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

DATE: June 2001

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

	COST ($ in Thousands)	FY 2000 Actual	FY 2001 Estimate	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	34,163	26,636	28,221	29,559	30,794	31,130	30,528	31,153	Continuing	TBD
2432	Defensive System Fusion Technology	10,664	8,181	7,388	8,130	8,301	8,474	8,652	8,834	Continuing	TBD
431G	RF Warning & Countermeasures Tech	9,296	8,208	8,484	8,756	8,939	9,124	9,316	9,513	Continuing	TBD
691X	EO/IR Warning & Countermeasures Tech	14,203	10,247	12,349	12,673	13,554	13,532	12,560	12,806	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0	0

Note: FY 2003 - FY 2007 budget numbers do not reflect the DOD Strategy Review results.

(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 (EO), infrared (IR), and laser threats to aerospace platforms. Note: In FY 2001, Congress added $1.0 million for the Integrated Demonstrations and Applications Laboratory (IDAL) Coherent Command, Control, Communications, Navigation, and Identification (C3NI) Signal Simulations.

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

		FY 2000	FY 2001	FY 2002	Total Cost
(U)	Previous President's Budget (FY 2001 PBR)	31,947	25,882	26,161	
(U)	Appropriated Value	32,334	26,882		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions				
	b. Small Business Innovative Research	-762			
	c. Omnibus or Other Above Threshold Reprogram	-789			
	d. Below Threshold Reprogram	3,718			
	e. Rescissions	-338	-246		
(U)	Adjustments to Budget Years Since FY 2001 PBR			2,060	
(U)	Current Budget Submit/FY 2002 PBR	34,163	26,636	28,221	TBD

(U) Significant Program Changes:
Not Applicable.

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

DATE: June 2001

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 2432

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	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	10,664	8,181	7,388	8,130	8,301	8,474	8,652	8,834	Continuing	TBD

(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. In FY 2001, Congress added $1.0 million to integrate 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) FY 2000 ($ in Thousands)

(U)	$1,819	Developed low-cost technologies to demonstrate data fusion (e.g., threat, targeting, C2, etc.) from off-board and on-board sensors to enhance situational awareness in both new and existing aerospace platforms. Ground demonstrated optimized sensor fusion algorithms in a coalition environment.
(U)	$1,425	Developed, as part of an international cooperative effort, the combat information management technologies necessary to provide real-time situational awareness in a joint or coalition theater environment.
(U)	$3,142	Developed and investigated C2 warfare electronic attack (EA) techniques to suppress and counter adversary C2 networks. Completed a brassboard demonstration model. Conducted laboratory testing against modern digital C2 network links. Conducted EA laboratory testing and threat exploitation.
(U)	$1,353	Conducted evaluations and risk reduction demonstrations of defensive sensors and fusion of multiple information sources for situational awareness. Conducted technology survivability trade studies for advanced fighter applications.
(U)	$2,925	Developed man- and hardware-in-the-loop multispectral synthetic battlespace evaluation technology. Developed effective high fidelity capability for warfighter to assess new combat platform sensor technology, threat systems, and countermeasures in a virtual battlespace.
(U)	$10,664	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 2001 ($ in Thousands)

(U)	$1,914	Develop 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 (RTIC) effort, perform design of optimized sensor fusion algorithms and processor hardware for joint coalition platforms.
(U)	$3,365	Develop and investigate offensive counter information warfare technologies to disrupt and/or deny adversarial command and control (C2) nodes and networks. Continue threat exploitation. Conduct ground/field testing of brassboard against modern digital C2 network links. Design experimental hardware and software to counter adversarial communication and navigation systems.
(U)	$2,427	Conduct evaluations and risk reduction demonstrations of defensive sensors and fusion of multiple information sources for situational awareness. Conduct laboratory evaluations of receiver technology for advanced fighter applications. Integrate 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)	$475	Develop affordable threat alert technologies for combat aircraft to increase survivability against advanced, integrated radio frequency air defense systems. Conduct trade study analyses for techniques to defeat future threat radar guided missile systems.
(U)	$8,181	Total

(U) FY 2002 ($ in Thousands)

(U)	$1,350	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 situational awareness in both new and existing aerospace platforms. Continue bilateral development and lab integration of tactical processors and optimized sensor fusion algorithms as part of an international cooperative experiment.
(U)	$3,217	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)	$297	Conduct evaluations and risk reduction demonstrations of defensive sensors and fusion of multiple information sources for situational awareness. Conduct laboratory risk reduction evaluations/demonstrations which evolve/optimize sensor fusion algorithms for utilization on U.S./coalition tactical platforms that provide real-time threat situational awareness.
(U)	$2,524	Develop Advanced Tactical Targeting Technology in conjunction with the Defense Advanced Research Projects Agency (DARPA) for

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

Suppression of Enemy Air Defenses. Integrate and flight test brassboard units that triangulate threat emitter positions and provide targeting for precision guided munitions. (In FY 2001, this effort was performed in PE 0603203F, Project 69DF.)

(U) $7,388 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 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: June 2001

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 431G

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	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	9,296	8,208	8,484	8,756	8,939	9,124	9,316	9,513	Continuing	TBD

(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 2000 ($ in Thousands)

(U) $1,799 Developed low-cost advanced radar and RF emitter warning concepts and techniques. Fabricated a wideband digital receiver for affordable electronic support measures and radar warning receiver suites.

