

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)								DATE February 2000	
BUDGET ACTIVITY 02 - Applied Research				PE NUMBER AND TITLE 0602204F Aerospace Sensors					
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	61,336	63,922	65,644	69,294	74,066	79,203	81,070	Continuing	TBD
622000 Electronic Countermeasures Technology	14,555	15,862	0	0	0	0	0	Continuing	TBD
622001 Electro-Optical Technology	448	492	0	0	0	0	0	Continuing	TBD
622002 Electronic Component Technology	8,820	6,900	17,406	16,494	16,910	16,919	17,249	Continuing	TBD
622003 EO Sensors & Countermeasures Tech	9,026	9,330	11,855	13,967	15,888	18,195	18,225	Continuing	TBD
626095 Sensor Fusion Technology	11,008	11,859	13,312	14,325	14,821	15,798	16,063	Continuing	TBD
626096 Microelectronics Technology	8,840	10,612	0	0	0	0	0	Continuing	TBD
627622 RF Sensors & Countermeasures Tech	8,639	8,867	23,071	24,508	26,447	28,291	29,533	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0

Note: In FY 2001 and out, work performed under Project 622000 moves to Projects 622002, 622003, and 627622. Project 622001 work moves to Project 622003. Project 626096 work moves to Project 622002. Portions of work previously performed in PE 0602702F, Project 624506 move to this PE, Project 627622. Apparent project ramps are due only to realignment of the projects. This realignment aligns projects with the Air Force Research Laboratory organization. Project realignment does not affect work planned for the overall program element or the budget topline.

(U) **A. Mission Description**  
 This program develops the technology base for Air Force aerospace sensors. Advances in aerospace sensors are required to increase combat effectiveness by providing 'anytime, anywhere' surveillance, reconnaissance, precision targeting, and electronic warfare capabilities. These advances will also reduce life cycle costs, facilitate affordable modernization of aging and future aerospace platforms, and provide protection against emerging hostile threats. Meeting these needs necessitates simultaneous advances in multiple, interrelated disciplines including: Radio frequency (RF) sensors (e.g., radar, threat warning, jamming); electro-optical (EO) sensors (e.g., laser countermeasures, ladars, forward looking infrared, hyperspectral imagers); multi-function high-power electronic devices; target detection, classification, and

UNCLASSIFIED

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

DATE  
**February 2000**

<b>BUDGET ACTIVITY</b> <b>02 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602204F Aerospace Sensors</b>
--	---

(U) **A. Mission Description Continued**  
 recognition; fire control; sensor fusion; communication and navigation subsystems; and electronic warfare. Note: In FY 2000, Congress added \$3.0 million for Collaboration Infrastructure, \$1.4 million for Space Protection, and \$1.8 million for Automatic Target Recognition.

(U) **B. Budget Activity Justification**  
 This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary sensor, electronics, and electronic combat technologies.

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

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>Total Cost</u>
(U) Previous President's Budget (FY 2000 PBR)	63,719	64,988	69,245	
(U) Appropriated Value	65,549	64,331		
(U) Adjustments to Appropriated Value				
a. Congressional/General Reductions	-1,830	-42		
b. Small Business Innovative Research	-902			
c. Omnibus or Other Above Threshold Reprogram		-225		
d. Below Threshold Reprogram	-1,139			
e. Rescissions	-342	-142		
f. Other				
(U) Adjustments to Budget Years Since FY 2000 PBR			-3,601	
(U) Current Budget Submit/FY 2001 PBR	61,336	63,922	65,644	TBD

(U) **Significant Program Changes:**  
 Changes to this program since the previous President's Budget are due to higher priorities within the Science and Technology (S&T) Program.

