) \$672 Apply interactive wall technology for multi-user access and continue to refine and implement visual force extractions for joint force battle plan simulation, assessment, and implementation</li> <li>(U) \$2,219 Total</li> </ul>								
(U)B. <u>Project Change Su</u> within the S&T Program.	mmary - Description of Significant Changes: Chang	ges to this program since the previous President's B	udget are due to higher priorities						
(U) C. <u>Other Program F</u> (U) <u>Related Activitie</u> – (U) PE 0604740I – (U) PE 0701112I – (U) This project	s: F, Computer Resource Management. F, Inventory Control Point Operation. has been coordinated through the Reliance process to h	armonize efforts and eliminate duplication.							
(U) D. <u>Acquisition Strate</u>	egy: Not Applicable.								
(U) E. <u>Schedule Profile</u> :	Not Applicable.								
Project 2530	Pag	e 6 of 8 Pages Exh	ibit R-2A (PE 0603728F)						
		365							

		DATE February 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603728F Advanced Cor	mputing Technology

RDT	&E BUDGET IT	EM JUS	TIFICAT	TION SH	IEET (R	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY 3 - Advanced Tech	nology Developm	ent		PE N <b>06</b>	UMBER AND		l Compu	ting Tech	PRO hnology 253		PROJECT
COST <i>(</i> \$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2532 Knowledge-Based Systems         3,000         3,099         2,369         2,924         3,317         3,391         3,461         3,534         Continuing         Continuing											
software tools and techniqu second, knowledge-based p operations planning and ex- knowledge-based software f (U) <u>FY 1998 (\$ in Th</u> – (U) \$441 – (U) \$1,898 – (U) \$661 – (U) \$661 – (U) \$3,000 (U) <u>FY 1999 (\$ in Th</u> – (U) \$492 – (U) \$1,750 – (U) \$781 – (U) \$7781 – (U) \$76 – (U) \$3,099	es to develop and evalua lanning, applies artificia ecution management, en techniques, exploits know <u>nousands</u> ): Tested systematic too and negotiation. Tested artificial intell generation in various Tested knowledge-ba requirements and rati Total <u>nousands</u> ): Develop dynamic dat Demonstrate artificia Demonstrate strategie Demonstrate knowled requirements and rati Identified as a source Total	te knowledg l intelligence aployment a wledge-based ols and evalu ligence plant military dor sed evolutio onale for sof a mining tec l intelligence es for efficie dge-based ev onale for sof for SBIR.	e-based inte e (AI) techno nd deployme d methods to ation method ning and sch mains. nary design ftware syster chniques and e planning at nt planning at rolutionary d ftware syster	lligent infor ology to pro ent planning o achieve ma dology for c eduling tool tools and de ns. collaboration nd schedulin scenario gen esign tools ans.	mation tools vide increase , logistics pl ajor improve: ollaborative ls for imprec eveloped capa ve decision-t ng tools for i neration in va and test capa	to support r ed cost-effec anning, reso ments in soft intelligent in ise environn abilities to m pased and kn mprecise en arious milita bilities to mo	obust, real-t tiveness in c urce allocati ware develo formation sy- nents. Teste onitor and e owledge-bas vironments a ry domains. onitor and e	ime, large-so liverse plann on, and sche pment and s ystems capab d strategies fo avaluate the s waluate the s	r large-scale agents for activition a	ion systems, ions such as esses. The th ities. nation, coop planning sce nd capture of information daptive repla nd capture of	. The air hird, eration, enario of systems. unning. f
Project 2532				Page 7 o	f 8 Pages			Exhibi	t R-2A (PE	0603728F)	

RDT&	E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999						
			PROJE	ECT					
3 - Advanced Techn	ology Development	0603728F Advanced Computing	Technology 2532	2					
(U) <u>FY 2000 (\$ in Th</u> – (U) \$829 – (U) \$1,153 – (U) \$387 – (U) \$2369	tousands): Test dynamic data mining techniques and collabor: Extend and evaluate knowledge-based technologie replanning, and integrate next-generation Commar (UCAV) environments. Extend knowledge-based evolutionary design tools requirements and rationale for software systems. Total	ative decision-based and knowledge-based agent s in continuous planning. Test planning and inf d and Control technology into aerospace and U and demonstrate capabilities to monitor and eva	s for large-scale information system ormation-based agents for adaptive nmanned Combat Aerial Vehicle luate the satisfaction and capture of	15. f					
(U) <u>FY 2001 (\$ in The</u> – (U) \$826 – (U) \$1,645 – (U) \$453 – (U) \$2924	<ul> <li><u>busands</u>):</li> <li>Evaluate dynamic data mining techniques and colla systems.</li> <li>Demonstrate knowledge-based technologies in cont adaptive replanning, and demonstrate next-generation</li> <li>Test knowledge-based evolutionary design tools and and rationale for software systems.</li> <li>Total</li> </ul>	borative decision-based and knowledge-based ag inuous planning. Integrate and evaluate plannin on Command and Control technology for aerosp I test capabilities to monitor and evaluate the sat	ents for large-scale information g and information-based agents for ace and UCAV environments. isfaction and capture of requirement	ts					
(U) B. <u>Project Change Su</u>	mmary - Description of Significant Changes: Not A	Applicable.							
(U) C. Other Program Fu	nding Summary:								
<ul> <li>(U) <u>Related Activities:</u></li> <li>(U) PE 0604740F, Computer Resource Management.</li> <li>(U) PE 0701112F, Inventory Control Point Operation.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>									
Project 2532	Pag	e 8 of 8 Pages	Exhibit R-2A (PE 0603728F)						
		368							

PE TITLE: C3 Advanced Development

RDT&E BUDGET IT	February 1999									
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603789F C3 Advanced Development										
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	12,288	13,179	17,402	14,985	16,300	15,541	15,865	16,195	Continuing	Continuing
2335 Advanced C3 Technology	4,710	4,021	4,093	2,557	5,087	5,198	5,306	5,416	Continuing	Continuing
4072 Correlation and Fusion	6,258	6,775	10,851	9,788	8,526	7,591	7,750	7,911	Continuing	Continuing
4216 Warfighter Information Usage, Management, and Integration Technologies	1,320	2,383	2,458	2,640	2,687	2,752	2,809	2,868	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: Beginning in FY 1998, PE 0603238F, Global Surveillance and Communications, has been incorporated as Project 4216, Warfighter Information Usage, Management, and Integration Technologies, within this PE.

(U) A. <u>Mission Description</u>: This Advanced Technology Development program develops and demonstrates ground and aerospace Command, Control, and Communications (C3) technology required to maintain Air Force capabilities in a fast-paced, sophisticated, high threat, and intense jamming environment. Enhanced surveillance and communications technology must be developed to counteract an enemy's jamming and to restore critical communications links to the warfighter. The technologies developed in this program include detection, identification, and tracking of hostile targets at long ranges on Command and Control (C2) and Intelligence platforms under combat conditions. Additionally, this project develops reliable, secure, jam-resistant communications and battle management technology that supports the military leader's combat decisions in response to the changing dynamics of the battlespace.

(U) B. <u>Budget Activity Justification</u>: This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new system developments that have military utility and address warfighter needs.

Page 1 of 10 Pages

Exhibit R-2 (PE 0603789F)

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RDT&E BUDGET ITEM JUS	DATE Februa	DATE February 1999				
BUDGET ACTIVITY		PE NUMBER AN	ID TITLE			•
3 - Advanced Technology Development		0603789F	C3 Advanc	ed Developn	nent	
(U) C. <u>Program Change Summary (\$ in Thousands)</u> :						
					Total	
	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	FY 2001	Cost	
(U) Previous President's Budget/FY 1999 PB	12,865	13,235	13,645	15,651	Cont	
(U) Appropriated Value	13,647	13,235				
(U) Adjustments to Appropriated Value						
a. Congressional/General Reductions	-483	-56				
b. SBIR	-301					
c. Omnibus/Other Above Threshold Reprogrammings	-87					
d. Below Threshold Reprogrammings	-488					
e. Rescissions						
(U) Other Adjustments to Budget Years Since FY 1999 PB			+3,757	-666		
(U) Current Budget Submit/FY 2000 PB	12,288	13,179	17,402	14,985	Cont	
(U) Significant Program Changes: Not Applicable.						
FY 1999: \$373 identified as a source for SBIR.						
	Pa	ge 2 of 10 Pages		E	Exhibit R-2 (PE 0603	789F)

