

UNCLASSIFIED

PE NUMBER: 0603270F

PE TITLE: Electronic Combat Technology

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2007
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BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603270F Electronic Combat Technology
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Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	32.247	28.528	23.743	21.287	23.832	25.862	26.376	26.939	Continuing	TBD
2432 Defensive System Fusion Technology	7.367	5.163	5.398	5.943	6.931	7.862	8.908	7.293	Continuing	TBD
431G RF Warning & Countermeasures Tech	9.264	9.352	7.743	6.862	8.460	7.774	7.043	9.007	Continuing	TBD
691X EO/IR Warning & Countermeasures Tech	15.616	14.013	10.602	8.482	8.441	10.226	10.425	10.639	Continuing	TBD

(U) A. Mission Description and Budget Item Justification

This program develops and demonstrates technologies to support Air Force electronic combat (EC) warfighting capabilities. 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 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 2007 Congress added \$1.0 million for RAPCEval; \$1.9 million for Affordable Visible Missile Warning System; and \$1.3 million for BLADES. 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)

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	33.342	24.436	24.857	26.978
(U) Current PBR/President's Budget	32.247	28.528	23.743	21.287
(U) Total Adjustments	-1.095			
(U) Congressional Program Reductions				
Congressional Rescissions	-0.002	-0.108		
Congressional Increases		5.200		
Reprogrammings	-0.353	-1.000		
SBIR/STTR Transfer	-0.740			

(U) Significant Program Changes:

Not Applicable.

C. Performance Metrics

Exhibit R-2, RDT&E Budget Item Justification

DATE

February 2007

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603270F Electronic Combat Technology

Under Development.

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification

DATE
February 2007

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 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
2432 Defensive System Fusion Technology	7.367	5.163	5.398	5.943	6.931	7.862	8.908	7.293	Continuing	TBD
Quantity of RDT&E Articles	0	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 warfare (C2W), stand off 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 stand off jammer technologies; and electronic collection methods to inform field commanders of changes in the electronic environment.

(U) B. Accomplishments/Planned Program (\$ in Millions)

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and investigate offensive counter information warfare technologies to disrupt and deny hostile command and control nodes and networks. Note: This effort completes in FY 2006.	0.850	0.000	0.000	0.000
(U) In FY 2006: Completed the electronic attack (EA)/electronic support (ES) system integration. Conducted laboratory and field tests of the countermeasure system to verify the capability to counter high-speed, wideband data communication links utilized by multiple ground-based and airborne platforms. Developed an integrated, networked approach to disrupt and deny current and future integrated air defense systems.				
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) MAJOR THRUST: Develop and integrate advanced sensor receiver and processing technologies. Note: This effort completes in FY 2007.	0.574	0.698	0.000	0.000
(U) In FY 2006: Performed risk reduction for defensive sensors using multiple information sources for situational awareness in the Integrated Demonstrations and Applications Laboratory (IDAL). Conducted IDAL laboratory risk reduction evaluations and demonstrations that evolve and optimize network EA techniques on disparate platforms. Conducted IDAL laboratory demonstrations of advanced digital receiver and processor technologies that provide the warfighter with multispectral warning, identification, and threat response for current and next generation aerospace platforms.				

Exhibit R-2a, RDT&E Project Justification

DATE

February 2007

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) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2006FY 2007FY 2008FY 2009

(U) In FY 2007: Complete risk reduction for defensive sensors using multiple information sources for situational awareness in the IDAL. Complete IDAL laboratory risk reduction evaluations and demonstrations that evolve and optimize network EA techniques on disparate platforms. Perform demonstrations of advanced multiplatform digital receiver and processor technologies that provide the warfighter with multispectral warning, identification, and threat response for current and next generation aerospace platforms.

(U) In FY 2008: Not Applicable.

(U) In FY 2009: Not Applicable.

(U)

(U) MAJOR THRUST: Develop affordable radio frequency (RF) and electro-optical (EO) emitter warning concepts and techniques. Develop techniques for coordination and management of multiple jamming nodes against integrated air defense systems (IADS). Conduct integrated electronic warfare (EW)/ information operations (IO) simulations and demonstrations for integrated air defense systems (IADS) deception and defeat.