**UNCLASSIFIED**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000		
BUDGET ACTIVITY <b>02 - Applied Research</b>				PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>				PROJECT <b>622000</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
622000	Electronic Countermeasures Technology	14,555	15,862	0	0	0	0	0	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            This program determines the feasibility of active and passive electronic countermeasure technologies and explores, develops, expands, and refines the most promising and cost-effective candidates. Technologies pursued support passive sensing of the entire electromagnetic spectrum to improve signal collection, detection, recognition, analysis, identification, location, and countering of enemy electronic emissions whether intentional or unintentional. This project also includes development of countermeasure concepts against radar, infrared (IR), and electro-optical threat weapon systems as well as against networks for communication, command, and control. Various links and sensors of threat air defense systems are analyzed and a database of countermeasure techniques and technologies is generated from which specific self-protection or support countermeasures equipment can be developed. Specifically, the program exploits emerging technologies to provide increased capability for: 1) radar warning, radio frequency (RF) electronic warfare, and electronic intelligence applications; 2) IR detection for passive missile warning, IR signature exploitation, and IR countermeasures; 3) laser detection for threat warning and countermeasures; 4) passive and combined passive/active off-board expendables (chaff, decoys, etc.); and 5) hardware and software for associated processing and technology integration needs. Advanced countermeasure capabilities are vital for survival of operational aerospace platforms facing future threats in hostile environments.</p>										
<p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p>										
(U)	\$3,332	Developed countermeasure technologies for on-board and off-board (active IR decoys) to counter IR-guided missiles and electro-optic threats. Evaluated techniques against imaging missile seekers. Developed cooperative jammer and decoy concepts. Demonstrated night vision device countermeasure concepts.								
(U)	\$2,663	Developed affordable RF jamming technology and concepts to degrade enemy radar, missile, and command and control systems. Completed covert featureless waveform study. Developed advanced deception countermeasures techniques. Developed techniques for degrading enemy modern communication networks. Evaluated RF countermeasure techniques in the laboratory.								
(U)	\$510	Developed off-board (expendable) RF and combined IR/RF countermeasure concepts. Developed design tools and analytic methods to predict effectiveness of advanced decoys.								
(U)	\$2,081	Developed technology for generic software modules to enable low-cost block upgrades to electronic warfare receivers. Tested combined de-interleaving, correlation, and threat identification software modules.								
(U)	\$4,675	Developed affordable antenna technology for use in operational and future aircraft. Demonstrated first wideband digital receiver. Developed new techniques for wideband to narrowband cueing. Investigated electromagnetic characterization of and demonstrated dual-use conformal array technology.								
Project 622000		Page 3 of 22 Pages				Exhibit R-2A (PE 0602204F)				

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE
BUDGET ACTIVITY		PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>February 2000</b> <b>622000</b>
(U)	<u><b>A. Mission Description Continued</b></u>	
(U)	<u>FY 1999 (\$ in Thousands) Continued</u>	
(U)	\$1,294	Developed missile and laser warning technology to accurately cue countermeasures and improve survivability. Developed laser warning techniques. Evaluated infrared (IR) clutter rejection techniques.
(U)	\$14,555	Total
(U)	<u>FY 2000 (\$ in Thousands)</u>	
(U)	\$3,508	Develop countermeasure technologies against IR-guided missiles and electro-optical threats. Continue evaluating techniques against imaging missile seekers and demonstrating cooperative jammer and decoy concepts. (In FY 2001, this work will transfer to Project 622003.)
(U)	\$2,991	Develop affordable radio frequency (RF) jamming technology and concepts that enhance aircraft survivability by degrading enemy radar, missile, and command and control systems. Complete evaluation of alternative methods for covert featureless waveform detection. Optimize advanced deceptive countermeasure techniques. Continue to develop techniques for degrading enemy modern communication networks. (In FY 2001, this work will transfer to Project 627622.)
(U)	\$475	Develop off-board (expendable) RF and combined IR/RF countermeasure concepts for affordable survivability. Demonstrate countermeasure effectiveness of advanced decoys against dual-mode missile seekers. (In FY 2001, this work will transfer to Project 622003.)
(U)	\$2,325	Develop technology for generic software modules to enable low-cost block upgrades to electronic warfare (EW) receivers. Complete tests of combined de-interleaving correlation and threat identification software modules for aerospace EW receivers. (In FY 2001, this work will transfer to Project 627622.)
(U)	\$3,029	Develop affordable RF receiver technology for use in operational and future EW receivers. Continue to demonstrate a wideband digital receiver brassboard. Evaluate narrowband receiver technology. Develop wideband analog-to-digital circuits. (In FY 2001, this work will transfer to Project 622002.)
(U)	\$2,042	Develop affordable antenna technology for use in operational and future aerospace platform electronic receivers and apertures. Develop low-frequency direction-finding antennas. Demonstrate advanced pattern control of multimode/multifunction antennas. Demonstrate phase shifters and transmit/receive module technology. (In FY 2001, this work will transfer to Project 627622.)
(U)	\$1,492	Develop aerospace missile and laser warning technologies to accurately cue countermeasures. Devise laser warning discrimination methods. Assess hyperspectral imaging technology for missile warning. Demonstrate infrared clutter rejection techniques. (In FY 2001, this work will transfer to Project 622003.)
(U)	\$15,862	Total
Project 622000		Exhibit R-2A (PE 0602204F)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>February 2000</b> <b>622000</b>
<p>(U) <b><u>A. Mission Description Continued</u></b></p> <p>(U) <b><u>FY 2001 (\$ in Thousands)</u></b></p> <p>(U) \$0 Efforts transferred to Projects 622002, 622003, and 627622.</p> <p>(U) \$0 Total</p> <p>(U) <b><u>B. Project Change Summary</u></b> Not Applicable.</p> <p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b></p> <p>(U) Related Activities:</p> <p>(U) PE 0603270F, Electronic Combat Technology.</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> Not Applicable.</p> <p>(U) <b><u>E. Schedule Profile</u></b> Not Applicable.</p>		
Project 622000	Page 5 of 22 Pages	Exhibit R-2A (PE 0602204F)