	RDT	&E BUDGET ITE	EM JUS	TIFICAT	ION SI	HEET (R	-2A Exh	ibit)		DATE Fe	bruary 1	999
BUDGET ACTIVIT 3 - Advance	ed Tech	nology Developm	ent		PE 1 06	NUMBER AND	TITLE C3 Advan	ced Dev	elopmen	PROJECT <b>2335</b>		
	COST <i>(</i> \$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
2335 Advanced	C3 Technolo	ду	4,710	4,021	4,09	3 2,557	5,087	5,198	5,306	5,416	Continuing	Continuing
concepts of force amounts of C3 in modular, progra capabilities for s requirements of Planner (JDP) putheater air and n	e deployme nformation mmable, m survivable, joint comb er the Joint nissile defe	for real-time decision m ulti-level secure communication distributed Command an at theater communication Standards Air Operation nsive planning and moni	ployment. I aking. This nications; se d Control (( ns. Note: D ns Software toring.	Dynamic, hos project deve cure surviva C2) facilities During FY 19 Configuratio	stile battlef elops and in ble network Multiban 197, the De on Control I	ield environm ntegrates tech ks; advanced d/multimode fensive Plann Board. The b	nents demand nologies for displays and programmal ing and Exe poard designa	d near instar : low probab l interfaces; ble radios w cution (DPE ated DPE as	and battle m and battle m ill be enhance program w the joint-Se	asmission and cept/anti-jan anagement c ed to addres vas renamed rvices' softw	d processing in transmission lecision support the transmistic the transmistic the Joint De vare applicat	of vast on; port ission link fensive ion for
(U) <u>FY 19</u> - (U) - (U) - (U) - (U) - (U)	9 <u>98 (\$ in Th</u> \$2,070 \$1,630 \$610 \$400 \$4,710	nousands): Developed and demon microwave integrated Demonstrated advanc including network ma Demonstrated theater decision support and the Unmanned Combat A Total	nstrated criti circuits to p ed networki inagement c battle mana rapid respon cerial Vehicl	ical ground a provide survi ng technolog apability for agement and ase capabiliti le demonstra	and aerospa avable radic gies to prov survivable time-critica es, includin tion.	ce communic os and transce ide efficient, Asynchronou al air operation ng a limited b	eations techn vivers. secure, inter us Transfer M ons technolog rassboard ca	ology advan operable, an Mode (ATM gies to provi pability for	aces in progr ad deployable ). ide field com JDP.	ammable de e communica nmanders ess	vices and mo ations systen sential opera	onolithic ns, tional
(U) <u>FY 1</u> - (U) - (U) - (U) - (U) - (U)	999 (\$ in T \$1,749 \$1,428 \$730 \$114 \$4,021	housands): Develop and demonst transceivers for critica Demonstrate advance including dynamic, in Demonstrate theater b decision support and Identified as a source Total	rate prograr al ground an d networkin ategrated, se pattle manag rapid respon for SBIR.	nmable devi ad aerospace g technologi lf-healing ne gement and t ase capabiliti	ces and mo communic es to provid etworking. ime-critical es. Comple	nolithic micro ations. de efficient, s air operation ete the brassb	owave integr ecure, intero is technologi oard JDP ca	rated circuit perable, and ies to provid pability.	technology i deployable le field comr	in survivable communicat nanders esse	e radios and ions systems ential operati	s, onal
Project 2335					Page 3 o	f 10 Pages			Exhibi	<u>t R-2A (PE</u>	<u>0603789F)</u>	

RDT	<b>&amp; E BUDGET ITEM JUSTIFICATION</b>	RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								
BUDGET ACTIVITY		PE NUMBER AND TITLE	PROJECT							
3 - Advanced Tech	nology Development	0603789F C3 Advanced Development	2335							
(U) <u>FY 2000 (\$ in Th</u> – (U) \$1,475 – (U) \$2,018 – (U) \$600 – (U) \$4,093	ousands): Develop and demonstrate user-friendly radio commu demand for service. Demonstrate integrated and distributed networking a deployable information systems, including a Multi-le Demonstrate integrated theater battle management as contingency replanning capability to mobile Tactical Total	Inications capability that can automatically sense and a and information system technologies to provide efficier evel Secure Information System Manager. nd time-critical air operations technologies, including I Air Control Parties (TACP) and Special Operations F	dapt to its environment and at, secure, interoperable, and brassboard to extend displays and orces (SOF)							
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>:         <ul> <li>(U) \$1,054</li> <li>Continue to develop and demonstrate user-friendly radio communications capability that can automatically sense and adapt to its environment and demand for service.</li> <li>(U) \$503</li> <li>Continue to demonstrate integrated and distributed networking and information system technologies to provide efficient, secure, interoperable, and deployable information.</li> <li>(U) \$1,000</li> <li>Continue to demonstrate integrated theater battle management and time-critical air operations technologies, adding micro-miniature, large volume storage capability for large-scale geographic mapping applications.</li> <li>(U) \$2,557</li> <li>Total</li> </ul> </li> </ul>										
<ul> <li>(U) C. Other Program Funding Summary:</li> <li>(U) Related Activities:</li> <li>(U) PE 0603617F, C3 Applications.</li> <li>(U) PE 0603737D, Advanced Research Projects Agency.</li> <li>(U) PE 0603006A, C3 Technology.</li> <li>(U) PE 0602702F, Command, Control, and Communications (C3).</li> <li>(U) PE 0602232N, C3 Technology.</li> <li>(U) PE 0603726F, C3 Subsystem Integration.</li> <li>(U) PE 0603728F, Advanced Computing Technology.</li> <li>(U) PE 0603728F, Advanced Computing Technology.</li> <li>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</li> </ul>										
Project 2335	Page	e 4 of 10 Pages Exhibit	t R-2A (PE 0603789F)							
		371								

RDT&E BUDGET ITEM JUSTIF	DATE Fe	bruary 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanc	ed Development	PROJECT 2335
(U) D. <u>Acquisition Strategy</u> : Not Applicable.			
(U) E. <u>Schedule Profile</u> : Not Applicable.			
Project 2335	Page 5 of 10 Pages	Exhibit R-2A (PE	0603789F)

	RDT	&E BUDGET IT	EM JUS	TIFICAT	ION SH	IEET (R·	-2A Exh	ibit)		date <b>Fe</b>	bruary 1	999
BUDGET ACTIVIT 3 - Advance	ץ ed Tech	nology Developm	nent		PE N <b>06</b>	UMBER AND 03789F	TITLE C3 Advan	ced Dev	elopmen	t	F	PROJECT <b>4072</b>
	COST <i>(</i> \$	In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
4072 Correlation and Fusion 6,258 6,775 10,851 9,788 8,526 7,591 7,750 7,911 Continuing Continui												Continuing
<ul> <li>identify, and track hostile targets. This project develops and demonstrates sensor processing techniques, track and fusion algorithms, bistatic sensor technologies, and correlation techniques in order to enhance target detection and tracking ranges. This project develops and integrates the necessary suite of complementary passive and active hostile target identification technologies for command and control platforms. These technologies will enhance the performance of identification and threat assessment systems for improved acquisition, tracking, and target engagement ranges for theater operations.</li> <li>(U) <u>FY 1998 (\$ in Thousands)</u>:         <ul> <li>(U) \$<u>52,816</u></li> <li>Developed and demonstrated advanced sensor technologies and concepts for assured detection and tracking of hostile airborne targets using multiple off-board sensors.</li> <li>(U) \$940</li> <li>Developed and demonstrated advanced passive sensor technologies and concepts for increased survivability of fielded systems and assured detection and tracking of combat threats.</li> <li>(U) \$2,502</li> <li>Developed and demonstrated advanced sensor correlation technologies and concepts for assured detection and tracking of hostile ground</li> </ul> </li> </ul>												
– (U) (U) <u>FY 1</u>	\$6,258 999 (\$ in T	Total housands):										
- (U) - (U)	\$2,864 \$1,011	Develop and evaluate tracking, and identifi Continue to develop tracking combat thre	e acoustic and cation of hos a bistatic airt	alysis algori tile airborne oorne testbec	thms, radar targets usir l and refine	identification ng multiple o concepts tha	n technologie off-board sen t increase the	es, and intell sors. e survivabili	ligent techno ty of fielded	blogies for as	ssured detect	tion, cting and
- (U) - (U) - (U)	\$2,708 \$192 \$6,775	Continue design of re teraflop signal proces Identified as a source Total	eal-time airbo ssor technolo e for SBIR.	orne demons gy.	tration of al	ll-source adv	anced correl	ation capabi	lity for time	-critical targ	ets and deve	lop
Project 4072					Page 6 of	10 Pages			Exhibi	t R-2A (PE	0603789F)	

RDT	<b>&amp;E BUDGET ITEM JUSTIFICATION</b>	SHEET (R-2A Exhi	bit)	DATE February 1999
BUDGET ACTIVITY 3 - Advanced Tech	nology Development	PE NUMBER AND TITLE 0603789F C3 Advance	ced Development	PROJECT 4072
(U) <u>FY 2000 (\$ in T</u>	housands):			
– (U) \$2,930	Initiate an effort for over-the-horizon situation aware develop an integrated approach to positive target ide	eness through passive exploitati ntification utilizing advanced re	on of signals emanating esource management and	from weapon systems and d cueing techniques.
– (U) \$1,198	Evaluate and assess bistatic airborne testbed data and radar applications.	d continue development of integ	grated adaptive processing	ng for spaceborne and airborne
– (U) \$2,847	Demonstrate an all-source advanced capability for th teraflop signal processor technology.	e detection and tracking of time	e-critical targets and con	tinue development of affordable
– (U) \$3,876	Develop advanced fusion technology to evaluate the rich environment as part of an integrated C3 network	capability of Unmanned Comba k.	at Aerial Vehicle (UCA)	V) to operate in a C4ISR data-
– (U)\$10,851	Total			
(U) <u>FY 2001 (\$ in T</u>	nousands):			
– (U) \$2,427	Continue development of techniques to provide over weapon systems.	-the-horizon situation awarenes	s through passive explo	itation of signals emanating from
– (U) \$1,559	Complete analysis of bistatic airborne testbed data ar radar applications.	nd continue development of inte	egrated adaptive process	ing for spaceborne and airborne
– (U) \$2,946	Evaluate the all-source capability developed for the oprocessor technology.	detection and tracking of time-c	ritical targets and demo	nstrate affordable teraflop signal
– (U) \$2,856	Continue to develop advanced fusion technology to e an integrated C3 network.	evaluate the capability of UCAV	/ to operate in a C4ISR	data-rich environment as part of
– (U) \$9,788	Total			
Project 4072	Page	e 7 of 10 Pages	Exhibit	R-2A (PE 0603789F)
		374		