4.016

4.465

5.398

5.943

(U) In FY 2006: Designed and initiated demonstration of advanced threat alert and jamming subsystem for combat aircraft to increase survivability against advanced, integrated RF, EO, and infrared (IR) air defense systems. Performed initial flight tests to select advanced jamming techniques for a significantly improved digital threat warning and response capability.

(U) In FY 2007: Complete engineering model demonstration of advanced threat alert and jamming subsystem for combat aircraft to increase survivability against advanced, integrated RF, EO, and IR air defense systems. Perform final flight tests to validate advanced jamming techniques for a significantly improved digital threat warning and response capability.

(U) In FY 2008: Complete maturation demonstration of advanced threat alert and jamming subsystem for combat aircraft to increase survivability against advanced, integrated RF, EO, and IR air defense systems. Investigate electronic warfare (EW) battle management strategies and technical protocols for control of multiple jamming nodes working in coordination against an IADS in the overall context of non-traditional intelligence, surveillance, and reconnaissance and strike operations. Develop and demonstrate technical protocols for the integration of EW, C2W, and IO operations against an IADS.

(U) In FY 2009: Conduct analyses and initial demonstrations of EW battle management strategies in the IDAL and VCL simulation facilities. Continue to develop and demonstrate technical protocols for the integration of EW, C2W, and IO operations against an IADS.

Exhibit R-2a, RDT&E Project Justification	DATE February 2007
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BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603270F Electronic Combat Technology	PROJECT NUMBER AND TITLE 2432 Defensive System Fusion Technology
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(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) CONGRESSIONAL ADD: Advanced Threat Alert ATD (Advanced Technology Demonstration) - Technology Insertion.	1.927	0.000	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for Advanced Threat Alert ATD - Technology Insertion.				
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) Total Cost	7.367	5.163	5.398	5.943

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
		<u>Actual</u>	<u>Estimate</u>	<u>Complete</u>							
(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 21 process to harmonize efforts and eliminate duplication.											
(U) <u>D. Acquisition Strategy</u>											
Not Applicable.											

Exhibit R-2a, RDT&E Project Justification

DATE
February 2007

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 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
431G RF Warning & Countermeasures Tech	9.264	9.352	7.743	6.862	8.460	7.774	7.043	9.007	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

(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)

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(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). Note: This effort completes in FY 2008.	1.565	1.557	1.165	0.000
(U) In FY 2006: Designed and fabricated critical aperture and receiver subsystems for an efficient, low frequency, wide band aperture compatible with unmanned aerial vehicle (UAV) platforms.				
(U) In FY 2007: Test critical subsystems of an efficient, low frequency, wide band aperture, and fabricate array compatible with UAV platforms.				
(U) In FY 2008: Complete integration and test of an array compatible with UAV platforms.				
(U) In FY 2009: Not Applicable.				
(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. Develop coordinated, multi-player radar jamming techniques for deception and neutralization of early warning and surveillance networks to enable all-platform operations in defended adversary airspace. Develop new electronic attack (EA) techniques fusing advanced digital signal processing receivers with digital technique generators.	5.771	6.799	6.578	6.862
(U) In FY 2006: Developed self-protection countermeasures effective against fourth generation surface-to-air missile systems. Developed and conducted laboratory evaluations of advanced countermeasures techniques and technology to defeat an advanced integrated air defense system (IADS). Laboratory- and field-tested innovative, networked RF countermeasure techniques against advanced				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007			
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE			
03 Advanced Technology Development (ATD)	0603270F Electronic Combat Technology	431G RF Warning & Countermeasures Tech			
(U) B. Accomplishments/Planned Program (\$ in Millions)		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
target engagement radars. Developed anti-jam techniques and technologies for advanced RF sensor systems. Demonstrated a lightweight, low-profile, multi-function, active electronically scanned array on an airborne test bed. Analyzed data from flight test and predicted system performance using advanced computational techniques.					
(U) In FY 2007: Continue developing self-protection countermeasures effective against advanced future surface-to-air missile systems. Complete laboratory and field-testing of innovative, networked RF countermeasure techniques against advanced target engagement radars. Complete development of advanced countermeasures techniques and technology to defeat an advanced IADS. Continue developing anti-jam techniques and technologies for advanced RF sensor systems. Complete demonstration of electronic support cross-cueing capabilities of a multi-intelligence sensor suite including the effects of electromagnetic interference and platform compatibility to provide precision location and identification with increased probability of intercept.					
(U) In FY 2008: Provide hardware simulation and analysis support to multi-intelligence sensor needs for accurate and timely electronic surveillance information. Conduct threat research, simulation, and analysis of early warning radar characteristics. Develop multiple technical strategies and techniques for deceiving early warning radars in a network enabled operational environment. Develop advanced simulation capabilities to support network enabled jamming of adversary early warning and surveillance networks. Develop and evaluate integrated digital receiver/jammer architectures.					
(U) In FY 2009: Continue to provide hardware simulation and analysis support to multi-intelligence sensor needs for accurate and timely electronic surveillance information. Develop advanced radar jamming engineering models including technique generators, wide band amplifier modules and apertures, needed to conduct network enabled research and evaluation of countermeasure techniques. Continue to develop advanced simulation capabilities to support network enabled jamming of adversary early warning and surveillance networks. Continue to develop and evaluate integrated digital receiver/jammer architectures.					
(U)					
(U) CONGRESSIONAL ADD: Electronic Combat Battle Management.		0.964	0.000	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for Electronic Combat Battle Management.					
(U) In FY 2007: Not Applicable.					
(U) In FY 2008: Not Applicable.					
(U) In FY 2009: Not Applicable.					

