RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

	COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	30,582	23,828	28,496	28,356	26,628	26,372	26,771	27,146	Continuing	TBD
2432	Defensive System Fusion Technology	7,769	7,932	8,086	7,677	5,888	5,368	5,449	5,525	Continuing	TBD
431G	RF Warning & Countermeasures Tech	7,867	5,878	8,047	8,287	8,660	8,727	8,860	8,984	Continuing	TBD
691X	EO/IR Warning & Countermeasures Tech	14,946	10,018	12,363	12,392	12,080	12,277	12,462	12,637	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

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

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 2003, Congress added $1.0 million to assess the 'see and avoid' requirement for unmanned aerial vehicles to operate in national airspace.

(U) B. Budget Activity Justification

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.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2003
BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

(U) C. Program Change Summary ($ in Thousands)

		FY 2002	FY 2003	FY 2004	Total Cost
(U)	Previous President's Budget	32,405	23,350	27,773	
(U)	Appropriated Value	32,721	24,350		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-316	-261		
	b. Small Business Innovative Research	-701			
	c. Omnibus or Other Above Threshold Reprogram		-261		
	d. Below Threshold Reprogram	-973			
	e. Rescissions	-149			
(U)	Adjustments to Budget Years Since FY 2003 PBR			723	
(U)	Current Budget Submit/FY 2004 PBR	30,582	23,828	28,496	TBD

(U) Significant Program Changes:
Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 2432

COST ($ in Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
2432	Defensive System Fusion Technology	7,769	7,932	8,086	7,677	5,888	5,368	5,449	5,525	Continuing	

(U) A. Mission Description

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) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $2,103 Developed and investigated offensive counter information warfare technologies to disrupt and/or deny adversarial C2 nodes and networks. Completed laboratory tests and subsequently demonstrated the advanced electronic attack (EA) techniques to counter modern digital C2 network links. Analyzed and evaluated technical data to determine technique effectiveness. Integrated hardware/software and conducted laboratory tests to evaluate EA techniques to counter adversarial communication and navigation systems. Continued the detailed planning process for ground and flight tests. Developed offensive countermeasures against high-speed, wideband data links for use by multiple ground-based and airborne platforms.

(U) $302 Developed and implemented advanced hardware-in-the-loop threat simulators in the Integrated Demonstrations and Applications Laboratory (IDAL) to conduct evaluations and risk reduction demonstrations of defensive sensors and fusion of multiple information sources for situational awareness. Developed and conducted IDAL risk reduction evaluations and demonstrations that evolve advanced sensor processing technologies for real-time threat situational awareness.

(U) $4,373 Developed affordable radar and radio frequency (RF) emitter warning concepts and techniques. Developed affordable threat alert and jamming technique generator technologies for combat aircraft to increase survivability against advanced, integrated RF, electro-optical, and infrared air defense systems. Performed trade study analyses for techniques to defeat future threat radar guided missile systems. Completed requirements study and transition analysis, began hardware and software development, and held preliminary design reviews for an advanced digital threat warning and response capability.

(U) $991 Continued integrating Coherent Command, Control, Communications, Navigation, and Identification (C3NI) signal simulation capabilities into the IDAL. Upgraded the IDAL's C3NI equipment to the standards required for a joint survivability demonstration.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603270F Electronic Combat Technology	PROJECT 2432