RDT&E BUDGET ITEM JUSTIFICATION	DATE February 1999	
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Developm	PROJECT <b>4072</b>
(U) .B. <u>Project Change Summary - Description of Significant Changes</u> : Not A	applicable.	
(U) C. Other Program Funding Summary:		
<ul> <li>(U) <u>Related Activities:</u> <ul> <li>(U) PE 0603203F, Advanced Aerospace Sensors.</li> <li>(U) PE 0602702F, Command, Control, and Communications (C3).</li> <li>(U) PE 060372F, Combat Identification Technology.</li> <li>(U) PE 0603728F, Advanced Computing Technology.</li> <li>(U) This project has been coordinated through the Reliance process to F</li> </ul> </li> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>	armonize efforts and eliminate duplication.	
Project 4072 Pag	e 8 of 10 Pages Exi	nibit R-2A (PE 0603789F)
	375	

F	RDT&E BUDGET ITE	EM JUS	TIFICAT	TION SH	IEET (R·	-2A Exh	ibit)		DATE Fe	bruary 19	999
BUDGET ACTIVITY <b>3 - Advanced</b>	Technology Developm	UMBER AND <sup>•</sup>	TITLE 3 Advan	ced Dev	elopmen	t	F	PROJECT			
с	OST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
4216 Warfighter Info Integration Tecl	rmation Usage, Management, and hnologies	1,320	2,383	2,458	2,640	2,687	2,752	2,809	2,868	Continuing	Continuing
(U) A. <u>Mission Description</u> : This project will develop and demonstrate the advanced technologies required to implement an interoperable, worldwide Information For The Warrior (IFTW) construct capable of supporting near-real-time multimedia (i.e., voice, data, video, and imagery) information exchange between ground and airborne platforms. The IFTW technology will provide "reachback" (i.e., updating information and mission changes to enroute aircraft and "in-transit visibility" of the aircraft and cargo status at Command and Control centers.) The IFTW capabilities will be enhanced through the incremental development, demonstration, and integration of advanced information management, network management, and communications transmission technologies. It will address interoperation across echelon, Service, and multi-national force boundaries, as well as provide support for mobile command and control, and sensor-to-shooter operations. This program directly responds to user deficiencies as expressed by the Joint Staff (Command, Control, Communications, Computers, and Intelligence for the Warrior), the Air Force (Theater Deployable Communications), Air Mobility Command (Air Mobility Master Plan and Airborne Situational Awareness), and the Defense Information Systems Agency (Far-Term Defense Information Systems Network).											
(U) <u>FY 1998 (</u>	(\$ in Thousands):	damonstrate	d and inter	motod IETW	advanced in	formation		tashnalasia	a fan data nat	miarral teamor	for and
-(U) \$ -(U) \$ -(U) \$	<ul> <li>5343 Designed, developed,</li> <li>presentation.</li> <li>5383 Designed, developed,</li> <li>global broadcast servi</li> <li>5394 Designed, developed,</li> </ul>	demonstrate ce and IFTV demonstrate	ed, and integ ed, and integ V. ed, and integ	grated advan grated advan	ced airborne	, high-speed module and	super-high bandwidth	frequency co managemen	ommunications and communications and communications and communications and communications are as a communication of the communications are as a communicat	ns technolog	gies for otocol
– (U) \$1,	technologies into the 3,320 Total	IFTW effort	. Conducted	l studies on	Asynchronou	us Transfer l	Mode (ATM	) technologi	es for the IF	TW environ	ment.
(U) <u>FY 1999 (</u>	(\$ in Thousands):										
– (U) \$	Design, develop, dem	onstrate, and	d integrate a	dvanced inf	ormation cor	nmunicatior	n mediation	management	t technologie	s for IFTW	joint task
– (U) \$	<ul> <li>(U) \$794 Design, develop, demonstrate, and integrate advanced airborne, super-high frequency communications and low-cost, phased array antenna technologies.</li> </ul>										
– (U) \$	\$796 Design, develop, demonstrate, and integrate advanced network and bandwidth management and technologies, including agents and routers, for IFTW in joint and international environments.										
-(U)	\$67 Identified as a source	for SBIR.									
- (0) \$2, Project 4216	,505 10141			Page 9 of	10 Pages			Exhibi	t R-2A (PE	0603789F)	

RDT&E BUDGET ITEM JUSTIFICATION	SHEET (R-2A Exhibit)	DATE February 1999
BUDGET ACTIVITY 3 - Advanced Technology Development	PE NUMBER AND TITLE 0603789F C3 Advanced Development	PROJECT <b>4216</b>
<ul> <li>(U) <u>FY 2000 (\$ in Thousands)</u>:         <ul> <li>(U) \$830</li> <li>Design, develop, integrate, and demonstrate advance global reach in a mobility environment.</li> <li>(U) \$865</li> <li>Design, develop, integrate, and demonstrate modular global reach in an airborne mobility environment.</li> <li>(U) \$763</li> <li>Design, develop, integrate, and demonstrate advance communications between air platforms and Comman environment.</li> </ul> </li> </ul>	d expert system decision algorithms and software to pri r, reprogrammable radio communications technologies d protocol network and commercial management techn d and Control centers at Scott Air Force Base for globa nd control for a global reach capability.	ioritize and control resources for for commercial and military ologies to validate al reach in a mobility
<ul> <li>(U) <u>FY 2001 (\$ in Thousands)</u>: <ul> <li>(U) <u>\$ FY 2001 (\$ in Thousands)</u>:</li> <li>(U) \$880 Design, develop, integrate, and demonstrate advance reach in a mobility environment.</li> <li>(U) \$909 Design, develop, integrate, and demonstrate advance mobility environment.</li> <li>(U) \$851 Design, develop, integrate, and demonstrate advance - (U) \$2,640 Total</li> </ul> </li> </ul>	ed intelligent agents and information structure managen ed reprogrammable radio communication and media con d global intranet technologies for global reach in a mot	nent technologies for global ntrol reach and awareness in a pility environment.
<ul> <li>(U) B. <u>Project Change Summary - Description of Significant Changes</u>: Not Aj</li> <li>(U) C. <u>Other Program Funding Summary</u>: Not Applicable.</li> <li>(U) <u>Related Activities</u>: <ul> <li>(U) PE 0602702F, Command, Control, and Communications (C3).</li> <li>(U) PE 0603726F, C3 Subsystem Integration.</li> <li>(U) This project has been coordinated through the Reliance process to h</li> </ul> </li> </ul>	armonize efforts and eliminate duplication.	
<ul> <li>(U) D. <u>Acquisition Strategy</u>: Not Applicable.</li> <li>(U) E. <u>Schedule Profile</u>: Not Applicable.</li> </ul>		
Project 4216 Page	10 of 10 Pages Exhibit	R-2A (PE 0603789F)

# 377

### **PE NUMBER: 0603876F**

UNCLASSIFIED

PE TITLE: Space Based Laser (SBL) (Space)

RDT&E BUDGET IT	DATE February 1999									
BUDGET ACTIVITY 3 - Advanced Technology Developm	PE 0	NUMBER AND	P	'ROJECT <b>1779</b>						
COST (\$ In Thousands)	FY 1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
4779 Space Based Laser	0*	34,884	63,8	40 63,779	63,674	63,565	64,244	64,938	Continuing	Continuing
Quantity of RDT&E Articles	0	0		0 0	0	0	0	0	0	0

\* No FY98 Air Force funding, program funded by BMDO (PE0603173C).

### (U) A. Mission Description

The Space Based Laser (SBL) program was created to provide the nation with a highly effective, continuous, global boost phase intercept option for both theater and national missile defense. An SBL system could defend against missiles without putting the lives of US military personnel at risk. The possible speed of light defense allows for boost phase intercept at the earliest possible moment, offering the highest probability that intercepted missile fragments (possibly containing active chemical/biological or nuclear materials) will fall within the attacker's territory, rather than defended territory. The SBL system could also provide many ancillary mission capabilities, including air defense, global surveillance, and target detection and designation.

The SBL program is structured to research the feasibility and operational contribution of performing boost phase missile defense from space. BMDO's directed energy program (PE0603173C, Project 1360) has been addressing several key critical technology issues, such as the Hydrogen Fluoride laser performance and modeling; optics experiments; laser and optics integration; and acquisition, tracking, pointing, and fire control (ATP/FC) tests. The Air Force began contributing to the SBL program in FY99. The combined AF/BMDO budget funds further technology development and risk reduction efforts leading to an Integrated Flight Experiment (IFX) that will provide opportunities for more complete ground and space flight testing. The IFX is a critical step in proving the feasibility of destroying ballistic missiles in their boost phase from space.

The Air Force program funding increase in FY2000 and beyond will aid the intense efforts planned for technology risk reduction, integrated system testing, and development of an IFX. The technology risk reduction activities include uncooled laser resonator optics, phase conjugation beam clean-up, and ATP demonstration. Potential ground experiments will demonstrate major risk area engineering design units (gain generator, resonator, beam control). Technology risk reduction and component demonstration prior to flight hardware development is an important part of the IFX program. The IFX will culminate in integration, performance of a series of on-orbit experiments, and demonstration of SBL boost phase intercept feasibility.