**UNCLASSIFIED**

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)</b>							DATE <b>February 2000</b>		
BUDGET ACTIVITY <b>02 - Applied Research</b>				PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>				PROJECT <b>622001</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
622001 Electro-Optical Technology	448	492	0	0	0	0	0	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>                      This project focuses on the development of military unique and essential devices and components for aerospace optical sensing, optical processing, and integration of electro-optical (EO) technology into avionics sensor systems. EO technologies provide faster, more accurate detection and targeting capability combined with the benefits of low weight and power requirements. The results of this technology provide the warfighter with increased situational awareness, enhanced defense suppression, and improved precision weapon delivery.</p> <p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b>                      (U) \$448 Developed advanced EO sensor technologies, including non-mechanical beam steering techniques, for a single compact, affordable navigation and targeting sensor.                      (U) \$448 Total</p> <p>(U) <b><u>FY 2000 (\$ in Thousands)</u></b>                      (U) \$492 Develop optical transmitter technology capable of sensing multiple target characteristics to provide robust non-cooperative combat identification. Perform proof-of-concept demonstrations. Complete critical design of transmitters for imaging and non-imaging applications. (In FY 2001, this work will be performed in Project 622003.)                      (U) \$492 Total</p> <p>(U) <b><u>FY 2001 (\$ in Thousands)</u></b>                      (U) \$0 Effort transferred to Project 622003.                      (U) \$0 Total</p> <p>(U) <b><u>B. Project Change Summary</u></b>                      Not Applicable.</p> <p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b>                      (U) Related Activities:                      (U) PE 0603203F, Advanced Aerospace Sensors.                      (U) PE 0602702F, Command Control and Communications.                      (U) PE 0603270F, Electronic Combat Technology.</p>									
Project 622001			Page 6 of 22 Pages				Exhibit R-2A (PE 0602204F)		

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>622001</b>
<p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b></p> <p>(U) PE 0602712E, Materials and Electronics Technology.</p> <p>(U) PE 0603739E, Advanced Electronics Technology.</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>		
Project 622001	Page 7 of 22 Pages	Exhibit R-2A (PE 0602204F)

**UNCLASSIFIED**

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)</b>	DATE <b>February 2000</b>
---	------------------------------

<b>BUDGET ACTIVITY</b> <b>02 - Applied Research</b>	<b>PE NUMBER AND TITLE</b> <b>0602204F Aerospace Sensors</b>	<b>PROJECT</b> <b>622002</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
622002 Electronic Component Technology	8,820	6,900	17,406	16,494	16,910	16,919	17,249	Continuing	TBD

- (U) **A. Mission Description**  
 This project focuses on the generation, control, reception, and processing of electronic and photonic signals for radio frequency (RF) sensor aerospace applications. Typical technologies include: solid state and vacuum electronic power devices and amplifiers; low noise and signal control components; high-temperature electronics; photonic components for RF links; signal control/distribution/processing; multi-function monolithic integrated circuits; high-speed analog-to-digital and digital-to-analog circuits; power distribution; multi-chip modules; and high density packaging and interconnect technologies. This project also covers design, development, fabrication, and evaluation of techniques for integrating these technologies. The aim is to demonstrate significantly improved military sensors with smaller size, lower weight, lower cost, lower power dissipation, higher reliability, and improved performance. The device and component technology developments under this project are military unique and based on Air Force and other DoD weapon systems requirements in the areas of radar, communications, electronic warfare (EW), navigation, and smart weapons.
- (U) **FY 1999 (\$ in Thousands)**
- (U) \$2,261      Developed compact, affordable, mixed-mode, multi-function receiver and phased array components for radar and EW. Designed miniature digital receiver components. Refined advanced component evaluation methods to reduce non-recurring engineering costs.
  - (U) \$2,493      Developed high-power (1 to 100 watts), military unique, solid state transmitters for radar and communications applications. Developed transmit amplifiers to improve range and kill probability of precision guided munitions and advanced microwave amplifiers for improved power dissipation and reliability.
  - (U) \$2,820      Developed high yield process technologies to enable high-operating-temperature, military essential, solid state microwave transmitters used in ground-based and airborne radar applications. Evaluated candidate materials for improved transistor reliability. Demonstrated integrated circuits and high power internally matched transistors.
  - (U) \$1,246      Developed military unique, very high-power (100 to 1,000 watts) vacuum electronics devices and components for affordable microwave and millimeter wave transmitters. Designed advanced microwave tube components.
  - (U) \$8,820      Total

