

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

DATE

**February 2000**

BUDGET ACTIVITY

**03 - Advanced Technology Development**

PE NUMBER AND TITLE

**0603270F Electronic Combat Technology**

COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	25,434	31,947	25,882	26,161	27,363	28,060	28,663	Continuing	TBD
632432 Defensive System Fusion Technology	6,490	11,201	7,257	7,346	8,076	8,238	8,401	Continuing	TBD
63431G RF Warning & Countermeasures Tech	8,339	8,399	8,284	8,436	8,698	8,871	9,046	Continuing	TBD
63691X EO/IR Warning & Countermeasures Tech	10,605	12,347	10,341	10,379	10,589	10,951	11,216	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

**(U) A. Mission Description**

This program develops and demonstrates technologies to support critical Air Force electronic combat (EC) requirements. The focus is on the development of components, subsystems, and technologies that have potential application to satisfy aerospace combat, special operations, and airlift EC requirements and to reduce acquisition and life cycle costs of EC systems. The program develops and demonstrates: radio frequency; infrared; electro-optical; warning; and command, control, and communications countermeasure technologies for aerospace platforms. In addition, the program develops and demonstrates technologies and concepts for signature reduction, advanced electronic warfare transmitters and receivers, and effective power management. Technology demonstrations include flyable brassboards against validated threat simulators. This program ensures the Air Force will maintain demonstrated technology solutions to defeat both current and next generation threats. Note: In FY 2000, Congress added \$2.0 million for Closed Loop Infrared Countermeasures and \$3.0 million for a multispectral battlespace capability for the Integrated Demonstrations and Applications Laboratory.

**(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 electronic combat system developments that have military utility and address warfighter needs.

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DATE  
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BUDGET ACTIVITY	PE NUMBER AND TITLE
<b>03 - Advanced Technology Development</b>	<b>0603270F Electronic Combat Technology</b>

(U) <u>C. Program Change Summary (\$ in Thousands)</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>Total Cost</u>
(U) Previous President's Budget (FY 2000 PBR)	25,476	27,334	26,775	
(U) Appropriated Value	25,553	32,334		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-77			
b. Small Business Innovative Research	-792			
c. Omnibus or Other Above Threshold Reprogram		-175		
d. Below Threshold Reprogram	892			
e. Rescissions	-142	-212		
f. Other				TBD
(U) Adjustments to Budget Years Since FY 2000 PBR			-893	
(U) Current Budget Submit/FY 2001 PBR	25,434	31,947	25,882	TBD
(U) <u>Significant Program Changes:</u> Not Applicable.				