(U) <u>FY 1998 (\$ in Thousands):</u> Not Applicable

Project 4779
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Page 1 of 7 Pages

Exhibit R-2 (PE 0603876F)

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RDT&E BUDGE		DATE Februar	y 1999		
BUDGET ACTIVITY	I	PE NUMBER AND TITLE			PROJECT
3 - Advanced Technology Develo	ment	0603876F Space Based Laser	(SBL)	(Space)	4779
(U) FY 1999 (\$ in Thousands):					
– (U) \$4,418 Alpha LAMP Integr	ion (ALI) risk reduction efforts and	d system definition			
– (U) \$2,500 Concept Definition	udy Extension (LMA)				
– (U) \$2,971 Alpha Laser Optimi	tion (ALO) risk reduction efforts a	and system definition			
– (U) \$2,500 Concept Definition	udy Extension (TRW)				
– (U) \$6,389 Advanced Phase-con	ugation Experiment (APEX) risk re	eduction efforts			
– (U) \$1,500 Advanced Mirror Sy	em Development (NASA) and join	nt efforts			
– (U) \$3,550 Modeling, Simulation	(XR), and SBL lethality studies (A	AFRL)			
– (U) \$4,257 AFSPC support effo	s and AFRL technology investment	ıt			
– (U) \$4,020 FFRDC and SETA s	pport				
– (U) \$1,648 Program Support					
– (U) \$1,131 Identified as a sourc	for SBIR				
– (U) \$34,884 Total					
<ul> <li>(U) <u>FY 2000 (\$ in Thousands):</u></li> <li>(U) \$55,415 Integrated Flight Ex</li> <li>(U) \$1,500 Advanced Mirror Sy</li> <li>(U) \$3,257 AFSPC support effor</li> <li>(U) \$2,020 FFRDC and SETA states</li> <li>(U) \$1,648 Program Support</li> <li>(U) \$63,840 Total</li> </ul>	eriment (IFX) Contract em Development (NASA) and join s and AFRL technology investment pport	nt efforts tt			
<ul> <li>(U) <u>FY 2001 (\$ in Thousands):</u></li> <li>(U) \$56,624 Integrated Flight Ex</li> <li>(U) \$250 Advanced Mirror Sy</li> <li>(U) \$3,257 AFSPC support effor</li> <li>(U) \$2,000 FFRDC and SETA states</li> <li>(U) \$1,648 Program Support</li> <li>(U) \$63,779 Total</li> </ul>	eriment (IFX) Contract em Development (NASA) and join s and AFRL technology investment pport	nt efforts it			
Project 4779	Page	e 2 of 7 Pages	Exhib	oit R-2 (PE 060387	6F)

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RDT&E BUDGET ITEM JUSTI	DATE Feb	DATE February 1999				
BUDGET ACTIVITY		PE NUMBER AN	D TITLE			PROJECT
3 - Advanced Technology Development		0603876F	Space Based	Laser (SBL	) (Space)	4779
(U) B. <u>Budget Activity Justification:</u> This PE is in Budget Activity 3 (Advanced Technology Develo development.	opment) becaus	se it is performin	ng technology devel	lopment and risk	reduction activit	ies in support of IFX
(U) C. Program Change Summary (\$ in Thousands)						
<ul> <li>(U) Previous President's Budget (FY 1999 PB)</li> <li>(U) Appropriated Value</li> <li>(U) Adjustments to Appropriated Value <ul> <li>a. Cong Reductions</li> <li>b. SBIR</li> </ul> </li> </ul>	<u>FY 1998</u> 0	<u>FY 1999</u> 35,000 35,000 -116	<u>FY 2000</u> 35,002	<u>FY 2001</u> 34,994 C	Total <u>Cost</u> ontinuing	
<ul> <li>c. Omnibus or Other Above Threshold Reprogram</li> <li>d. Below Threshold Reprogramming</li> <li>(U) Adjustments to Budget Years Since FY 1999 PB</li> <li>(U) Current Budget Submit/FY 2000 PB</li> </ul>	0	34,884	28,838 63,840	28,785 63,779 C	ontinuing	n to add additional
funds to the program and increase the intense efforts for technology	risk reduction	, integrated syst	em testing, and dev	velopment of an I	FX.	n to add additional
FY99: \$1,131 identified as a source for SBIR						
Project 4779	Pag	e 3 of 7 Pages		Ext	iibit R-2 (PE 06	603876F)

RDT&E BUDGET IT	DATE February 1999									
BUDGET ACTIVITY       PE NUMBER AND TITLE         3 - Advanced Technology Development       0603876F Space Based Laser (SBL) (\$								(Space)	PR <b>4</b>	:OJECT <b>779</b>
(U) D. <u>Other Program Funding Summary (\$ in</u>	<u>Thousands)</u>		·							
(U) RDT&E, BMDO, R-29, Support Technologies-Adv Tech Dev	<u>FY 1998</u> 118,323	<u>FY 1999</u> 126,388	<u>FY 2000</u> 75,000	<u>FY 2001</u> 75,000	<u>FY 2002</u> 75,000	<u>FY 2003</u> 75,000	<u>FY 2004</u> 75,000	<u>FY 2005</u> 75,000	To <u>Compl</u> Cont	Total <u>Cost</u> Cont

(U) E. <u>Acquisition Strategy:</u> BMDO and the Air Force are jointly funding the SBL risk reduction activities. BMDO is the program lead, and the Air Force is the integrating executing agent for BMDO. The IFX contract award is planned to occur by 3QFY99. The IFX contract plans to bring together the three major contractors under a joint venture agreement to accomplish the IFX. The contract will be structured under a Total System Authority (TSA) arrangement allowing the contractor broad authority and responsibility for program success (planning, baselining, resource management, etc.).

Project 4779

Page 4 of 7 Pages

Exhibit R-2 (PE 0603876F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)										DATI	DATE February 1999						
BUDGET ACTIVITY 3 - Advanced Technology Develo	opment					PE NUN 0603	1867 A	ND TI <b>S</b> p	TLE Dace	Bas	ed	Lase	er (SBL)	(Spa	ace)	P 4	ROJECT
(U) F. <u>Schedule Profile</u> *																	
<ul> <li>(U) Concept Definition Studies Awarded</li> <li>(U) Integrated Flight Experiment (IFX)</li> <li>Contract Award</li> <li>(U) Component Development/Risk</li> <li>Reduction Efforts on laser and optics</li> <li>components (under IFX contract)</li> <li>(U) High Altitude Flight Test of</li> <li>Component Technology</li> <li>* Schedule profile reflects AF and BMDO fun</li> </ul>	1 $\frac{FY}{X}$	<u>1998</u> 3	4	1	<u>FY 1</u> <sup>2</sup>	999 3 X X	4	1 X	<u>FY 2</u> 2	2000 3	4	1	<u>FY 2001</u> 2 3	4			
Project 4779					Page	5 of 7	Pages						Exhi	bit R-2	2 (PE 060	3876F)	
						382											

R	RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)										
BUDGET ACTIVITY					PE NUM	IBER AND TITLE				F	PROJECT
3 - Advanced	d Technology	y Developm	ent		0603	876F Spa	ce Based L	.aser (SBL)	(Space)	) 4	4779
(U) A. <u>Project (</u>	Cost Breakdown	(\$ in Thousand	<u>s)</u>								
					<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>			
(U) Alpha LAMP	Integration (ALI)	risk reduction e	efforts		0	4,418					
(U) Concept Defin	ition Study Exten	nsion (LMA)			0	2,500					
(U) Alpha Laser C	Optimization (ALC	O) risk reduction	n efforts		0	2,971					
(U) Concept Defin	ition Study Exten	nsion (LMA)			0	2,500					
(U) Integrated Flig	ght Experiment (I	FX) Contract			0	0	55,415	56,624			
(U) Advanced Pha	se-conjugation E	xperiment (APE	X) risk		0	6,389	0	0			
reduction efforts		<b>-</b>									
(U) Advanced Mir	ror System Devel	lopment (AMSE	) and joint		0	1,500	1,500	250			
efforts	-	-									
(U) Modeling, Sin	nulation (XR), and	d Lethality (AFI	RL) studies		0	3,550	0	0			
(U) AFSPC support	rt efforts and AFF	RL technology in	nvestment		0	4,257	3,257	3,257			
(U) FFRDC and S	ETA support				0	4,020	2,020	2,000			
(U) Program Supp	ort				0	1,648	1,648	1,648			
(U) Identified as a	source for SBIR				0	1,131	0	0			
(U) Total					0	34,884	63,840	63,779			
(U) B. <u>Budget A</u>	Acquisition Histor	ry and Plannin	g Information	<u>n (\$ in Th</u>	ousands)						
Performing Orga	anizations:										
Contractor or	Contract										
Government	Method/Type	Award or	Performing	Project	Tota	1					
Performing	or Funding	Obligation	Activity	Office	Prior to	Budget	Budget	Budget	Budget	Budget to	Tota
Activity	Vehicle	Date	EAC	EAC	<u>FY 1998</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	Complete	Program
Identified as a sou	rce for SBIR						1,13	31			
Project 4779					Page 6 of 7	Pages		Exhi	bit R-3 (PE	0603876F)	
					383						