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>622002</b>
(U) <u>A. Mission Description Continued</u>		
(U) <u>FY 2000 (\$ in Thousands)</u>		
(U) \$4,460	Develop compact, affordable, mixed-mode, multi-function receiver and phased array components for radar and electronic warfare (EW). Fabricate miniature digital receiver components, direct digital waveform transmitters, and very low power (<0.5W) analog-to-digital converters for space-based sensors. Refine advanced component evaluation methods.	
(U) \$332	Develop microwave technologies to enable high operating temperature, solid state microwave transmitters used in military ground-based and airborne radar applications. Develop robust high-speed, high-power III-nitride transistors.	
(U) \$318	Demonstrate high-power, internally matched transistors that will allow replacement of S-band vacuum tube transmitters to increase the reliability and lower the life cycle cost of high-power, ground-based radars.	
(U) \$903	Develop aerospace surface protective coatings and packaging technologies for high-performance, mixed analog/digital microwave circuits to improve reliability and lower the cost of components that operate in harsh military environments. Develop advanced packaging and interconnect processes for phased array antennas and EW transmitters. (In FY 2000, this work moved from Project 626096.)	
(U) \$887	Develop military unique, very high-power (100 to 1,000 watts) vacuum electronics devices and components for compact, affordable microwave and millimeter wave transmitters used in EW, radar, and communications applications. Fabricate advanced microwave tube components.	
(U) \$6,900	Total	
(U) <u>FY 2001 (\$ in Thousands)</u>		
(U) \$5,233	Develop compact, affordable, multi-function receiver and phased array components for radar, electronic warfare, and other intelligence, surveillance, and reconnaissance (ISR) sensors. Demonstrate miniature airborne digital receiver components. Fabricate direct digital waveform transmitters and high-resolution (10 bit), ultra-low power (<1.0W) analog-to-digital converters. Demonstrate and refine advanced component evaluation methods. (In FY 2000, portions of this work were performed in Project 626096.)	
(U) \$4,544	Develop microwave technologies for advanced radio frequency apertures and phased array antennas used in military ISR sensors. Fabricate a high operating temperature, high-efficiency power amplifier to allow dispersed placement of active arrays. Demonstrate S-band (2-4 GHz) silicon carbide transistors for air defense networks. Demonstrate advanced vacuum electronics components. Conduct a reliability evaluation of high-power heterojunction bipolar transistors for ground and airborne radars and EW transmitters. (In FY 2000, portions of this work were performed in Project 622000.)	
(U) \$3,854	Develop packaging and integration technologies for high performance aerospace radio frequency (RF) sensor components. Demonstrate device and multi-chip module surface protective coatings and mixed analog/digital microwave circuits to improve reliability and lower the cost of components operating in harsh military environments. Test advanced packaging and interconnect processes for phased array antennas and EW transmitters. (In FY 2000, portions of this work were performed in Project 626096.)	
(U) \$1,114	Develop signal control components and techniques to meet RF loss levels required for future radar, electronic warfare, and ISR sensors. Design	
Project 622002	Page 9 of 22 Pages	Exhibit R-2A (PE 0602204F)

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)</b>		DATE <b>February 2000</b>
BUDGET ACTIVITY <b>02 - Applied Research</b>	PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>	PROJECT <b>622002</b>
<p>(U) <b><u>A. Mission Description Continued</u></b></p> <p>(U) <b><u>FY 2001 (\$ in Thousands) Continued</u></b></p> <p>micro-electro-mechanical phase shifters with a 300% improvement in radio frequency (RF) loss performance. Develop miniature filters for high performance channelized radar and electronic warfare receivers.</p> <p>(U) \$2,661 Develop RF photonics technologies to demonstrate compact, affordable, wide bandwidth, high data rate aerospace sensors. Fabricate photonic components for high performance digital receivers and processors. (Prior to FY 2001, this work was performed in Project 626096.)</p> <p>(U) \$17,406 Total</p> <p>(U) <b><u>B. Project Change Summary</u></b> Not Applicable.</p> <p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b></p> <p>(U) Related Activities:</p> <p>(U) PE 0603203F, Advanced Aerospace Sensors.</p> <p>(U) PE 0603270F, Electronic Combat Technology.</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> Not Applicable.</p> <p>(U) <b><u>E. Schedule Profile</u></b></p> <p>(U) Not Applicable.</p>		
Project 622002	Page 10 of 22 Pages	Exhibit R-2A (PE 0602204F)