Exhibit R-2a, RDT&E Project Justification	DATE February 2007
--	------------------------------

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603270F Electronic Combat Technology	PROJECT NUMBER AND TITLE 431G RF Warning & Countermeasures Tech
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(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U)				
(U) CONGRESSIONAL ADD: Receiver and Processing Concepts Evaluation (RAPCEval).	0.964	0.996	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for RAPCEval.				
(U) In FY 2007: Conduct Congressionally-directed effort for RAPCEval.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) Total Cost	9.264	9.352	7.743	6.862

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to Complete</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>								
(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 21 process to harmonize efforts and eliminate duplication.										
(U) <u>D. Acquisition Strategy</u>										
Not Applicable.										

Exhibit R-2a, RDT&E Project Justification

DATE
February 2007

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 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
691X EO/IR Warning & Countermeasures Tech	15.616	14.013	10.602	8.482	8.441	10.226	10.425	10.639	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

(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, multispectral 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)

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Analyze the vulnerabilities of current IR missile systems and future imaging IR sensors. Note: Increased funding in FY 2006 supported field demonstration of cooperative techniques and expendable decoys with modified spatial and kinematic properties for countering IR missiles.	4.197	2.104	1.905	1.539
(U) In FY 2006: Conducted in-house analyses on IR-guided missile and future imaging IR sensor susceptibilities. Evaluated countermeasure techniques for countering multiple types of missiles and imaging IR sensors.				
(U) In FY 2007: Continue conducting in-house analyses on IR guided missiles and future imaging IR sensor susceptibilities. Further evaluate countermeasure techniques for countering multiple types of missiles and imaging IR sensors. Conduct digital simulations to assess the effectiveness of spatial decoy techniques against imaging IR missiles under flyout conditions. Assess proposed advanced countermeasure techniques to defeat imaging IR sensors.				
(U) In FY 2008: Conclude in-house analyses on IR guided missiles and future imaging IR sensor susceptibilities. Further evaluate countermeasure techniques for countering multiple types of missiles and imaging IR sensors. Identify optimal countermeasure techniques to defeat single color imaging IR sensors.				
(U) In FY 2009: Perform laboratory analyses on future IR guided missile capabilities. Assess effectiveness of current and planned techniques against new threat trends and direction of future countermeasure technique requirements. Conduct digital simulations to assess effectiveness of expendable and laser countermeasure techniques.				
(U) MAJOR THRUST: Develop aerospace laser warning sensor technologies for timely alert to advanced	1.953	1.840	1.536	1.709

