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

DATE: February 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

	COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	26,391	32,405	23,350	27,773	27,047	26,302	27,165	Continuing	TBD
2432	Defensive System Fusion Technology	9,362	8,307	8,110	8,251	7,815	6,058	5,529	Continuing	TBD
431G	RF Warning & Countermeasures Tech	7,672	8,402	6,009	6,906	6,618	7,814	8,990	Continuing	TBD
691X	EO/IR Warning & Countermeasures Tech	9,357	15,696	9,231	12,616	12,614	12,430	12,646	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

In FY 2003, space unique tasks in this PE, Projects 431G and 691X, will be 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 2002, Congress added $1.0 million for the Integrated Demonstrations and Applications Laboratory's Coherent Command, Control, Communications, Navigation, and Identification Signal Simulations, and $3.5 million for Closed-Loop Infrared Countermeasures.

(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.

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PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

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

		FY 2001	FY 2002	FY 2003	Total Cost
(U)	Previous President's Budget	26,636	28,221	29,559	
(U)	Appropriated Value	26,882	32,721		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions		-316		
	b. Small Business Innovative Research	-631			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram	386			
	e. Rescissions	-246			
(U)	Adjustments to Budget Years Since FY 2002 PBR			-6,209	
(U)	Current Budget Submit/FY 2003 PBR	26,391	32,405	23,350	TBD

(U) Significant Program Changes:

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

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

DATE: February 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 2432

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2432 Defensive System Fusion Technology	9,362	8,307	8,110	8,251	7,815	6,058	5,529	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 support countermeasures for denial, disruption, and suppression of adversary air defense operations. Technologies included are: 1) advanced components and techniques needed to jam enemy radars; 2) advanced standoff jammer technologies; and 3) electronic collection methods to inform field commanders of changes in the electronic environment.

(U) FY 2001 ($ in Thousands)

(U) $2,193 Developed low-cost technologies to demonstrate data fusion (e.g., threat recognition, targeting, etc.) from off-board and on-board sensors to enhance situational awareness in both new and existing aerospace platforms. As part of an international cooperative Real-Time Information-in-the-Cockpit effort, performed design of optimized sensor fusion algorithms and processor hardware for joint coalition platforms.

(U) $3,847 Developed and investigated offensive counter information warfare technologies to disrupt and/or deny adversarial C2 nodes and networks. Continued threat exploitation. Conducted ground/field testing of brassboard against modern digital C2 network links. Designed experimental hardware and software to counter adversarial communication and navigation systems.

(U) $2,767 Conducted evaluations and risk reduction demonstrations of defensive sensors and fusion of multiple information sources for situational awareness. Conducted laboratory evaluations of receiver technology for advanced fighter applications. Integrated Navy and Air Force Integrated Demonstrations and Applications Laboratory (IDAL) Coherent Command, Control, Communications, Navigation, and Identification (C3NI) signal simulation for joint survivability demonstrations.

(U) $555 Developed affordable threat alert technologies for combat aircraft to increase survivability against advanced, integrated radio frequency air defense systems. Conducted trade study analyses for techniques to defeat future threat radar guided missile systems.

(U) $9,362 Total

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BUDGET ACTIVITY 03 - Advanced Technology Development	PE NUMBER AND TITLE 0603270F Electronic Combat Technology
	PROJECT 2432

