PE NUMBER: 0603270F
PE TITLE: Electronic Combat Technology

Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2004

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

	Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
	Total Program Element (PE) Cost	24.000	34.597	28.282	26.555	26.318	26.759	27.189	Continuing	Continuing
2432	Defensive System Fusion Technology	7.766	8.017	7.657	5.872	5.357	5.447	5.534	Continuing	Continuing
431G	RF Warning & Countermeasures Tech	5.727	11.846	8.265	8.636	8.709	8.856	8.998	Continuing	Continuing
691X	EO/IR Warning & Countermeasures Tech	10.507	14.734	12.360	12.047	12.252	12.456	12.657	Continuing	Continuing

Note: In FY 2003, space unique tasks in this PE, Projects 431G and 691X, transferred to PE 0603500F, Project 5034, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to support Air Force electronic combat (EC) requirements. The program focuses on developing components, subsystems, and technologies with potential aerospace combat, special operations, and airlift EC applications in three project areas. The first project develops and demonstrates techniques and technologies for integrating EC sensors and systems into a fused and seamless whole. The second project develops and demonstrates advanced technologies for radio frequency EC suites. The third project develops and demonstrates advanced warning and countermeasure technologies to defeat electro-optical, infrared, and laser threats to aerospace platforms. Note: In FY 2004, Congress added $0.5 million for that Receiver and Processing Concepts Evaluation Program and $2.5 million for Detect and Avoid for UAV. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new sensor and EC system developments that have military utility and address warfighter needs.

(U) B. Program Change Summary ($ in Millions)

		FY 2003	FY 2004	FY 2005
(U)	Previous President's Budget	23.828	28.496	28.356
(U)	Current PBR/President's Budget	24.000	34.597	28.282
(U)	Total Adjustments	0.172	6.101	
(U)	Congressional Program Reductions		-0.003	
	Congressional Rescissions		-0.296	
	Congressional Increases		6.400	
	Reprogrammings	0.673		
	SBIR/STTR Transfer	-0.501		
(U)	Significant Program Changes:			

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2004
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology	PROJECT NUMBER AND TITLE: 2432 Defensive System Fusion Technology	

Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
2432 Defensive System Fusion Technology	7.766	8.017	7.657	5.872	5.357	5.447	5.534	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates technologies for integrating electronic combat (EC) sensors and EC system fusion. It develops advanced algorithms and assessment techniques needed to evaluate and enable combat aircraft operations in multi-spectral threat and countermeasure environments. It also matures technologies required for command and control (C2) warfare, standoff jamming, and electronic support measures for the denial, disruption, and suppression of adversary air defense operations. Technologies included are: advanced components and techniques needed to jam enemy radars; advanced standoff jammer technologies; and electronic collection methods to inform field commanders of changes in the electronic environment.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Develop and investigate offensive counter information warfare technologies to disrupt and deny hostile command and control nodes and networks.	3.236	3.394	2.975
(U) In FY 2003: Completed hardware and software system integration, and conducted extensive ground tests to evaluate electronic attack and electronic support measures techniques to counter adversarial communication and navigation systems. Continued detailed planning for the flight tests. Investigated and analyzed various computer networks for selection of the most viable threat. Designed effective countermeasure techniques against selected high-speed, wideband data link targets.			
(U) In FY 2004: Finalize the detailed flight test plan, based on the results of the exhaustive ground tests. Flight test the Electronic Attack/Electronic Support (EA/ES) countermeasures system to counter adversary communication and navigation systems. Document system design and ground/flight test results in a final report. Design hardware and software for the EA/ES system to counter high-speed, wideband data/communication links utilized by multiple ground-based and airborne platforms. Fabricate hardware to process and attack the threat network.			
(U) In FY 2005: Integrate and demonstrate flyable hardware and software for the EA/ES support system to counter high-speed, wideband data and communication links utilized by multiple ground based and airborne platforms.			
(U)			
(U) MAJOR THRUST: Develop and integrate advanced sensor receiver and processing technologies.	2.232	1.805	2.045
(U) In FY 2003: Conducted risk reduction evaluations and demonstrations in the Integrated Demonstrations and Applications Laboratory (IDAL) that focused these technologies on mission applications. Conducted IDAL risk reduction evaluations and demonstrations to evolve advanced sensor threat identification and location algorithms for real-time threat situational awareness.			
(U) In FY 2004: Conduct evaluations and risk reduction demonstrations of defensive sensors and the fusion of multiple			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603270F Electronic Combat Technology	PROJECT NUMBER AND TITLE 2432 Defensive System Fusion Technology

information sources for situational awareness in the IDAL. Continue conducting IDAL laboratory risk reduction evaluations and demonstrations that evolve and optimize sensor fusion algorithms.