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$7,769	Total

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$3,236	Develop and investigate offensive counter information warfare technologies to disrupt and deny hostile command and control nodes and networks. Complete hardware/software system integration and conduct extensive ground tests to evaluate electronic attack and electronic support measures techniques to counter adversarial communication and navigation systems. Continue detailed planning for the flight tests. Investigate and analyze various computer networks for selection of the most viable threat. Design effective countermeasure techniques against selected high-speed, wideband data link targets.
(U)	$2,398	Integrate advanced sensor receiver and processing technologies. Conduct risk reduction evaluations and demonstrations in the Integrated Demonstrations and Applications Laboratory (IDAL) that focus these technologies on mission applications. Conduct IDAL risk reduction evaluations and demonstrations to evolve advanced sensor threat identification and location algorithms for real-time threat situational awareness.
(U)	$2,298	Develop affordable radar and radio frequency (RF) emitter warning concepts and techniques. Develop affordable threat alert and jamming techniques generator technologies for combat aircraft to increase survivability against advanced, integrated RF, electro-optical, and infrared air defense systems, including trade study analyses for techniques to defeat future threat radar-guided missile systems. Continue hardware and software development through subsystem tests and early system integration for an advanced digital threat warning and response capability.
(U)	$7,932	Total

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$3,463	Continue developing and investigating offensive counter information warfare technologies to disrupt and/or deny adversarial command and control nodes and networks. 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)	$1,805	Conduct evaluations and risk reduction demonstrations of defensive sensors and the fusion of multiple information sources for situational awareness in the IDAL. Conduct IDAL laboratory risk reduction evaluations and demonstrations which evolve and optimize sensor fusion algorithms. These sensor fusion algorithms would provide real-time threat situational awareness for U.S. and coalition tactical platforms.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2003
BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology / PROJECT: 2432

(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

(U)	$2,818	Continue developing affordable radar and radio frequency (RF) emitter warning concepts and techniques. Continue developing affordable threat alert and jamming techniques generator technologies for combat aircraft to increase survivability against advanced, integrated RF, electro-optical, 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)	$8,086	Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:
(U) PE 0602204F, Aerospace Sensors.
(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.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 431G

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
431G RF Warning & Countermeasures Tech	7,867	5,878	8,047	8,287	8,660	8,727	8,860	8,984	Continuing	

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

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) FY 2002 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$1,252	Developed advanced tactical targeting technology in conjunction with the Defense Advanced Research Projects Agency for Suppression of Enemy Air Defenses (SEAD). Integrated and flight-tested brassboard units that triangulate threat emitter positions and provide targeting for precision-guided munitions.
(U)	$779	Developed wideband, multi-mode, multi-function apertures for electronic warfare applications (i.e., threat detection, threat avoidance, SEAD, surveillance, and reconnaissance). Fabricated and laboratory tested low-cost adaptive wideband conformal aperture sub-arrays consisting of structurally integrated, multiple polarization elements.
(U)	$5,836	Studied and initiated developing aerospace platform self-protection and support jamming technologies to counter advanced RF threats associated with current and future aerospace weapon systems. Conducted field evaluation of an advanced monopulse ECM brassboard system. Developed and tested ECM techniques for aircraft against future RF threat systems. Optimized, laboratory tested, and field tested electronic protection breadboard that will shield advanced radar systems against electronic attacks.
(U)	$7,867	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2003
BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology / PROJECT: 431G

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$1,903	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). Demonstrate 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)	$3,975	Complete study and continue developing and demonstrating aerospace platform self-protection and support jamming technologies and techniques to counter advanced radio frequency (RF) threats associated with current and future aerospace weapon systems. Initiate developing next generation monopulse countermeasure systems. Continue developing and evaluating innovative RF countermeasure techniques for aerospace platforms against future RF threat systems. Continue developing and performing laboratory and field tests of advanced electronic protection techniques and technology to protect our aerospace radar systems.
(U)	$5,878	Total

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$2,091	Continue developing wideband, multi-mode, multi-function apertures for electronic warfare applications (i.e., threat detection, threat avoidance, suppression of enemy air defenses, surveillance, and reconnaissance). 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. These subarrays will have multiple polarization elements and will perform over the ultra-high frequency through Ku band with instantaneous bandwidths of 4:1 to 10:1.
(U)	$5,956	Continue developing and evaluating aerospace platform self-protection and support jamming technologies and techniques to counter advanced RF threats associated with current and future aerospace weapon systems. 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 RF threat systems. Continue developing innovative electronic protection techniques in advanced radar systems. Laboratory and field test these techniques.
(U)	$8,047	Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2003
BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology
	PROJECT: 431G

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

(U) Related Activities:

(U) PE 0602204F, Aerospace Sensors.