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000	
BUDGET ACTIVITY <b>03 - Advanced Technology Development</b>				PE NUMBER AND TITLE <b>0603270F Electronic Combat Technology</b>				PROJECT <b>632432</b>	
COST (\$ in Thousands)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
632432    Defensive System Fusion Technology	6,490	11,201	7,257	7,346	8,076	8,238	8,401	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            This project develops and demonstrates techniques and technologies for integrating electronic combat (EC) sensors and EC system fusion. It develops the 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. Included in these are: 1) advanced components and techniques needed to jam enemy radars; 2) advanced standoff jammer technologies; and 3) novel electronic collection methods to inform field commanders of changes in the electronic environment.</p>									
<p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p>									
(U) \$1,317	Developed low-cost technologies to demonstrate data fusion (e.g., threat, targeting, command and control, etc.) from off-board and on-board sensors to enhance situation awareness in both new and existing aerospace platforms. Optimized code. Completed preliminary design trade offs for candidate techniques and algorithms using commercial technology architectures.								
(U) \$5,173	Developed and investigated C2 warfare electronic attack (EA) techniques to suppress and counter adversary C2 networks. Designed critical hardware/software components for denying modern digital C2 network links. Prepared to test designs against advanced telemetry links.								
(U) \$6,490	Total								
<p>(U) <b><u>FY 2000 (\$ in Thousands)</u></b></p>									
(U) \$1,867	Develop low-cost technologies to demonstrate data fusion (e.g., threat, targeting, C2, etc.) from off-board and on-board sensors to enhance situation awareness in both new and existing aerospace platforms. Ground demonstrate optimized sensor fusion algorithms in a coalition environment.								
(U) \$1,473	Develop, as part of an international cooperative effort, the combat information management technologies necessary to provide real-time situation awareness in a joint or coalition theater environment.								
(U) \$3,487	Develop and investigate C2 warfare EA techniques to suppress and counter adversary C2 networks. Complete a brassboard demonstration model. Conducting laboratory testing against modern digital C2 network links. Conduct EA laboratory testing and threat exploitation.								
(U) \$1,401	Conduct evaluations and risk reduction demonstrations of defensive sensors and fusion of multiple information sources for situational awareness. Conduct technology survivability trade studies for advanced fighter applications.								
(U) \$2,973	Develop man- and hardware-in-the-loop multispectral synthetic battlespace evaluation technology. Develop effective high fidelity capability for warfighter to assess new combat platform sensor technology, threat systems, and countermeasures in a virtual battlespace.								
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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE
BUDGET ACTIVITY		PROJECT
<b>03 - Advanced Technology Development</b>	<b>0603270F Electronic Combat Technology</b>	<b>February 2000</b> <b>632432</b>
(U) <b><u>A. Mission Description Continued</u></b>		
(U) <b><u>FY 2000 (\$ in Thousands) Continued</u></b>		
(U) \$11,201	Total	
(U) <b><u>FY 2001 (\$ in Thousands)</u></b>		
(U) \$1,923	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 into the Cockpit (RTIC) effort, perform design and initial lab integration of optimized sensor fusion algorithms and processor hardware for joint coalition platforms.	
(U) \$3,432	Develop and investigate offensive counter information warfare technologies to disrupt and/or deny adversarial C2 nodes and networks. Continue threat exploitation. Conduct ground/field testing of brassboard against modern digital C2 network links. Design experimental hardware/software to counter adversarial communication and navigation systems.	
(U) \$1,427	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.	
(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) \$7,257	Total	
(U) <b><u>B. Project Change Summary</u></b>		
	Not Applicable.	
(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b>		
(U)	Related Activities:	
(U)	PE 0602204F, 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) <b><u>D. Acquisition Strategy</u></b>		
	Not Applicable.	
(U) <b><u>E. Schedule Profile</u></b>		
(U)	Not Applicable.	
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BUDGET ACTIVITY <b>03 - Advanced Technology Development</b>				PE NUMBER AND TITLE <b>0603270F Electronic Combat Technology</b>				PROJECT <b>63431G</b>		
COST (\$ in Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
63431G	RF Warning & Countermeasures Tech	8,339	8,399	8,284	8,436	8,698	8,871	9,046	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            This project develops and demonstrates advanced technologies for radio frequency (RF) electronic combat (EC) suites to enhance survivability of aerospace vehicles and to provide crew situation awareness. One major area addressed covers technologies for missile/threat warning, radar frequency 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 novel electronic countermeasures (ECM) techniques as well as advanced ECM technologies such as antennas, power amplifiers, preamplifiers, etc.</p>										
<p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p>										
(U)	\$2,530	Developed low-cost advanced radar and RF emitter warning concepts and techniques. Completed preliminary design for a wideband digital receiver for affordable electronic support measures and radar warning receiver suites. Completed a design for an advanced antenna that improves gain by a factor of ten at half the cost of current designs.								
(U)	\$5,809	Developed aircraft self-protection and support jamming technologies to counter advanced RF threats associated with current and future air defense weapon systems. Developed and demonstrated monopulse angle jamming electronic countermeasures. Developed steerable high-power arrays. Completed design trade offs for affordable improvements to existing ECM suites. Developed multifunction, compact, modular ECM jamming technology.								
(U)	\$8,339	Total								
<p>(U) <b><u>FY 2000 (\$ in Thousands)</u></b></p>										
(U)	\$1,500	Develop low-cost advanced radar and RF emitter warning concepts and techniques. Fabricate a wideband digital receiver for affordable electronic support measures and radar warning receiver suites.								
(U)	\$3,849	Develop wideband, multimode, multifunction apertures for electronic warfare applications. Fabricate an advanced antenna that improves gain by a factor of ten at half the cost of current designs.								
(U)	\$3,050	Develop aerospace platform self-protection and support jamming technologies to counter advanced RF threats associated with current and future air defense weapon systems. Develop EC techniques to increase space system survivability. Laboratory test a steerable high-power array. Demonstrate advanced monopulse angle jamming techniques.								
(U)	\$8,399	Total								
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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>03 - Advanced Technology Development</b>	<b>0603270F Electronic Combat Technology</b>	<b>63431G</b>
(U) <b><u>A. Mission Description Continued</u></b>		
(U) <b><u>FY 2001 (\$ in Thousands)</u></b>		
(U) \$1,508	Develop affordable radar and radio frequency (RF) emitter warning concepts and techniques. Evaluate a wideband digital receiver for affordable electronic support measures and radar warning receiver suites.	
(U) \$3,610	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 electronic combat 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.	
(U) \$8,284	Total	
(U) <b><u>B. Project Change Summary</u></b>		
	Not Applicable.	
(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b>		
(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) <b><u>D. Acquisition Strategy</u></b>		
	Not Applicable.	
(U) <b><u>E. Schedule Profile</u></b>		
(U) Not Applicable.		
Project 63431G	Page 6 of 9 Pages	Exhibit R-2A (PE 0603270F)