Exhibit R-2a, RDT&E Project Justification

DATE

February 2007

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) B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
laser acquisition/tracking sensors, including detecting and locating both high power (dazzle/damage) and low power (laser-guided ordnance) signals.				
(U) In FY 2006: Developed advanced laser warning receivers for aircraft. Developed laser warning sensor technologies to address emerging laser threats. Developed laser warning sensor packages for integration into UAVs and NVGs.				
(U) In FY 2007: Initiate development of an advanced laser warning receiver for integration into tactical aircraft. Continue developing laser warning sensor technologies to address emerging laser threats. Initiate miniature laser warning for personnel protection.				
(U) In FY 2008: Continue developing laser warning sensors to address emerging laser threats. Develop miniaturized laser warning sensors. Fabricate compact device for personnel protection. Demonstrate capability to geolocate laser threats for enhanced situational awareness.				
(U) In FY 2009: Continue developing laser warning sensors to address emerging laser threats. Continue development of miniaturized laser warning sensors. Fabricate sensor for sensor and eye protection cueing. Demonstrate capability to cue agile filters for optimized protection against advanced laser threats.				
(U) MAJOR THRUST: Develop a countermeasure technology to defeat passive EO and IR aircraft tracking sensors and ordnance guidance.	2.897	5.955	5.592	5.234
(U) In FY 2006: Completed development of testbed to locate and counter passive threats before threats can develop a fire control solution. Conducted field demonstration over extended ranges to demonstrate capability.				
(U) In FY 2007: Continue field tests to locate and counter passive threats before threats can develop a fire control solution. Initiate development of a tower demonstration system. Demonstrate capability to scan wide field of regard and locate passive surveillance sensors in real time.				
(U) In FY 2008: Complete field tests to locate and counter passive threats before threats can develop fire control solution. Complete tower demonstration system development and conduct experiments over 2 km range. Evaluate effectiveness of countermeasure techniques against night vision devices and other passive surveillance sensors.				
(U) In FY 2009: Initiate development of affordable, lightweight infrared countermeasures capability combining passive surveillance and missile defeat techniques for tactical aircraft. Initiate design of a compact system to geolocate and identify threats.				

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2007			
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE			
03 Advanced Technology Development (ATD)	0603270F Electronic Combat Technology	691X EO/IR Warning & Countermeasures Tech			
(U) B. Accomplishments/Planned Program (\$ in Millions)		<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(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. Note: This effort completes in FY 2008.		0.882	0.926	1.569	0.000
(U) In FY 2006: Performed integration of subsystem components into affordable visible missile warning system (AVMWS). Performed test and evaluation of AVMWS. Coordinated AVMWS development with the Affordable Laser Infrared Survivability System countermeasure system.					
(U) In FY 2007: Complete test and evaluation of AVMWS.					
(U) In FY 2008: Characterize sensor performance in varied background clutter. Identify maximum detection ranges for high priority threat missiles.					
(U) In FY 2009: Not Applicable.					
(U)					
(U) CONGRESSIONAL ADD: Detect and Avoid for UAVs.		1.349	0.000	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for Detect and Avoid for UAVs.					
(U) In FY 2007: Not Applicable.					
(U) In FY 2008: Not Applicable.					
(U) In FY 2009: Not Applicable.					
(U)					
(U) CONGRESSIONAL ADD: Infrared Countermeasures Electronics Improvement Program.		0.965	0.000	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for the Infrared Countermeasures Electronics Improvement Program.					
(U) In FY 2007: Not Applicable.					
(U) In FY 2008: Not Applicable.					
(U) In FY 2009: Not Applicable.					
(U)					
(U) CONGRESSIONAL ADD: Affordable Visible Missile Warning System.		2.024	1.893	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for the Affordable Visible Missile Warning System.					
(U) In FY 2007: Conduct Congressionally-directed effort for the Affordable Visible Missile Warning System.					
(U) In FY 2008: Not Applicable.					

Exhibit R-2a, RDT&E Project Justification

DATE
February 2007

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
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(U) B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Battlefield Laser Detection System (BLADES).	1.349	1.295	0.000	0.000
(U) In FY 2006: Conducted Congressionally-directed effort for BLADES.				
(U) In FY 2007: Conduct Congressionally-directed effort for BLADES.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) Total Cost	15.616	14.013	10.602	8.482

(U) C. Other Program Funding Summary (\$ in Millions)	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Complete</u>							
(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 21 process to										
harmonize efforts and										
eliminate duplication.										

Exhibit R-2a, RDT&E Project Justification

DATE

February 2007

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) D. Acquisition Strategy

Not Applicable.