(U) In FY 2005: Continue conducting evaluations and risk reduction demonstrations of defensive sensors and fusion of multiple information sources for situational awareness in the Integrated Demonstrations and Applications Laboratory (IDAL). Continue conducting IDAL laboratory risk reduction evaluations and demonstrations that evolve and optimize sensor fusion algorithms for utilization on tactical platforms that provide real-time threat situational awareness. Conduct IDAL laboratory risk reduction evaluations and demonstrations for advanced digital receiver and processor technologies that provide the warfighter with multispectral warning, identification, and threat response for current and next generation aerospace platforms.

(U)

(U) MAJOR THRUST: Develop affordable radio frequency (RF) and electro-optical (EO) emitter warning concepts and techniques.	2.298	2.818	2.637	
(U) In FY 2003: Developed affordable threat alert and jamming techniques generator technologies for combat aircraft to increase survivability against advanced, integrated RF, EO, and infrared air defense systems, including trade study analyses for techniques to defeat future threat radar-guided missile systems. Continued hardware and software development through subsystem tests and early system integration for an advanced digital threat warning and response capability.				
(U) In FY 2004: Continue developing affordable threat alert and jamming techniques generator technologies for combat aircraft to increase survivability against advanced, integrated RF, EO, and infrared air defense systems, including trade study analyses for techniques to defeat future threat radar guided missile systems. Complete system integration, tests, and laboratory demonstrations for an advanced digital threat warning and response capability.				
(U) In FY 2005: Demonstrate affordable threat alert and jamming techniques generator technologies for combat aircraft to increase survivability against advanced, integrated RF, EO, and infrared air defense systems, including implementation of techniques to defeat future threat radar guided missile systems. Incorporate advanced jamming techniques into plans for flight demonstrations of a significantly improved digital threat warning and response capability. Develop advanced processing and encoding methods for complex emitter signals.				
(U) Total Cost	7.766	8.017	7.657	

(U) C. Other Program Funding Summary ($ in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602204F, Aerospace Sensors.									

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603270F Electronic Combat Technology**	PROJECT NUMBER AND TITLE **2432 Defensive System Fusion Technology**

(U) C. Other Program Funding Summary ($ in Millions)

(U) PE 0603203F, Advanced Aerospace Sensors.

(U) PE 0603500F, Multi-disciplinary Advanced Space Technology.

(U) PE 0604270F, Electronic Warfare (EW) Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification

DATE: February 2004

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT NUMBER AND TITLE: 431G RF Warning & Countermeasures Tech

Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
431G RF Warning & Countermeasures Tech	5.727	11.846	8.265	8.636	8.709	8.856	8.998	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: In FY 2003, space unique tasks in this project transferred to PE 0603500F, Project 5034, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates advanced technologies for radio frequency (RF) electronic combat (EC) suites to enhance the survivability of aerospace vehicles and to provide crew situational awareness. One major area addresses technologies for missile/threat warning, RF receivers, EC preprocessors, advanced sorting/preprocessing algorithms, and expert software for applications on existing and future EC systems. Another major technology area focuses on the development and demonstration of subsystems and components for generating on-board/off-board RF countermeasure techniques. This includes the development of electronic countermeasures (ECM) techniques as well as advanced ECM technologies such as antennas, power amplifiers, preamplifiers, etc.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Develop wideband, multi-mode, multi-function apertures for electronic warfare applications (i.e., threat detection, threat avoidance, suppression of enemy air defenses, surveillance, and reconnaissance).	1.828	2.040	3.315
(U) In FY 2003: Demonstrated proof-of-concept for cost and weight reduction for adaptive, wideband conformal phased arrays that are integrated into potential unmanned aerospace platforms. These subarrays will have multiple polarization elements and perform over an extremely wide frequency range with an instantaneous bandwidth of between 4:1 to 10:1.			
(U) In FY 2004: Fully characterize adaptive, wideband, conformal phased arrays that have been structurally integrated into future unmanned aerial vehicle aperture and receiver concepts to assess technology readiness levels.			
(U) In FY 2005: Develop low-cost wideband and conformal, multiple polarization arrays through the use of RF-on-Flex techniques.			
(U)			
(U) MAJOR THRUST: Develop aerospace platform self-protection and support jamming technologies and techniques to counter advanced RF threats associated with current and future aerospace weapon systems.	3.899	5.906	4.950
(U) In FY 2003: Completed study of and continued developing and demonstrating aerospace platform self-protection and support jamming technologies and techniques to counter advanced RF threats associated with current and future aerospace weapon systems. Initiated developing next generation monopulse countermeasure systems. Continued developing and evaluating innovative RF countermeasure techniques for aerospace platforms against future RF threat systems. Continued developing and performing laboratory and field tests of advanced electronic protection techniques and technology to protect aerospace radar systems.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603270F Electronic Combat Technology**	PROJECT NUMBER AND TITLE **431G RF Warning & Countermeasures Tech**