**UNCLASSIFIED**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000		
BUDGET ACTIVITY 02 - Applied Research				PE NUMBER AND TITLE 0602204F Aerospace Sensors				PROJECT 622003		
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
622003	EO Sensors & Countermeasures Tech	9,026	9,330	11,855	13,967	15,888	18,195	18,225	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            Develops and demonstrates technical feasibility of advanced electro-optical (EO) aerospace sensor technologies for a variety of offensive and defensive functions. Sensor technologies under development range from the ultraviolet (UV) through the infrared (IR) portion of the spectrum. Related efforts include improvements in avionics integration, digital processing, analysis tools, and sensor architectures. One of the main goals of this project is to improve EO technologies for the detection, tracking, and identification of difficult targets such as those obscured by camouflage. This project also develops the passive and active hyperspectral imaging sensors and algorithms needed to enable precision targeting in the presence of severe weather. These sensor technologies are critical to future air and space-based surveillance and targeting capabilities. Other project goals include the improvement of the technology bases for advanced EO threat warning and countermeasures.</p> <p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p> <p>(U) \$2,324      Developed software engineering technologies to promote assured performance and affordability of complex existing and next-generation air and space platform software. Demonstrated automated means to ensure correctness of cockpit display and console software. Developed capability for performing in-flight self-checking of mission critical weapons and information systems software. Developed new techniques for rapidly incorporating new functions and hardware into scaleable systems.</p> <p>(U) \$3,812      Developed advanced machine intelligence technologies to provide a capability for enhanced management of critical on-board sensors and detection/recognition of targets. Demonstrated enhanced, real-time embedded avionics database management system. Demonstrated advanced multi-target, multi-source identification capability. Demonstrated an advanced tactical surveillance sensor manager. Developed and applied efficient target recognition and combat information fusion techniques.</p> <p>(U) \$2,890      Developed and demonstrated avionics integration technologies that allow rapid re-allocation of avionics hardware to meet changing operational requirements. These technologies dramatically reduce warfighter timelines for interoperability and adaptability in changing threat environments.</p> <p>(U) \$9,026      Total</p> <p>(U) <b><u>FY 2000 (\$ in Thousands)</u></b></p> <p>(U) \$2,292      Develop software engineering technologies to promote assured performance and affordability of complex existing and next-generation air and space platform software. Continue to demonstrate automated means to ensure correctness of cockpit display and console software. Develop and apply capability for performing in-flight self-checking of mission critical weapons and information systems software. Continue to develop new techniques for rapidly incorporating new hardware/software functions into scaleable, plug-and-play systems.</p> <p>(U) \$2,560      Develop sensor component technologies to detect, locate, and identify low-contrast ground and aerospace targets from high altitude and space.</p>										
Project 622003			Page 11 of 22 Pages				Exhibit R-2A (PE 0602204F)			

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>622003</b>
(U) <u>A. Mission Description Continued</u>		
(U) <u>FY 2000 (\$ in Thousands) Continued</u>		
	Develop aerospace infrared hyperspectral sensor components and fusion algorithms. Validate sensor target models.	
(U) \$1,113	Develop technology for non-cooperative identification of airborne and ground-based platforms. Investigate target background and atmospheric phenomenology effects on sensor performance. Generate multi-dimensional/multi-functional sensor platform concepts. Develop coherent image processing/extraction algorithms.	
(U) \$1,833	Develop electro-optical (EO) technology to enable passive or active targeting of difficult targets. Investigate ways of mitigating atmospheric phenomenology effects on extended range aerospace sensors. Develop turbulence compensation techniques for precision targeting, target signatures, and phenomenology models. Select multifunction sensor target characteristics.	
(U) \$445	Develop military-unique optical transmission components to enable information dominance. Fabricate laboratory high-speed optical communication subsystem.	
(U) \$1,087	Develop innovative techniques and components to target difficult objects in degraded atmospheric conditions. Fabricate components for active multispectral imaging. Assess active imaging systems for their ability to penetrate weather and obscurants and improve capabilities in existing systems.	
(U) \$9,330	Total	
(U) <u>FY 2001 (\$ in Thousands)</u>		
(U) \$2,305	Develop day/night electro-optical sensor component technologies to detect, locate, and identify low contrast ground and aerospace targets from high altitude and space. Develop imaging spectrometer techniques and multispectral focal plane array components. Perform laboratory and field tests on techniques and components. Assess performance.	
(U) \$1,779	Develop technology for non-cooperative identification of airborne and ground-based platforms. Design long-range sensors. Test coherent image processing/extraction algorithms. Flight demonstrate a multifunction ladar.	
(U) \$673	Develop military-unique optical transmission components to enable information dominance. Demonstrate useful commercial-off-the-shelf technologies integrated with military-unique components.	
(U) \$1,239	Develop innovative techniques and components to target difficult objects in degraded atmospheric conditions. Fabricate components for active multispectral imaging. Assess active imaging systems for their ability to penetrate weather and obscurants. Design generic modules to improve capabilities of existing systems. Analyze and demonstrate concepts based on high precision pointing, range gating, and image processing.	
(U) \$3,506	Develop countermeasure technologies against infrared-guided missiles and electro-optic threats. Design components and refine techniques to defeat imaging missile seekers. (Prior to FY 2001, this work was conducted in Project 622000.)	
(U) \$1,859	Develop aerospace missile and laser warning technologies to accurately cue countermeasures. Develop temporal and spectral tracking algorithms, advancing from two-color to multispectral imaging techniques. Test advanced sensor hardware. (Prior to FY 2001, this work was	
Project 622003	Page 12 of 22 Pages	Exhibit R-2A (PE 0602204F)