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$2,282	Develop and investigate offensive counter information warfare technologies to disrupt and/or deny adversarial C2 nodes and networks. Complete laboratory tests and subsequently demonstrate the advanced electronic attack (EA) techniques to counter modern digital C2 network links. Analyze and evaluate technical data to determine technique effectiveness. Integrate hardware/software and conduct laboratory tests to evaluate EA techniques to counter adversarial communication and navigation systems. Continue the detailed planning process for ground and flight tests. Develop offensive countermeasures against high-speed, wideband data links for use by multiple ground-based and airborne platforms.
(U)	$302	Develop and implement 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. Develop and conduct IDAL risk reduction evaluations and demonstrations that evolve advanced sensor processing technologies for real-time threat situational awareness.
(U)	$4,732	Develop affordable radar and radio frequency (RF) emitter warning concepts and techniques. Develop 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. Perform trade study analyses for techniques to defeat future threat radar guided missile systems. Complete requirements study and transition analysis, begin hardware and software development, and hold preliminary design reviews for an advanced digital threat warning and response capability. (In FY 2001, portions of this effort were performed in PE 0603203F, Project 69DF.)
(U)	$991	Continue integrating Coherent Command, Control, Communications, Navigation, and Identification (C3NI) signal simulation capabilities into the IDAL. Upgrade the IDAL's C3NI equipment to the standards required for a joint survivability demonstration.
(U)	$8,307	Total

(U) FY 2003 ($ in Thousands)

(U)	$3,296	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 the detailed planning for the flight tests. Investigate and analyze various computer networks for selection of the most viable threat. Design effective countermeasures techniques against the selected high-speed, wideband data link targets.
(U)	$2,458	Integrate advanced sensor receiver and processing technologies, and conduct IDAL risk reduction evaluations and demonstrations that focus these technologies on mission applications. Conduct IDAL risk reduction evaluations and demonstrations to evolve advanced sensor threat

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

identification and location algorithms for real-time threat situation awareness.

(U) $2,356 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) $8,110 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 Adv Space Tech.

(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 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 431G

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
431G RF Warning & Countermeasures Tech	7,672	8,402	6,009	6,906	6,618	7,814	8,990	Continuing	

In FY 2003, space unique tasks in this project will transfer 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 addressed covers 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 2001 ($ in Thousands)

(U) $1,406 Developed affordable radar and RF emitter warning concepts and techniques. Evaluated a wideband digital receiver for affordable electronic support measures and radar warning receiver suites.

(U) $3,313 Developed wideband, multimode, multifunction apertures for electronic warfare applications (i.e., threat detection, threat avoidance, suppression of enemy air defenses, surveillance, and reconnaissance). Integrated and chamber tested a multimode antenna to demonstrate a tenfold improvement in gain while providing a wide field of view and a low radar cross section.

(U) $2,953 Developed aerospace platform self-protection and support jamming technologies to counter advanced RF threats associated with current and future air defense weapon systems. Conducted laboratory evaluations of EC techniques to increase aerospace system survivability. Completed demonstration of a steerable high-power array. Designed and developed a flight-worthy brassboard for monopulse angle jamming integrated electronic countermeasures. Built and demonstrated an advanced electronic protection breadboard.

(U) $7,672 Total

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BUDGET ACTIVITY: 03 - Advanced Technology Development	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology
	PROJECT: 431G

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$1,305	Develop Advanced Tactical Targeting Technology in conjunction with DARPA for Suppression of Enemy Air Defenses (SEAD). Integrate and flight test brassboard units that triangulate threat emitter positions and provide targeting for precision guided munitions.
(U)	$779	Develop wideband, multimode, multifunction apertures for electronic warfare applications (i.e., threat detection, threat avoidance, SEAD, surveillance, and reconnaissance). Fabricate and test in the laboratory low-cost adaptive wideband conformal aperture sub-arrays consisting of structurally integrated, multiple polarization elements.
(U)	$6,318	Study and initiate developing aerospace platform self-protection and support jamming technologies to counter advanced radio frequency threats associated with current and future aerospace weapon systems. Conduct field evaluation of advanced monopulse electronic countermeasure (ECM) brassboard system. Develop and test ECM techniques for aircraft against future RF threat systems. Optimize, laboratory test, and field test electronic protection breadboard that will shield advanced radar systems against electronic attacks.
(U)	$8,402	Total

(U) FY 2003 ($ in Thousands)

(U)	$1,934	Develop wideband, multimode, multifunction 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 and extremely wide frequency range with an instantaneous bandwidth of between 4:1 to 10:1.
(U)	$4,075	Complete study and continue 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. 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)	$6,009	Total

(U) B. Project Change Summary

Not Applicable.