(U) In FY 2004: Continue developing, and initiate testing of, next generation monopulse countermeasure systems for Air Force aerospace platforms. Perform laboratory testing of innovative RF countermeasure techniques for aerospace platforms against future radio frequency (RF) threat systems. Continue developing innovative electronic protection techniques in advanced radar systems. Laboratory and field test these techniques.

(U) In FY 2005: Develop self-protection countermeasures effective against for fourth generation surface to air missile systems. Conduct laboratory evaluations of countermeasures to defeat an advanced integrated air defense system. Continue laboratory and field-testing of innovative, networked RF countermeasure techniques against advanced target engagement radars. Develop anti-jam technologies for advanced RF sensor systems.

(U)

(U) CONGRESSIONAL ADD: Advanced Threat Alert Response/Lightweight Modular Support Jammer (ATAR/LMSJ).	0.000	3.400	0.000

(U) In FY 2003: Not Applicable.

(U) In FY 2004: Design, fabricate, and test technologies to support an end-to-end support jammer system with software-reconfigurable digital receivers and processors, countermeasures techniques, a waveform generator, jammer controller, and integrated RF transmitters and arrayed antenna apertures.

(U) In FY 2005: Not Applicable.

(U)

(U) CONGRESSIONAL ADD: Receiver and Processing Concepts Evaluation Program.	0.000	0.500	0.000

(U) In FY 2003: Not Applicable.

(U) In FY 2004: Expand research in advanced RF receiver and processing algorithms using state-of-the art concepts and modern technologies.

(U) In FY 2005: Not Applicable.

(U) Total Cost	5.727	11.846	8.265

(U) C. Other Program Funding Summary ($ in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost

(U) Related Activities:

(U) PE 0602204F, Aerospace Sensors.

(U) PE 0604270F, Electronic Warfare (EW) Development.

(U) PE 0603500F, Multi-disciplinary Advanced Space Technology.

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603270F Electronic Combat Technology**	PROJECT NUMBER AND TITLE **431G RF Warning & Countermeasures Tech**

(U) C. Other Program Funding Summary ($ in Millions)

(U) PE 0604270N, EW Development.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2004
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology	PROJECT NUMBER AND TITLE: 691X EO/IR Warning & Countermeasures Tech	

Cost ($ in Millions)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
691X	EO/IR Warning & Countermeasures Tech	10.507	14.734	12.360	12.047	12.252	12.456	12.657	Continuing	Continuing
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: In FY 2003, space unique tasks in this project transferred to PE 0603500F, Project 5034, in conjunction with the Space Commission recommendation to consolidate all space unique tasks.