(U) $4,148 Developed wideband, multimode, multifunction apertures for electronic warfare applications. Fabricated an advanced antenna that improves gain by a factor of ten at half the cost of current designs.

(U) $3,349 Developed aerospace platform self-protection and support jamming technologies to counter advanced RF threats associated with current and future air defense weapon systems. Developed EC techniques to increase space system survivability. Laboratory tested a steerable high-power array. Demonstrated advanced monopulse angle jamming techniques.

(U) $9,296 Total

(U) FY 2001 ($ in Thousands)

(U) $1,499 Develop affordable radar and RF emitter warning concepts and techniques. Evaluate a wideband digital receiver for affordable electronic support measures and radar warning receiver suites.

(U) $3,543 Develop wideband, multimode, multifunction apertures for electronic warfare applications (i.e., threat detection, threat avoidance, suppression of enemy air defenses, surveillance, and reconnaissance). Integrate and chamber test multimode antenna to demonstrate a tenfold improvement in gain while providing a wide field of view and a low radar cross section.

(U) $3,166 Develop aerospace platform self-protection and support jamming technologies to counter advanced RF threats associated with current and future air defense weapon systems. Conduct laboratory evaluations of EC techniques to increase aerospace system survivability. Complete demonstration of a steerable high-power array. Design and develop a flight-worthy brassboard for monopulse angle jamming integrated electronic countermeasures. Build and demonstrate an advanced electronic protection breadboard.

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(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U) $8,208 Total

(U) FY 2002 ($ in Thousands)

(U) $2,545 Develop affordable radar and radio frequency (RF) emitter warning concepts and techniques. Develop affordable threat alert and jamming techniques 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 radar-guided missile systems. Complete requirements study and transition analysis, begin hardware and software development, and hold preliminary design review for an advanced digital threat warning and response capability.

(U) $1,952 Develop wideband, multimode, multifunction apertures for electronic warfare applications (i.e., threat detection, threat avoidance, suppression of enemy air defenses, 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) $3,987 Develop aerospace platform self-protection and support jamming technologies to counter advanced RF threats associated with current and future aerospace weapon systems. Conduct laboratory 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) $8,484 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 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: June 2001

BUDGET ACTIVITY: 03 - Advanced Technology Development

PE NUMBER AND TITLE: 0603270F Electronic Combat Technology

PROJECT: 691X

COST ($ in Thousands)		FY 2000 Actual	FY 2001 Estimate	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	14,203	10,247	12,349	12,673	13,554	13,532	12,560	12,806	Continuing	TBD

(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 2000 ($ in Thousands)

(U) $8,102 Developed on-board, closed-loop, laser infrared countermeasures (IRCM) for large aircraft to defeat current and future IR missiles in multiple scenarios. Conducted live fire aerial cable car testing at White Sands Missile Range.

(U) $2,188 Conducted in-house analyses of current and future IR threat missiles. Refined digital threat models. Developed countermeasure techniques for imaging IR missiles. Integrated a target simulator for imaging IR seekers.

(U) $1,405 Developed aerospace laser warning sensor technologies for timely alert and response to advanced laser acquisition/tracking sensors, including detecting and locating both high power (dazzle/damage) and low power (laser-guided ordnance) signals. Developed low-cost warning technologies for special operations, combat, and mobility aircrew protection.

(U) $2,508 Developed IR missile warning technologies to detect advanced, low signature threat missiles. Evaluated distributed aperture algorithms. Collected signature data on advanced IR threat missiles. Demonstrated real-time missile warning algorithms for low-cost, uncooled sensors.

(U) $14,203 Total

(U) FY 2001 ($ in Thousands)

(U) $4,224 Develop on-board, closed-loop, laser IRCM for large aircraft to defeat current and future IR missiles in multiple scenarios. Fabricate a flight-worthy closed-loop IRCM suite for demonstration on large aircraft.

(U) $1,298 Conduct in-house analyses of current and future IR threat missiles. Complete digital models of IR threat missiles. Simulate expendable countermeasure techniques for conventional and imaging IR missiles. Design combined effects expendables for tactical aircraft to defeat imaging IR missiles.

(U) $1,076 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. Conduct laboratory evaluation of ability of laser warning sensor technology to locate/identify laser hazards and cue appropriate response.

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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 2001 ($ in Thousands) Continued

(U)	$2,093	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. Evaluate multispectral imaging technology for missile warning and/or distributed aperture sensors.
(U)	$1,556	Develop countermeasure technology to defeat passive EO/IR aircraft tracking sensors and ordnance guidance. Investigate gimballess beam steering technologies to reduce weight and drag of countermeasure subsystems.
(U)	$10,247	Total

(U) FY 2002 ($ in Thousands)

(U)	$6,175	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)	$1,235	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)	$2,593	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 development of laser warning sensor technology for space situational awareness. 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)	$864	Develop EO/IR missile warning technologies to alert aircrews and aircraft self-protection systems to the approach of advanced, low-signature threats. Initiate development of multi-color warning technologies that improve threat detection and reduce declaration times in heavy clutter environments.
(U)	$1,482	Develop countermeasure technology to defeat passive EO/IR aircraft tracking sensors and ordnance guidance. Continue evaluation of 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)	$12,349	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	691X

(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 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.