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>622003</b>
<p>(U) <b><u>A. Mission Description Continued</u></b></p> <p>(U) <b><u>FY 2001 (\$ in Thousands) Continued</u></b></p> <p>conducted in Project 622000.)</p> <p>(U) \$494 Develop optical transmitter technology capable of sensing multiple target characteristics to provide robust non-cooperative target identification. Fabricate a single imaging and non-imaging transmitter. (Prior to FY 2001, this work was conducted in Project 622001.)</p> <p>(U) \$11,855 Total</p> <p>(U) <b><u>B. Project Change Summary</u></b> Not Applicable.</p> <p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b></p> <p>(U) Related Activities:</p> <p>(U) PE 0603253F, Advanced Sensor Integration.</p> <p>(U) PE 0602301E, Intelligence System Program.</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> Not Applicable.</p> <p>(U) <b><u>E. Schedule Profile</u></b></p> <p>(U) Not Applicable.</p>		
Project 622003	Page 13 of 22 Pages	Exhibit R-2A (PE 0602204F)

**UNCLASSIFIED**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000	
BUDGET ACTIVITY <b>02 - Applied Research</b>				PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>				PROJECT <b>626095</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
626095    Sensor Fusion Technology	11,008	11,859	13,312	14,325	14,821	15,798	16,063	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            Develops the baseline technologies required to perform management and fusion of on-board sensor information for timely, comprehensive situation awareness, automatic target recognition (ATR), integrated fire control, and bomb damage assessment. This project determines the feasibility of technologies and concepts for fire control to aid in precisely locating, identifying, and targeting airborne and surface targets. The emphasis is on finding reduced signature targets and targets of opportunity and enabling new covert tactics for successful air-to-air and air-to-surface strikes.</p> <p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p> <p>(U) \$1,207      Developed, evaluated, and demonstrated air-to-air single and multisensor tracking, sensor management, fire control, situation awareness, and identification algorithms to dramatically improve air combat capability.</p> <p>(U) \$5,049      Developed, evaluated, and demonstrated air-to-ground single and multi-sensor tracking, sensor management, fire control, situation awareness, and identification algorithms to dramatically improve reconnaissance, surveillance, and strike operations.</p> <p>(U) \$2,759      Developed, evaluated, and demonstrated feasibility of single and multi-sensor ATR algorithms to dramatically improve capability to recognize hostile ground forces.</p> <p>(U) \$1,203      Developed and demonstrated ATR enabling technologies for long-range, high-altitude air and space vehicles.</p> <p>(U) \$790        Developed precision time, position, and velocity sensors to generate a common precision reference and enable platforms to share sensor data.</p> <p>(U) \$11,008     Total</p> <p>(U) <b><u>FY 2000 (\$ in Thousands)</u></b></p> <p>(U) \$4,210      Develop, evaluate, and demonstrate single and multisensor lethality algorithms to dramatically improve air combat capability. Perform a ground station emulation. Simulate targeting with real-time information-into-the-cockpit. Develop adaptive resource allocation.</p> <p>(U) \$4,010      Develop, evaluate, and demonstrate air-to-ground single and multi-sensor radar target signature models to support automatic target recognition in strike operations. Investigate computational electromagnetics techniques. Generate geometric target models. Characterize clutter.</p> <p>(U) \$2,149      Develop, evaluate, and demonstrate feasibility of multi-sensor ATR algorithms for on- and off-board sensor-to-shooter image and data fusion to rapidly attack time-critical targets. Complete evaluation of a sensor-to-shooter algorithm. Devise multi-sensor performance metrics. Evaluate multisensor ATR algorithms.</p> <p>(U) \$1,490      Develop precision time, position, and velocity sensors capable of operating in jamming environments enabling multiple platform sensor to shooter operations. This includes simultaneous localization using diverse power level reference signals and optimal co-location of reference</p>									
Project 626095			Page 14 of 22 Pages				Exhibit R-2A (PE 0602204F)		