#### DATE **RDT&E PROGRAM ELEMENT/PROJECT COST BREAKDOWN (R-3)** February 1999 BUDGET ACTIVITY PE NUMBER AND TITLE PROJECT 4779 3 - Advanced Technology Development 0603876F Space Based Laser (SBL) (Space) Contract Contractor or Government Method/Type Award or Performing Project Total Obligation Activity Office or Funding Prior to Performing Budget Budget Budget Budget Budget to Total EAC FY 2001 Vehicle Date EAC FY 1998 FY 1998 FY 1999 FY 2000 Complete Program Activity Product Development Organizations Lockheed Martin C/CPFF 1089 0 0 4,418 0 0 0 4,418 0 0 0 0 Lockheed Martin FFP 2098 2,500 0 2,500 TRW C/CPFF 0 0 4092 0 2,971 0 0 2,971 TRW FFP 2098 0 0 2,500 0 0 0 2,500 C/CPFF TRW 40FY89 0 0 6,389 0 0 0 6,389 250 NASA (AFRL) MIPR 0 0 1,500 1,500 TBD TBD N/A TBD C/CPAF 3099 0 0 0 55,415 56,624 TBD TBD Support and Management Organizations Misc Misc 0 0 TBD TBD 13,475 6,925 6,905 Test and Evaluation Organizations N/A N/A (U) B. Budget Acquisition History and Planning Information Continued (\$ in Thousands) **Government Furnished Property:** None. Identified as a source for SBIR 1,131 0 0 20,278 TBD TBD Subtotal Product Development 56,915 56,874 Subtotal Support and Management 13,475 6,925 6,905 Subtotal Test and Evaluation **Total Project** 0 0 34.884 63.840 63.779 TBD TBD Exhibit R-3 (PE 0603876F) Project 4779 Page 7 of 7 Pages 384

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1 9 JAN 1999

# MEMORANDUM FOR SAF/FMBIM

FROM: HQ AFMC/CEP 4225 Logistics Avenue, Room A-127 Wright-Patterson AFB OH 45433-5745

SUBJECT: Update to the FY 2000-2001 RDT&E Construction Program Budget Estimate (BES) Submission

1. We reviewed our initial FY 2000-2001 BES, 8 Sep 98, and have no changes to our previous submittal.

2. In accordance with Air Force Instruction (AFI) 65-601, Volume 1, Chapter 13, we are resubmitting for your review, Air Staff coordination, and congressional notification the AFMC FY 2000-2001 RDT&E Construction Program and changes to the FY99 President's Budget Investment Call.

FV	Project #	Title	<u>PE</u>	<u>(\$000)</u>	<u>Remarks</u>
<u>1999</u>	FSPM981305	Airborne Laser Complex Upgrade	6.33.19F	6,845	Moved from FY98 New Start
1999		Minor Construction	6.58.07F	350	New Start

FY	Project #	Title	<u>PE</u>	(\$000)	<u>Remarks</u>
2000		Minor Construction	6.27.02F	636	
2000		Minor Construction	6.58.07F	525.5	

				(0000)	Danamlia
FY	Project #	Title	<u>PE</u>	<u>(\$000)</u>	<u>Kemarks</u>
	<u> </u>				
				250	
2001		Minor Construction	6.27.02F	350	
2001		Minor Construction	6 58 07F	820	
2001	1		0.50.071		

Each of the projects has been reviewed and we find that they meet the RDT&E funding criteria as outlined in AFI 65-601. The RDT&E (Appn 3600) Minor Construction (MC) requirements are listed by Program Element (PE) but are line item listed by base on the attached DD Form 1391s.

2. Our point of contact for this effort is Mr. Art Rosenfelder, HQ AFMC/CEPD, DSN 787-7610.

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THOMAS M. GRIFFITH, colonel, USAF Chief, Programs and Operations Division Directorate of the Command Civil Engineer

Attachments:

1. DD Form 1391, FSPM981305

2. DD Forms 1391, Misc Minor Construction

cc:

HQ USAF/ILEC HQ AFMC/FMA/DRS/DOR HQ AFRL/DS

AIR FORCE       (COMPUTER generated)         3. INSTALLATION AND LOCATION       4. PROJECT TITLE         EDWARDS AIR FORCE BASE, CALIFORNIA       AIRBORNE LASER COMPLEX UPG         5. PROGRAM ELEMENT       6. CATEGORY CODE       7. PROJECT NUMBER       8. PROJECT COS         6.33.19F       311-114       FSPM981305       6.845.0         9. COST ESTIMATES       9. COST ESTIMATES       (1         AIRBORNE LASER COMPLEX UPGRADE       (2)       (1)         CONSTRUCT PAD FRESSURE RECOVERY SYSTEM       LS       (1)         UPGRADE SYSTEM INTEGRATION LAB       LS       (2)         CONSTRUCT FUEL FARM       LS       (2)         CONTRUCT SUPPORT AREA       LS       (2)         CONTRUCT NEUTRALIZATION SUBSYSTEMS       LS       (2)         SUBFORIA, CONTRACT COST       SUPEWISION, INSPECTION AND OVERHEAD (6%)       6         TOTAL CONTRACT COST       5       5         SUPERVISION, INSPECTION AND OVERHEAD (6%)       6       6         TOTAL FUNDED COST       5       6       6         10. Description of Proposed Construction:       Modify existing Birk Flight Test Facility (BTF) (Building and associated areas) and install necessary Facovery system, upgrade Bidg 151 for installion of a system integratileboratory, other Bidg. 151 mods, construct a laser fuel fam, and a neutralization subsystem. All	1. COMPONENT	FY 1999 RDT&E F	ACILITY	PROJEC	T DAT	A	2	. DATE
3. INSTALLATION AND LOCATION EDWARDS AIR FORCE BASE, CALIFORNIA AIRBORNE LASER COMPLEX UPG 6.33.19F 311-114 FSPM981305 6.33.19F 311-114 FSPM981305 6.33.19F 311-114 FSPM981305 6.33.19F 311-114 FSPM981305 6.33.19F 311-114 FSPM981305 6.345.0 9. COST ESTIMATES 0.0000 1.0000 SUBTOR SUPPORTING SUPPORT AREA US UPGRADE SYSTEM INTEGRATION LAB SUPPORTING FACILITIES CONSTRUCT FUEL FARM CONSTRUCT FUEL FARM CONSTRUCT NUTRERATION SUBSYSTEMS SUBTORAL CONSTRUCT OST SUBTORAL CONSTRUCT OST SUBTORAL CONSTRUCT OST SUBTORAL CONSTRUCT OST SUBTORAL 10. Description of Proposed Construction: Modify existing Birk Flig TotAL CONTACT COST SUPERVISION, INSPECTION AND OVERHEAD (6%) TOTAL FUNDED COST 10. Description of Proposed Construction concrete pad for press recovery system, upgrade Bldg 151 for installion of a system integratu Indefinition Sinclude construct a laser fuel farm, and a neutralization subsystem. All work required for a complete facility 11. REQUIREMENT: As required. PROJECT: Modify existing Birk Flight Test Facility (BTFF) (Building and associated areas) and install necessary RED equipment to support IN SEQUIREMENT: As required. PROJECT: Modify existing Birk Flight Test Facility (BTFF) (Building and associated areas) and install necessary RED equipment to support Exported areas) and install necessary RED equipment to support IN ERCONTENDER ARE program is designed to exploit powerful technologies which have evolved over the past 20 years and integrates into a revolutionary airborne weapon system which is lethal to boost: enemy Theater Ballistic Missiles (TBMS) at extremely long ranges. T Hauchers. Test facilities must be capable of supporting dest providing missile trajectory information to the heater point defense and identifying TBM Launch points for counter force strikes against i launchers. Test facilities must be capable of supporting a test providing missile trajectory information to the heater point defense and identifying TBM Launch points for counter forc	AIR FORCE	(compute	er gener	ated)				
EDWARDS AIR FORCE BASE, CALIFORNIA       AIRBORNE LASER COMPLEX UPG         5. PROGRAM ELEMENT       6. CATEGORY CODE       7. PROJECT NUMBER       8. PROJECT COS         6.33.19F       311-114       FSPM981305       6.845.0         9. COST ESTIMATES       9. COST ESTIMATES       UNIT         ITEM       U/M QUANTITY       COST       (1         AIRBORNE LASER COMPLEX UPGRADE       0.0000       (1)       0.0000         CONSTRUCT FAD PRESSURE RECOVERY SYSTEM       LS       (1)         UPGRADE SYSTEM INTEGRATION LAB       LS       (2)         CONSTRUCT FUL FARM       LS       (2)         CONSTRUCT NEUTRALIZATION SUBSYSTEMS       LS       (2)         SUBFORTAL       CONTINGENCY (10%)       5         TOTAL CONTRACT COST       5       5         SUPERVISION, INSPECTION AND OVERHEAD (6%)       6         TOTAL CONTRACT COST       6       6         10. Description of Proposed Construction: Modify existing Birk Flig       7         Test Facility (Bldg 151 and associated areas) and install necessary F       6         recovery system, Upgrade Bldg 151 for installion of a system integrate       1         Recorderive System, Upgrade Bldg 151 for installion of a system integrate       1         Recorderive System, Marcone Laser fuel farm,	3. INSTALLATION	AND LOCATION		4. PRO	JECT	FITLE		
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FY 1999 RDTAE FACILITY PROJECT DATA (computer generated)           3. INSTALATION AND LOCATION           EDMARDS AIR FORCE BASE, CALIFORNIA           4. PROJECT TITLE           AIRBORNE LASER COMPLEX UPGRADE           however, are needed to support the weapon element of the FDRR ABL. No pad exists to mount a pressure recovery system designed to simulate FDRR ABL operating altitudes. Other Building 151 facility modifications are required to accommodate the uniqueness of testing and operating a high needed to support laboratory equipment in the system integration laboratory. Not having a laser fuel farm and install equipment. A neutralization pond does not exist and may be required to handle expended themicals from laser operations.           IMPACT IF NOT PROVIDED:         Significant costs and schedule delays will be incurred if the government cannot provide the facilities are not sufficient to support the PDRR ABL. The program is currently on track to demonstrate labolatory against boosting Theater Ballistic Missiles in the year 2003.           ADDITIONAL:         10 USC 2353 authorizes the use of RDT2 funds to construct facilities necessary for the performance of a contract. This construction project supports the PDRR ABL Integration contractor. There is no criteria to accept for this project in Part II of Military Handbook 1190, "Facility Planning and Design Guide" and in APH 32-1084, "Facility Requirements."	1 COMDONIENTO		2. DATE
AIR PORCE       (computer generated)         1. INSTALLATION AND LOCATION         EDWADDS AIR FORCE BASE, CALIFORNIA         4. PROJECT TITLE         AIRBORNE LASER COMPLEX UPGRADE         however, are needed to support the weapon element of the PDRR ABL         operating altitudes. Other Building ISI facility modifications are         required to accommodate the uniqueness of testing and operating a high         needy laser system. As an example, minor power and RVAC upgrades may be         Incident to accommodate the uniqueness of testing and install aquipment. A         areas will be prepared to construct a fue farm and install aquipment. A         areas will be government cannot provide the farilities are not sufficient         to support the PDRR ABL. The program is currently on track to demostrate         lethality against boosting Theater Ballistic Missiles in the year 2003.         ADDITIONAL: 10 USC 2353 authorizes the use of a contract. This construct facilities necessary for the performance of a contract. This construct facilities necessary for the performance of a contract. This construct facility Planning and Design Guide" and in APH 32-1084, "Facility Requirements."         "Facility Planning and Design Guide" and in APH 32-1084, "Facility	1 COMPONENT	FY 1999 RDT&E FACILITY PROJECT DATA	
INSTALLATION AND LOCATION      DUMARDS AIR FORCE BASE. CALIFORNIA     FROJECT TITLE     INFOLICT     INFOLICT TITLE     INFOLICT     INFORTORY     INFOLICT     INFOLICT	AIR FORCE	(computer generated)	
EDWARDS AIR FORCE BASE. CALIFORNIA A. PROJECT TITLE AIRBORNE LASER COMPLEX UPGRADE bowver, are needed to support the weapon element of the FDRR ABL. No pad exists to mount a pressure recovery system designed to simulate FDRR ABL operating altitudes. Other Building 151 facility modifications are required to accommodate the uniqueness of tasting and operating a high energy later system. As an example, minor power and HVAC upgrades may be needed to support laboratory equipment in the system integration laboratory. Not having a laser fuel farm or a neutralization subsystem, areas will be prepared to construct a fuel farm and install equipment. A neutralization pond does not exist and may be required to handle expended chemicals from laser operations. IMPACT 1F NOT PROVIDED: Significant costs and schedule delays will be integration contractor. Existing contractor facilities are not sufficient to support the pORR ABL. The program is currently on track to demonstrate lathality against boosting thereformance of a contract. There is no project supports the PDRR ABL integration contractor. There is no criteria to scope for this project in PAT II of Military Handbook 1190, "Facility Blanning and Design Guide" and in AFH 32-1084, "Facility Requirements."	3. INSTALLAT	TION AND LOCATION	
IDMERDS AIR PORCE BASE, CALIFORNIA       5. FROJECT NUMBER         4. PROJECT TITLE       5. FROJECT NUMBER         AIRBORNE LASER COMPLEX UPGRADE       FGEM981305         however, are needed to support the weapon element of the FDRR ABL. No pad exists to mount a pressure recovery system designed to simulate FDRR ABL operating altitudes. Other Building 151 facility modifications are required to accommodate the uniqueness of tasting and operating a high energy lacer system. As an example, minor power and HVAC upgrades may be needed to support laboratory equipment in the system integration laboratory. Not having a laser fuel farm or a neutralization subsystem, areas will be prepared to construct a fuel farm and install equipment. A neutralization pond does not exist and may be required to handle expended themicals from laser operations.         IMPACT IF NOT PROVIDED: Significant costs and schedule delays will be incurred if the government cannot provide the facilities are not sufficient to support the PDR ABL. The program is currently on track to demonstrate lethality against boosting Theater Ballistic Missiles in the year 2003.         ADDITIONAL: 10 USC 2353 authorizes the use of RDTB funds to construct facilities necessary for the performance of a contract. This construction project supports the PDRR ABL integration contractor. There is no criteria to scope for this project in PATIE funds to construct facility Planning and Design Guide" and in AFH 32-1084, "Pacility Requirements."	1		
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INTROCENT LASER CONFIGENCE Construction of the PDR ABL No padexists to mount a pressure recovery system designed to similate PDR ABL operating altitudes. Other Building 151 facility modifications are required to accommodate the uniqueness of testing and operating a high energy laser system. As an example, minor power and HVAC upgrades may be needed to support laboratory equipment in the system integration laboratory equipment in the system integration subsystem, areas will be prepared to construct a fuel farm and install equipment. A neutralization pond does not exist and may be required to handle expended to chandle expended integration contractor. Existing contractor facilities are not sufficient to support the PDR ABL. The program is currently on track to demonstrate lathity against boosting fractor Ballistic Missiles in the year 2003. ADDITIONAL: 10 USC 2353 authorizes the use of RDT&E funds to construct facilities are construct facilities apports the PDRR ABL integration contractor. This construct facilities to support the PDRR ABL integration contractor. There is no criteris to scope for this project in Part II of Military Handbook 1190. "Facility Planning and Design Guide" and in AFH 32-1084, "Facility Requirements."			FSPM981305
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	AIREORNE LAS	HER COMPLEX UPGRADE a needed to support the weapon element of the H bunt a pressure recovery system designed to sin clitudes. Other Building 151 facility modifice accommodate the uniqueness of tasting and oper system. As an example, minor power and HVAC upport laboratory equipment in the system integ Not having a laser fuel farm or a neutralization propared to construct a fuel farm and instation form laser operations. <u>OF PROVIDED</u> : Significant costs and schedule do the government cannot provide the facilities and the government cannot provide the facilities and the PDRR ABL. The program is currently on tra- gainst boosting Theater Ballistic Missiles in 10 USC 2353 authorizes the use of RDT&E fund necessary for the performance of a contract. Dorts the PDRR ABL integration contractor. Th scope for this project in Part II of Military lanning and Design Guide" and in AFH 32-1084, s."	FSPM981305 PDRR ABL. No pad mulate PDRR ABL ations are rating a high upgrades may be gration tion subsystem, 11 equipment. A handle expended elays will be required by the re not sufficient the year 2003. s to construct This construction ere is no Handbook 1190, "Facility"