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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000		
BUDGET ACTIVITY <b>03 - Advanced Technology Development</b>				PE NUMBER AND TITLE <b>0603270F Electronic Combat Technology</b>				PROJECT <b>63691X</b>		
COST (\$ in Thousands)		FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
63691X	EO/IR Warning & Countermeasures Tech	10,605	12,347	10,341	10,379	10,589	10,951	11,216	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            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. Countermeasure capability against advanced EO, IR, and laser-guided threats are vital for aerospace platform survival in wartime and peacetime.</p> <p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p> <p>(U) \$6,978      Developed on-board, closed-loop, laser-based infrared countermeasure technology and off-board (active decoy) technology to defeat current and future IR missiles in multiple scenarios. Tower tested threat-adaptable, laser-based jamming codes. Designed flight-worthy closed-loop laser infrared countermeasures (IRCM) hardware for flight demonstrations in a C-17 or other large aircraft.</p> <p>(U) \$736      Conducted in-house experiments to analyze current and future IR threat missiles. Developed digital threat models of threat IR missiles. Validated countermeasure techniques for conventional IR missiles. Developed a target simulator for imaging IR seekers.</p> <p>(U) \$1,983      Developed aerospace laser warning and countermeasure technologies necessary to defeat advanced laser acquisition/tracking sensors on threat air defense systems, including detecting and locating both high power (dazzle/damage) and low-power (laser guided ordinance) signals and threat modeling technologies to counter dual-mode missile seekers.</p> <p>(U) \$908      Developed IR missile warning technologies to detect advanced, low signature threat missiles. Developed distributed aperture algorithms and clutter rejection techniques.</p> <p>(U) \$10,605      Total</p> <p>(U) <b><u>FY 2000 (\$ in Thousands)</u></b></p> <p>(U) \$7,636      Develop on-board, closed-loop, laser IRCM for large aircraft to defeat current and future IR missiles in multiple scenarios. Conduct live fire aerial cable car testing at White Sands Missile Range. Fabricate a flight-worthy closed-loop IRCM suite for demonstration on C-17 or other large aircraft.</p> <p>(U) \$1,725      Conduct in-house analyses of current and future IR threat missiles. Refine digital threat models. Develop countermeasure techniques for imaging IR missiles. Integrate a target simulator for imaging IR seekers.</p> <p>(U) \$942      Develop aerospace laser warning sensor technologies for timely alert and response to advanced laser acquisition/tracking sensors, including</p>										
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BUDGET ACTIVITY <b>03 - Advanced Technology Development</b>		PROJECT <b>63691X</b>
PE NUMBER AND TITLE <b>0603270F Electronic Combat Technology</b>		DATE <b>February 2000</b>
(U)	<b><u>A. Mission Description Continued</u></b>	
(U)	<b><u>FY 2000 (\$ in Thousands) Continued</u></b>	
	detecting and locating both high power (dazzle/damage) and low power (laser guided ordnance) signals. Develop low-cost warning technologies for special operations, combat, and mobility aircrew protection.	
(U)	\$2,044	Develop infrared (IR) missile warning technologies to detect advanced, low signature threat missiles. Evaluate distributed aperture algorithms. Collect data. Demonstrate real-time missile warning algorithms for low-cost, uncooled sensors.
(U)	\$12,347	Total
(U)	<b><u>FY 2001 (\$ in Thousands)</u></b>	
(U)	\$4,307	Develop on-board, closed-loop, laser infrared countermeasures (IRCM) for large aircraft to defeat current and future IR missiles in multiple scenarios. Integrate and flight test closed-loop IRCM technology on a C-17 or other large aircraft.
(U)	\$1,309	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.
(U)	\$2,093	Develop electro-optical (EO) and 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)	\$10,341	Total
(U)	<b><u>B. Project Change Summary</u></b>	
	Not Applicable.	
(U)	<b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b>	
(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.	
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BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>03 - Advanced Technology Development</b>	<b>0603270F Electronic Combat Technology</b>	<b>63691X</b>
<p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b></p> <p>(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.</p> <p>(U) <b><u>D. Acquisition Strategy</u></b></p> <p>Not Applicable.</p> <p>(U) <b><u>E. Schedule Profile</u></b></p> <p>(U) Not Applicable.</p>		
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