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>626095</b>
(U) <u>A. Mission Description Continued</u>		
(U) <u>FY 2000 (\$ in Thousands) Continued</u>		
	sensors as the key to the next generation jam resistant technology.	
(U) \$11,859	Total	
(U) <u>FY 2001 (\$ in Thousands)</u>		
(U) \$4,137	Develop, evaluate, and demonstrate single and multi-sensor lethality algorithms to dramatically improve air combat capability. Perform a live-feed to ground station emulation to evaluate real-time information-into-the-cockpit targeting schemes, and to optimize adaptive resource allocation methods. Complete demonstration of real-time, on-board automatic target recognition (ATR) and information fusion using live threat emitter data.	
(U) \$3,889	Develop, evaluate, and demonstrate single and multi-sensor radar target signature models to support ATR in strike operations. Transition the ground target signature database to an operational air-to-ground ATR system. Develop physics-based dynamic complex synthetic aperture radar (SAR) scene simulation capability using advanced modeling and simulation (M&S) techniques. Develop innovative target recognition techniques using advanced scattering phenomenology analysis. Transition advanced phenomenology-based target recognition techniques to the intelligence community.	
(U) \$2,144	Develop, evaluate, and demonstrate feasibility of multi-sensor ATR algorithms for on- and off-board sensor-to-shooter image and data fusion to rapidly attack time-critical targets. Develop full, collaborative sensor-to-shooter algorithm environment utilizing the most advanced DoD laboratory capabilities from across the country. Evaluate sensor-to-shooter technologies and develop operational concepts.	
(U) \$2,508	Develop and demonstrate enabling ATR technologies for future intelligence, surveillance, and reconnaissance (ISR) applications. Evaluate physics-based and adaptive learning techniques to reduce cost and increase capabilities of follow-on ISR systems. Using ground-based technology demonstrations and hardware-in-the-loop simulations, continue developing high-impact technologies needed to provide extremely high altitude, long-range targeting and attack capabilities.	
(U) \$634	Develop sensors to provide precise time, position, and velocity measurements to enable multiple-platform, sensor-to-shooter operations in jamming environments. Develop Global Positioning System (GPS) specific jamming mitigation techniques for operation in hostile radio frequency environments. Assess the advantages for signal tracking of collocating an inertial measurement unit with the phase center of a GPS antenna, and devise techniques to exploit this capability for navigation and strike. Design and implement methods to enable GPS receivers to simultaneously handle strong signals from nearby differential reference sources and the weak signals from GPS satellites to improve jam-resistance and positional accuracy.	
(U) \$13,312	Total	
Project 626095	Page 15 of 22 Pages	Exhibit R-2A (PE 0602204F)

UNCLASSIFIED

<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)</b>		DATE <b>February 2000</b>
BUDGET ACTIVITY <b>02 - Applied Research</b>	PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>	PROJECT <b>626095</b>
<p>(U) <b><u>B. Project Change Summary</u></b> Not Applicable.</p> <p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b>                  (U) Related Activities:                  (U) PE 0603203F, Advanced Aerospace Sensors.                  (U) PE 0602602F, Conventional Munitions.                  (U) PE 0603270F, Electronic Combat Technology.                  (U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.                  (U) PE 0603762E, Sensor and Guidance Technology.                  (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> Not Applicable.</p> <p>(U) <b><u>E. Schedule Profile</u></b>                  (U) Not Applicable.</p>		
Project 626095	Page 16 of 22 Pages	Exhibit R-2A (PE 0602204F)