3. INSTALLATION AND LOCATION       4. PROJECT TITLE         EDWARDS AIR FORCE BASE, CALIFORNIA       Minor Construction < \$500,00         3. PROGRAM ELEMENT       6. CATEGORY CODE       7. PROJECT NUMBER       8. PROJECT COST (\$000)         65807F       116-665       FSPM982523       350.0         9. COST ESTIMATES       UM       QUANTITY       UNIT       0         Minor Construction using RDT&E funds for FY1999:       LS       Interview       Interview       Interview         Construct Joint Strike Force Harrier Pit       LS       Interview       Interview	AIR FORCE	F	Y 1999 MILITARY CC (comp	NSTRUC	TION PRO ated)	OJECT	DAT	A 2. [	DATE
EDWARDS AIR FORCE BASE, CALIFORNIA       Minor Construction < \$500,00	3. INSTALLATION A	ND LOCA	TION		4. PROJEC	T TITLE		K	
3. PROGRAM ELEMENT       6. CATEGORY CODE       7. PROJECT NUMBER       8. PROJECT COST (5000)         65807F       116-665       FSPM982523       350.0         9. COST ESTIMATES       350.0       350.0         ITEM       U/M       QUANTITY       UNIT         Minor Construction using RDT&E funds for FY1999:       U/M       QUANTITY       COST         Construct Joint Strike Force Harrier Pit       LS       I       I         10. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit         11. REQUIREMENT: As required.         PROJECT: Construct Joint Strike Force Harrier Pit         REQUIREMENT: A required.         PROJECT: Construct Joint Strike Force Harrier Pit         REQUIREMENT: A Harrier type pit is required to allow testing of the vertical take off capabil new Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.         CURRENT SITUATION: There is no facility available to support this test requirement.         IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succestesting of this state-of-the-art aircraft.	EDWARDS AIR I	FORCE	BASE, CALIFORNIA		1	Minor (	Constr	uction < \$	500,000
65807F       116-665       FSPM982523       350.0         9. COST ESTIMATES         UM QUANTITY COST         Minor Construction using RDT&E funds for FY1999:         Construct Joint Strike Force Harrier Pit       LS         ID. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit         10. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit         11. REQUIREMENT: As required.         PROJECT: Construct Joint Strike Force Harrier Pit         REQUIREMENT: A farrier type pit is required to allow testing of the vertical take off capabil new Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.         CURRENT SITUATION: There is no facility available to support this test requirement.         IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.	5. PROGRAM ELEME	ENT	6. CATEGORY CODE	7. PROJE	ECT NUMBE	R	8. PR(	DIECT COST	Г <b>(\$</b> 000)
9. COST ESTIMATES         UNIT       UNIT         Minor Construction using RDT&E funds for FY1999:       Construct Joint Strike Force Harrier Pit         LS       LS       LS       Image: Cost of the strike Force Harrier Pit       Image: Cost of the strike Force Harrier Pit       Image: Cost of the strike Force Harrier Pit         10. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit         11. REQUIREMENT: As required.         PROJECT: Construct Joint Strike Force Harrier Pit         REQUIREMENT: A Harrier type pit is required to allow testing of the vertical take off capabilinew Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.         CURRENT SITUATION: There is no facility available to support this test requirement.         IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.	65807F		116-665	F	SPM98252	:3		35	50.0
ITEM       UM       QUANTITY       COST       O         Minor Construction using RDT&E funds for FY1999:       LS       LS       Image: Construct Joint Strike Force Harrier Pit       LS       Image: Construct Joint Strike Force Harrier Pit       Image: Construct Joint Strike Force Harrier Pit       Image: Construct Joint Strike Force Harrier Pit         10. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit       Image: Construct Joint Strike Force Harrier Pit         11. REQUIREMENT: As required.       PROJECT: Construct Joint Strike Force Harrier Pit         REQUIREMENT: A Harrier type pit is required to allow testing of the vertical take off capabilinew Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.         CURRENT SITUATION: There is no facility available to support this test requirement.         IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succestesting of this state-of-the-art aircraft.			9. C	OST ESTIM	ATES			UNIT	T C
Minor Construction using RDT&E funds for FY1999:         Construct Joint Strike Force Harrier Pit         LS         10. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit         11. REQUIREMENT: As required.         PROJECT: Construct Joint Strike Force Harrier Pit         REQUIREMENT: A Harrier type pit is required to allow testing of the vertical take off capabil new Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.         CURRENT SITUATION: There is no facility available to support this test requirement.         IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.			ITEM		U/M	QUAN	TITY	COST	(
Construct Joint Strike Force Harrier Pit LS	Minor Construction	n using I	RDT&E funds for FY19	99:					
10. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit         11. REQUIREMENT: As required.         PROJECT: Construct Joint Strike Force Harrier Pit         REQUIREMENT: A Harrier type pit is required to allow testing of the vertical take off capabil new Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.         CURRENT SITUATION: There is no facility available to support this test requirement.         IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.	Construct Joint Str	ike Forc	e Harrier Pit		LS				
<ul> <li>10. DESCRIPTION OF PROPOSED WORK: Construct in-ground concrete test pit</li> <li>11. REQUIREMENT: As required.</li> <li>PROJECT: Construct Joint Strike Force Harrier Pit</li> <li>REQUIREMENT: A Harrier type pit is required to allow testing of the vertical take off capabil new Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.</li> <li>CURRENT SITUATION: There is no facility available to support this test requirement.</li> <li>IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.</li> </ul>									
<ul> <li>PROJECT: Construct Joint Strike Force Harrier Pit</li> <li>REQUIREMENT: A Harrier type pit is required to allow testing of the vertical take off capabilities new Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation.</li> <li>CURRENT SITUATION: There is no facility available to support this test requirement.</li> <li>IMPACT IF NOT PROVIDED: Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.</li> </ul>									
<b>REQUIREMENT:</b> A Harrier type pit is required to allow testing of the vertical take off capabilinew Joint Strike Fighter (JSF) aircraft while providing noise and blast attenuation. <b>CURRENT SITUATION:</b> There is no facility available to support this test requirement. <b>IMPACT IF NOT PROVIDED:</b> Lack of this mission critical capability will impede the succestesting of this state-of-the-art aircraft.	10. DESCRIP	TION C	OF PROPOSED WO	RK: Con	struct in-s	ground	t con	crete test	t pit
<b>CURRENT SITUATION:</b> There is no facility available to support this test requirement. <b>IMPACT IF NOT PROVIDED:</b> Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.	10. DESCRIP <sup>-</sup> 11. REQUIREM PROJECT: Cons	TION C ENT: 4	<b>OF PROPOSED WO</b> As required. nt Strike Force Harrier F	<b>RK:</b> Cons	struct in-s	ground	d con	crete test	t pit
<b>IMPACT IF NOT PROVIDED:</b> Lack of this mission critical capability will impede the succest testing of this state-of-the-art aircraft.	10. DESCRIP <sup>-</sup> 11. REQUIREM <u>PROJECT:</u> Cons <u>REQUIREMEN</u> new Joint Strike F	TION C ENT: A struct Joi <u>Fighter (</u>	OF PROPOSED WO As required. nt Strike Force Harrier F rrier type pit is require (JSF) aircraft while pr	Pit ed to allov	struct in-s	f the velast atte	ertical	crete test	t pit
	10. DESCRIP <sup>-</sup> 11. REQUIREM <u>PROJECT:</u> Cons <u>REQUIREMENT</u> new Joint Strike F	TION C ENT: A struct Joi Fighter ( JATION	<b>OF PROPOSED WO</b> As required. nt Strike Force Harrier F rrier type pit is require (JSF) aircraft while pr <b><u>N</u>:</b> There is no facility	RK: Cons Pit ed to allow oviding no available	struct in-g	f the velast atte	ertical enuati	crete test	t pit
	10. DESCRIP 11. REQUIREM PROJECT: Cons REQUIREMENT new Joint Strike F CURRENT SITU IMPACT IF NOT testing of this stat	TION C ENT: A struct Joi Fighter ( JATION te-of-the	<b>OF PROPOSED WO</b> As required. Int Strike Force Harrier F (JSF) aircraft while pro <b><u>V</u>:</b> There is no facility <u><b>VIDED:</b></u> Lack of this pro- e-art aircraft.	RK: Cons Pit ed to allow oviding no available mission cr	struct in-s	f the volume ability	ertical enuati est req will ir	take off on. uirement.	t pit
	10. DESCRIP 11. REQUIREM PROJECT: Cons REQUIREMENT new Joint Strike F CURRENT SITU IMPACT IF NOT testing of this stat	TION C ENT: A struct Joi Fighter ( JATION T PROY te-of-the	<b>OF PROPOSED WO</b> As required. Int Strike Force Harrier F (JSF) aircraft while pro <b>V</b> : There is no facility <b>VIDED:</b> Lack of this pro- e-art aircraft.	RK: Cons Pit ed to allow oviding no available mission cr	struct in-s	f the volume f the volume f this tend	ertical enuati est req will ir	take off on. uirement.	t pit