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603270F Electronic Combat Technology	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 Adv Space Tech.

(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 2002

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 691X

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
691X EO/IR Warning & Countermeasures Tech	9,357	15,696	9,231	12,616	12,614	12,430	12,646	Continuing	

In FY 2003, space unique tasks in this project will be 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 radio frequency (RF) missiles.

(U) FY 2001 ($ in Thousands)

(U)	$3,859	Developed on-board, closed-loop, laser infrared countermeasures (IRCM) for large aircraft to defeat current and future IR missiles in multiple scenarios. Fabricated a flight-worthy closed-loop IRCM suite for demonstration on large aircraft.
(U)	$1,193	Conducted in-house analyses of current and future IR threat missiles. Completed digital models of IR threat missiles. Simulated expendable countermeasure techniques for conventional and imaging IR missiles. Designed combined effects expendables for tactical aircraft to defeat imaging IR missiles.
(U)	$980	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. Conducedt laboratory evaluation of ability of laser warning sensor technology to locate/identify laser hazards and cue appropriate response.
(U)	$1,907	Developed EO and IR missile warning technologies to alert aircrews and aircraft self-protection systems to the approach of advanced, low-signature threats. Evaluated multispectral imaging technology for missile warning and/or distributed aperture sensors.
(U)	$1,418	Developed countermeasure technology to defeat passive EO/IR aircraft tracking sensors and ordnance guidance. Investigated gimballess beam steering technologies to reduce weight and drag of countermeasure subsystems.
(U)	$9,357	Total

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BUDGET ACTIVITY: 03 - Advanced Technology Development	PE NUMBER AND TITLE: 0603270F Electronic Combat Technology
PROJECT: 691X	

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands)

(U)	$9,164	Develop on-board, closed-loop, laser infrared countermeasures (IRCM) for large aircraft to defeat current and future IR-guided missiles in multiple scenarios. Integrate and flight test closed-loop IRCM technology on large aircraft.
(U)	$1,151	Conduct in-house analyses of current and future IR guided threat missiles. Complete evaluation of novel expendable countermeasure design concepts and dispense patterns to defeat conventional IR-guided and imaging antiaircraft IR missiles. Initiate development of expendable decoy technology suitable for peacekeeping operations which can be safely deployed at low altitudes over urban areas.
(U)	$1,618	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. Continue developing laser warning sensor technology for space situational awareness. Complete design of radiometer module and initiate designing geolocation and spectrometer modules. Test and evaluate laser warning sensor components for aircrew protection. Design laser warning sensor to provide cueing for eye/sensor protection on airborne platforms.
(U)	$1,829	Develop electro-optical (EO) and infrared (IR) missile warning technologies to alert aircrews and aircraft self-protection systems to the approach of advanced, low-signature threats. Initiate developing multi-color warning technologies that improve threat detection and reduce declaration times in heavy clutter environments.
(U)	$1,934	Develop countermeasure technology to defeat passive EO/IR aircraft tracking sensors and ordnance guidance. Continue evaluating detection techniques for locating, identifying, and countering conventional and advanced EO/IR tracking sensors. Field test the most promising techniques on a 2km range.
(U)	$15,696	Total

(U) FY 2003 ($ in Thousands)

(U)	$320	Develop on-board, closed-loop, laser 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)	$1,604	Conduct in-house analyses of the vulnerabilities of current infrared missile systems and future imaging infrared sensors. Fabricate 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 infrared sensors used for target acquisition.
(U)	$2,949	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 airborne laser warning sensor which can cue agile filter protection for aircrew or sensor protection.

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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
03 - Advanced Technology Development	0603270F Electronic Combat Technology	691X

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

(U)	$4,358	Develop countermeasure technology to defeat passive EO/IR aircraft tracking sensors and ordnance guidance. Initiate advanced technology demonstration program to detect and counter passive electro-optical and infrared tracking sensors. Complete preliminary design for a method to counter sensors beyond kinematic launch capability.
(U)	$9,231	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 Adv Dev Space Tech.
(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.