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

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

(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.

(U) E. Schedule Profile

(U) Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 691X

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
691X EO/IR Warning & Countermeasures Tech	14,946	10,018	12,363	12,392	12,080	12,277	12,462	12,637	Continuing	

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

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) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $8,796 Developed on-board, closed-loop, laser infrared countermeasures (IRCM) for large aircraft to defeat current and future IR-guided missiles in multiple scenarios. Integrated and flight-tested closed-loop IRCM technology on large aircraft.

(U) $1,056 Conducted in-house analyses of current and future IR-guided threat missiles. Completed evaluation of novel expendable countermeasure design concepts and dispense patterns to defeat conventional IR-guided and imaging anti-aircraft IR missiles. Initiated development of expendable decoy technology suitable for peacekeeping operations which can be safely deployed at low altitudes over urban areas.

(U) $1,523 Developed 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. Continued developing laser warning sensor technology for space situational awareness. Completed design of radiometer module and initiated designing geolocation and spectrometer modules. Tested and evaluated laser warning sensor components for aircrew protection. Designed laser warning sensor to provide cueing for eye/sensor protection on airborne platforms.

(U) $1,735 Developed EO and IR missile warning technologies to alert aircrews and aircraft self-protection systems to the approach of advanced, low-signature threats. Initiated developing multi-color warning technologies that improve threat detection and reduce declaration times in heavy clutter environments.

(U) $1,836 Developed countermeasure technology to defeat passive EO/IR aircraft tracking sensors and ordnance guidance. Continued evaluating detection techniques for locating, identifying, and countering conventional and advanced EO/IR tracking sensors. Field tested the most promising techniques on a 2km range.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603270F Electronic Combat Technology	PROJECT 691X

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$14,946	Total

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$320	Develop on-board, closed-loop, laser infrared countermeasures (IRCM) for large aircraft to defeat current and future IR-guided missiles in multiple scenarios. Complete flight tests of closed-loop IRCM technology on large aircraft.
(U)	$1,577	Conduct in-house analyses of the vulnerabilities of current infrared (IR) missile systems and future imaging IR sensors. Fabricate an expendable decoy technology suitable for peacekeeping operations that can be safely deployed at low altitudes over urban areas. Acquire and assess capabilities and vulnerabilities of imaging IR sensors used for target acquisition.
(U)	$2,922	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. Initiate design of an airborne laser warning sensor which can cue agile filter protection for aircrew or sensor protection.
(U)	$4,257	Develop a countermeasure technology to defeat passive electro-optical (EO) and IR aircraft tracking sensors and ordnance guidance. Initiate an advanced technology demonstration program to detect and counter passive EO and IR tracking sensors. Complete preliminary design for a method to counter sensors beyond kinematic launch capability.
(U)	$942	Develop, demonstrate, and 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)	$10,018	Total

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$2,282	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 sensors.
(U)	$4,348	Continue developing aerospace laser warning sensor technologies for timely alert to advanced laser acquisition and tracking sensors, including detecting and locating both high power (dazzle/damage) and low power (laser-guided ordnance) signals. Complete design of an airborne laser warning sensor which 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)	$1,110	Develop EO/IR missile warning technologies to alert aircrews and aircraft self-protection systems to the approach of advanced, low-signature

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2003
BUDGET ACTIVITY 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603270F Electronic Combat Technology
PROJECT 691X	

(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

threats. 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) $4,623 Continue developing countermeasure technology to defeat passive electro-optical/infrared aircraft tracking sensors and ordnance guidance. Finalize designing a system that can locate and counter passive threats beyond kinematic launch boundaries. Complete assessment of multiple threats and threat surrogates. Begin developing a laboratory testbed.

(U) $12,363 Total

(U) B. Project Change Summary

Not Applicable.

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

(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.

(U) E. Schedule Profile

(U) Not Applicable.