Atch 2

AIR FORCE	FY	2000 MILITARY CO (compu	NSTRUC ter gener:	TION PR ated)	OJEC1	2. DATE			
3. INSTALLATION A	ND LOCAT	FION		4. PROJEC	T TITLE				
ROME LAB. NEV	V YORK			N N	linor C	Constru	ction < \$1	1,000,0	
5. PROGRAM ELEME	NT	6. CATEGORY CODE	7. PROJE	CT NUMBE	R	8. PR(	DJECT COST	Г ( <b>S</b> 000)	
62702F		610-281	UL	.DF930021	22		63	6.0	
		9. CC	ST ESTIM	ATES					
		ITEM		U/M	QUAN	TITY	COST		
Minor Constructio	on using I	DT&E funds for FY200	00:		1				
Upgrade Resea	rch Engi	neering Area, Bldg 106		LS					
			K• This i	s a quality	of life	impro	vement fo	or the S	
<b>10. DESCRIPT</b> Directorate offices partitions with a no distribution, lightin	ION OF in Build onasbes g, suspe	<b>PROPOSED WOR</b> ing 106. Improvement tos wall system, replace ended ceilings, fire dete	K: This is include cement of ection and	s a quality : replacer f obsolete d protectio	of life nent of buildin on syst	impro existi ig syst ems.	vement fo ng asbest ems inclu	or the S tos cen ding el	
<b>10. DESCRIPT</b> Directorate offices partitions with a no distribution, lightin <b>11. REQUIREM</b>	ION OF in Build onasbes g, suspe ENT:	PROPOSED WOR ing 106. Improvement tos wall system, replac ended ceilings, fire dete	K: This is include cement of ection and	s a quality : replacer f obsolete d protectio	of life nent of buildin on syst	impro existi g syst ems.	vement fo ng asbest ems inclu	or the S tos cen ding el	
<b>10. DESCRIPT</b> Directorate offices partitions with a no distribution, lightin <b>11. REQUIREM</b>	ION OF in Build onasbes g, suspe ENT: grade Res	PROPOSED WOR ing 106. Improvement tos wall system, replacended ceilings, fire detended ceilings, fire	K: This is include cement of ection and , Bldg 100	s a quality replacer f obsolete d protection	of life nent of buildin on syst	impro existii g syst ems.	vement fo ng asbest ems inclu	or the S toos cen ding el	
10. DESCRIPT Directorate offices partitions with a no distribution, lightin 11. REQUIREM <u>PROJECT::</u> Up <u>REQUIREMEN</u> facilities to accon	ION OF in Build onasbes g, suspe ENT:. grade Re: <u>T:</u> Ror nplish its	PROPOSED WOR ing 106. Improvement tos wall system, replace ended ceilings, fire deter search Engineering Area ne Research Site facili mission.	K: This is include cement of ection and , Bldg 100 ties requi	s a quality replacer f obsolete d protectio	of life nent of buildin on syst	impro existi ig syst ems. atory a	vement fo ng asbest ems inclu	or the S tos cen ding el	
<ul> <li>10. DESCRIPT</li> <li>Directorate offices</li> <li>partitions with a not</li> <li>distribution, lightin</li> <li>11. REQUIREM</li> <li>PROJECT:: Upp</li> <li>REQUIREMEN</li> <li>facilities to accon</li> <li>CURRENT SIT</li> <li>1952, virtually no</li> <li>and outmoded by</li> <li>denies personnel</li> </ul>	ION OF in Build onasbes g, suspe ENT:. grade Res <u>T:</u> Ror nplish its <u>UATIOI</u> change today's I the ben	<b>PROPOSED WOR</b> ing 106. Improvement tos wall system, replace ended ceilings, fire deter search Engineering Area ne Research Site facili mission. <u>N:</u> Building 106 was or s other than painting h standards, which serie efit of a modern quality	K: This is include cement of ection and dection and , Bldg 100 ties requi ties requi riginally b ave occu ously imp y office/la	s a quality replacer f obsolete d protection ire modern uilt in 194 pred since bacts on the b facility of	of life ment of buildin on syst a labor 3 and 2. Facil meir saf which r	impro existi g syst ems. atory a renova ities at ety, ef neets	and profes ated into a re substar ficiency, p AF standa	ssional haborandard, product	