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates the advanced warning and countermeasure technologies required to negate electro-optical (EO), infrared (IR), and laser threats to aerospace platforms. Off-board (decoys and expendables) and on-board countermeasure technologies developed for aircraft self-protection will provide robust, affordable solutions for protection against IR missiles with autonomous seekers, multi-spectral threats, laser-guided weapons, and EO and IR tracking systems used to direct EO, IR, and radar-guided missiles.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Develop on-board, closed-loop, laser infrared countermeasures (IRCM) for large aircraft to defeat current and future IR-guided missiles in multiple scenarios.	0.320	0.000	0.000
(U) In FY 2003: Completed flight tests of closed-loop IRCM technology on large aircraft.			
(U) In FY 2004: Not Applicable. Work completed.			
(U) In FY 2005: Not Applicable.			
(U)			
(U) MAJOR THRUST: Analyze the vulnerabilities of current IR missile systems and future imaging IR sensors.	1.822	2.282	2.386
(U) In FY 2003: Conducted in-house analyses of the vulnerabilities of current IR missile systems and future imaging IR sensors. Fabricated an expendable decoy technology suitable for peacekeeping operations that can be safely deployed at low altitudes over urban areas. Acquired and assessed capabilities and vulnerabilities of imaging IR sensors used for target acquisition.			
(U) In FY 2004: Continue conducting in-house analyses on vulnerabilities of current and future IR imaging sensors and missiles. Demonstrate and evaluate countermeasure techniques for countering multiple types of imaging IR sensors used for target acquisition. Initiate developing low-cost, cooperative techniques to counter imaging IR sensors.			
(U) In FY 2005: Continue conducting in-house analyses on current IR-guided missile susceptibilities and future imaging IR sensors. Continue evaluation of countermeasure techniques for countering multiple types of imaging IR sensors used for target acquisition. Initiate developing low-cost, cooperative techniques to counter imaging IR sensors. Continue designing and begin developing expendable decoy technology with modified spatial and kinematic properties that can be used to deceive imaging IR missiles.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2004		
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603270F Electronic Combat Technology**	PROJECT NUMBER AND TITLE **691X EO/IR Warning & Countermeasures Tech**		
(U)				
(U) MAJOR THRUST: Develop aerospace laser warning sensor technologies for timely alert to advanced laser acquisition/tracking sensors, including detecting and locating both high power (dazzle/damage) and low power (laser-guided ordnance) signals.		3.166	4.219	4.036
(U) In FY 2003: Initiated design of an airborne laser warning sensor which can cue agile filter protection for aircrew or sensor protection.				
(U) In FY 2004: Complete design of an airborne laser warning sensor that can cue agile filter protection for aircrew or sensor protection. Conduct laboratory demonstration of cueing capabilities. Test and demonstrate a multi-platform sensor capable of identifying and classifying battlefield lasers that are dangerous to eyes and sensors.				
(U) In FY 2005: Initiate risk reduction research and development for continuous wave and femto-second lasers from remote vehicles and sensors. Initiate development of advanced eye and sensor protection cueing concepts tailored for specific operational deficiencies.				
(U)				
(U) MAJOR THRUST: Develop a countermeasure technology to defeat passive electro-optical (EO) and infrared (IR) aircraft tracking sensors and ordnance guidance.		4.257	4.623	4.709
(U) In FY 2003: Initiated an advanced technology demonstration program to detect and counter passive EO and IR tracking sensors. Completed preliminary design for a method to counter sensors beyond kinematic launch capability.				
(U) In FY 2004: Complete designing a system that can locate and counter passive threats beyond kinematic launch boundaries. Complete assessment of multiple threats and threat surrogates. Initiate developing a laboratory testbed.				
(U) In FY 2005: Demonstrate laboratory capability to locate and counter passive threats before threats can develop a fire control solution. Initiate fabricating a testbed for field demonstrations over extended ranges.				
(U)				
(U) MAJOR THRUST: Develop EO/IR missile warning technologies to alert aircrews and aircraft self-protection systems to the approach of advanced, low-signature threats.		0.000	1.110	1.229
(U) In FY 2003: Not Applicable.				
(U) In FY 2004: Establish spatial, spectral, and temporal trade space for advanced missile warning sensors optimized for detecting low contrast missile threats in high clutter backgrounds. Perform airborne experiments to quantify expected performance.				
(U) In FY 2005: Perform a concept evaluation of a visible band passive warning sensor that can provide timely countermeasure initiation with high declaration probability and low false alarm rate.				
(U)				
(U) CONGRESSIONAL ADD: Detect and Avoid for UAV. Note: In FY 2003, this Add was titled Test Detect and Avoid Technology for FAA.		0.942	2.500	0.000
(U) In FY 2003: Developed and demonstrated an interim "see and avoid" system for unmanned aerial vehicles that meets				

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603270F Electronic Combat Technology**	PROJECT NUMBER AND TITLE **691X EO/IR Warning & Countermeasures Tech**

with Federal Aviation Administration approval to do limited flying in national airspace without a chase aircraft.

(U) In FY 2004: Implement an interim "see and avoid" system for unmanned aerial vehicles that meets with Federal Aviation Administration approval to do limited flying in national airspace without a chase aircraft.

(U) In FY 2005: Not Applicable.

(U) Total Cost	10.507	14.734	12.360

(U) C. Other Program Funding Summary ($ in Millions)

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost

(U) Related Activities:

(U) PE 0602204F, Aerospace Sensors.

(U) PE 0604270F, Electronic Warfare (EW) Development.

(U) PE 0603500F, Multi-disciplinary Advanced Development Space Technology.

(U) PE 0604270N, EW Development.

(U) PE 0603203F, Advanced Aerospace Sensors.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.