							12	DATE
AIR FORCE	FY	2000 MILITARY CON (compute)	STRUC er gener	TION PF ated)	ROJEC <sup>-</sup>	T DAT	A	
3 INSTALLATION A	ND LOCA	TION		4. PROJE	CT TITLI	E	<b>_</b>	
5. 1101/12/2010/01						_		<b>77</b> 00 000
EDWARDS AIR F	FORCE	BASE, CALIFORNIA			Minor	Constr	ruction <	< \$500,000
5. PROGRAM ELEME	NT	6. CATEGORY CODE	7. PROJE	CT NUMB	ER	8. PR	OJECT CO	DST (\$000)
65807F		211-183	F	SPM9925	02			495.5
		9. COS	ST ESTIM	ATES				
		ITEM		U/N	QUA:	NTITY	UNIT COST	COST (\$000)
Multi Axis Thrust	Stand (M	IATS) Pad 17		SF	8,0	000		
Supporting Facilitie Utilities Pavements Site Improvement Subtotal Contingency (10% Total Contract Cos Supervision, Inspec Total Funded Cost	es s t ction, and	d Overhead		LS LS				$\begin{array}{c} 423.0\\(141.0)\\(141.0)\\(141.0)\\423.0\\42.3\\465.3\\30.2\\495.5\end{array}$
10. DESCRIPT		F PROPOSED WOR	K: Uns	pecified	Minor	Constr	uction (	13.15.4).
Construct a stand support remote e structure will be	for the lectrical procure	Multi Axis Thrust Stan , fueling, and monitorin d from NASA AMES at	d at Pad g while Moffet	17. Re test vehi t Field, C	inforce cle is o CA.	concre n a rai	ete, prov sed stan	vide utilities to id. The test stand
11. REQUIREM	ENT: A	As required.						
PROJECT: Con	struct N	IATS at Pad 17						
REQUIREMENT a capacity of 60 to Concrete pad mus restrictions. A ren computer modelin	Cons ons. A r t be rein notely o g inform	truct a test stand capable new control cab made of inforced to withstand the operated system will mo- mation as testing progre	e of hois f concre weight onitor the sses.	sting a te te masor and thru e system	st vehic ry unit: st of m supply	cle up s to be ultiple ing fue	to 50' at placed : test veh el, electr	bove ground, with near the pad. nicles with no rical, and
CURRENT SITU could be transferr Fighter Task Forc	IATION ed to Pa e could	<b>1:</b> A MATS stand exists d 17, where Dryden Flig utilize the facility in tes	s at NAS ght Rese sting the	SA AME earch Fac new cor	S that i ility (E nposite	s not b DFRF), vehic	oeing us , NASA les.	ed. The stand or Joint Strike

**IMPACT IF NOT PROVIDED:** Costs incurred in research and development will continue to rise. Benefits of knowledge gained from a multi-dimensional thrust exhaust nozzle could reduce costs following information gained utilizing the MATS stand at Pad 17.

DD FORM 1391, DEC 76 (COMPUTER GENERATED)

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1. COMPONENT							2.	DATE			
AIR FORCE (AFMC)	F	(computer generated)									
3. INSTALLATION A	ND LOCA	TION		4. PROJE	PROJECT TITLE						
EGLIN AIR FOR	CE BAS	SE, FLORIDA			Minor (	Constr	uction <	\$500,000			
5. PROGRAM ELEME	NT	6. CATEGORY CODE	7. PROJE	CT NUMB	CT NUMBER 8. PROJECT COST (\$000)						
65807F		312-477	F	TFA9012	00		1	60.0			
		9. CO	ST ESTIM	ATES				· · · · · · · · · · · · · · · · · · ·			
		ITEM		U/M	QUAN	TITY	UNIT COST	COST (\$000)			
Minor Constructio	n using	RDT&E funds for FY200	0:								
FTFA901200 Co	ommerci	al Water		LS				30.0			
10. DESCRIPTI	ON OF	PROPOSED WORK	(: Instal	i water I	ine and	fire h	nydrants				
11. REQUIREM	ENT:										
PROJECT: Con	nmerci	al Water Connection									
REQUIREMENT	<u>:</u> . Prov	vide reliable water so	urce to t	est facil	ty to si	upport	t fire pro	tection for hig			
CURRENT SITU well and has no	ATION fire pro	I: Test Facility is currection.	rently fe	d by a si	mall ¾	inch li	ine from	an existing			
MPACT IF NOT	PROV	<u>IDED:</u> Potential loss	of high	value e	quipme	ent due	e to fire.				
								<u> 2405 NO. 4/4</u>			

L COMPONENT					·			12 Г	ATE	
AIR FORCE (AFMC)	F	FY 2001 MILITARY CONSTRUCTION PROJECT DATA (computer generated)								
3. INSTALLATION A	ND LÔCA	TION		4. PRO	DIEC.	T TITLE				
ROME LAB, NEV	VYOR	<			М	linor Co	onstru	uction < S1	.000,000	
5. PROGRAM ELEME	INT	6. CATEGORY CODE	7. PROJE	ECT NUN	MBE	R	8. PRC	DIECT COST	(\$000)	
62702F		610-281	U	LDF95	0076	5	350.0			
		9. COS	STESTIM	ATES		<u>.                                    </u>		113/17	COST	
		ITEM		U	7М	QUAN	LILA.	COST	(\$000)	
Minor Construction	on using	RDT&E funds for FY2001	1:							
Upgrade Resea	rch Engi	neering Area, Bldg 104			LS				350.0	
<b>10. DESCRIPT</b> Directorate offices the South end of the building systems in systems and the ir	ION Of of the F ne buildi ncluding ncorpora	Photonics Center. Impro ing, the construction of r electrical distribution, lig ation of systems furniture	C: This is ovement new peri ghting, s e.	s a qua s incluo meter j suspen	ality de: part ded	of life in The de itions, r ceiling	mprov molitio replac s, fire	vement for on of exist cement of detection	the Sensors ting offices in obsolete a, and protection	
11. REQUIREM	ENT:									
PROJECT: Upgr	ade Rese	arch Engineering Area, Bl	ldg 104							
REQUIREMENT	: Rom	e Research Site facilitie mission.	s require	e mode	ern l	aborato	ory an	nd profess	ional office	
CURRENT SITU facility denies pers	ATION	: This buildings faciliti the benefit of a modern o	es are c ffice/lab	utdate	d by	/ today'	's stai	ndards. Th	ne current	
IMPACT IF NOT continue to operat productivity.	' PROV e in sub	<b>(IDED:</b> The Rome Resense International Standard, inefficient, a	earch Sit	e elem noded	nent: fac	s curre ilities h	ntly h aving	oused in E impact or	Bldg 104 will a efficiency and	

DD FORM 1391, DEC 76 (COMPUTER GENERATED)

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AIR FORCE (AFMC)	F	Y 2001 MILITARY CON (compute	ISTRUC er gener:	TION ated)	N PRO	OJECT	DAT	A 2.	DATE
3. INSTALLATION A	ND LOCA	TION		4. PF	ROJEC	T TITLE			
EGLIN AIR FOR	CE BAS	E, FLORIDA			ſ	Minor C	Constr	uction <	\$500,000
5. PROGRAM ELEME	ENT	6. CATEGORY CODE	7. PROJE	CT NI	UMBE	R	8. PR(	DJECT CO	ST (\$000)
65807F		Multi		Μι	ulti			8	820.0
		9. COS	T ESTIM	ATES		I			
		ITEM			U/M	QUAN	TITY	UNIT COST	COST (\$000)
Minor Constructio	n using	RDT&E funds for FY2001	:	†					
FTFA880252 UI FTFA971041 Co	pgrade T onstruct	est Project Building Munitions Test Facility			LS LS				400.0 <u>420.0</u>
Total FY2001 Mir	nor Cons	truction							820.0
10. DESCRIPTI	ON OF	PROPOSED WORK	: Expar	nd ex	xistin unitic	g facili	ity to	accom	modate test
			e existin	ig m	unnuc			1613.	
11. REQUIREME	NT:								
PROJECT: Multi	iple Co	nstruction projects as	describ	oed a	above	e			
REQUIRENT	•		<b>.</b> .						
lot and loading ra facility to replace	mp to a three d	accommodate additior	ay for b nai mun suppor	athro ition t mu	oom: s tes nitior	s and d it perso ns test	onice onnel pers	areas, I. Cons onnel.	a new parking truct a new
CURRENT SITUA	ATION: ent and	Existing facility cann	iot acco a perma	ommo aneni	odate t faci	e addit ility.	ional	person	nel and trailers
	PROVI	DED: Test customers	s canno	ot be	supp	ported	and i	munitio	ns personnel
will continue to op	berate (	out of inemicient trailer	space.						

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### COMBATING TERRORISM RESOURCES

Research, Development, Test and Evaluation, AF	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05
BA: 5 - Engineering and Manufacturing Development PE: 0604617 Agile Combat Support	2.8	1.2	2.4	0.9	0.7	0	0	0	0
BA: 7 - Operational System Development PE: 0305128F Security & Investigative Activities	0	3.3	1.4	0.5	0.4	0.4	0.4	0.4	0.5
TOTAL COMPONENT	3.0	4.5	3.8	1.4	1.1	0.4	0.4	0.4	0.5