**UNCLASSIFIED**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000		
BUDGET ACTIVITY <b>02 - Applied Research</b>				PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>				PROJECT <b>626096</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
626096	Microelectronics Technology	8,840	10,612	0	0	0	0	0	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            This project focuses on military unique, sensor aspects of microelectronics and radio frequency (RF) photonics such as photonic sub systems and components for the control and distribution of RF signals; high-speed devices and circuits; packaging and power distribution; design tools; and hardware design languages. The warfighter requirements for technology developments are based on Air Force and other DoD weapon systems needs in the areas of radar, communications, electronic warfare (EW), navigation, and smart weapons applications. Future surveillance and sensor information processing systems will require very small, environmentally robust, high-speed, low power, lightweight components and subsystems using both microelectronics and photonics in the following areas: electronic and photonic analog-to-digital converter circuits, fiber optic signal control and distribution sub-systems, high-temperature electronics, multi-function monolithic integrated circuits, high density photonic interconnects, and RF distributions and radar beamforming. Computer-aided engineering technology is key to addressing the low-cost, very high performance, low power, tough environmental, multi-organization development, and high complexity challenges of our warfighting electronics. The developed technology is unavailable through commercial sources.</p>										
<p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p>										
(U)	\$2,934	Developed advanced high-speed devices and fabrication processes for digital integrated circuits (e.g., very high-speed, analog-to-digital converters and digital RF memory chips) to allow high-speed military sensors to interface with slower commercial processors, thereby eliminating bulky, costly, and temperature-sensitive down-conversion electronics. Demonstrated fabrication processes and devices for a transceiver chip set and augmented analog-to-digital conversion circuits to enable use of commercial-of-the-shelf components in radar, EW, and other sensors.								
(U)	\$2,596	Developed surface protective coatings and packaging technologies for high performance, mixed analog/digital microwave circuits to improve reliability and lower component cost for space sensor components. Developed advanced packaging and interconnect processes for phased array antennas and electronic warfare transmitters and receivers. (In FY 2000, this work moves to Project 622002.)								
(U)	\$2,515	Developed advanced design tools to reduce the cost and time required to create complex Air Force electronic systems. Assessed and refined tools for next-generation 'systems-on-a-chip' and reconfigurable computer design.								
(U)	\$795	Developed next generation design representations and system-level modeling and simulation capability to support the complexity in implementing the Air Force's 'system of systems' vision. Developed extensions to industry standard hardware description and design language tools for complex military information systems.								
(U)	\$8,840	Total								
Project 626096		Page 17 of 22 Pages				Exhibit R-2A (PE 0602204F)				

## UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE
BUDGET ACTIVITY <b>02 - Applied Research</b>		PROJECT <b>626096</b>
PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>		
(U)	<b><u>A. Mission Description Continued</u></b>	
(U)	<b><u>FY 2000 (\$ in Thousands)</u></b>	
(U)	\$2,468	Develop advanced high-speed device technologies to enable affordable, compact space-based sensors. Design radio frequency components and analog-to-digital converters for high dynamic range, high sensitivity micro-receivers. (In FY 2001, this work will be performed in Project 622002.)
(U)	\$1,752	Develop advanced design tools to reduce the cost and time required to create complex Air Force electronic systems such as mixed analog and digital systems. Demonstrate tools for reconfigurable computers and for describing hardware behavior. (In FY 2001, this work will be performed in Project 622002.)
(U)	\$3,756	Develop next-generation design representations and system-level modeling and collaborative engineering capability to support the complexity in implementing the Air Force's 'system of systems' vision. Specify required representations. Develop advanced techniques for analyzing life cycle cost/performance trade offs.
(U)	\$2,251	Develop radio frequency photonics technologies to demonstrate compact, affordable, wide bandwidth, high data rate sensors. Design photonic interconnect architectures for high performance digital receivers and processors. (Prior to FY 2000, this work was performed under PE 0602702F, Project 624600. Beginning in FY 2001, this work will be performed in PE 0602204F, Project 622002.)
(U)	\$385	Develop, as part of an international cooperative effort, the three-dimensional multilayer microwave packaging and interconnect multichip assembly technologies needed for next-generation airborne moving target indicator radars. (In FY 2001, this work will transfer to Project 622002.)
(U)	\$10,612	Total
(U)	<b><u>FY 2001 (\$ in Thousands)</u></b>	
(U)	\$0	Effort transferred to Project 622002.
(U)	\$0	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 0603203F, Advanced Aerospace Sensors.	
(U)	PE 0603270F, Electronic Combat Technology.	
(U)	PE 0602702F, Command Control and Communications.	
(U)	PE 0602705A, Electronics and Electronic Devices.	
Project 626096		Exhibit R-2A (PE 0602204F)

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>626096</b>
<p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b></p> <p>(U) PE 0602234N, Materials, Electronics and Computers.</p> <p>(U) PE 0602712E, Materials and Electronics.</p> <p>(U) PE 0603739E, Manufacturing Technology.</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>		
Project 626096	Page 19 of 22 Pages	Exhibit R-2A (PE 0602204F)

**UNCLASSIFIED**

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)								DATE February 2000	
BUDGET ACTIVITY <b>02 - Applied Research</b>				PE NUMBER AND TITLE <b>0602204F Aerospace Sensors</b>				PROJECT <b>627622</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
627622 RF Sensors & Countermeasures Tech	8,639	8,867	23,071	24,508	26,447	28,291	29,533	Continuing	TBD
<p>(U) <b><u>A. Mission Description</u></b>            Determines feasibility of technology for reliable, all-weather, reconnaissance and precision strike radio frequency (RF) sensors and electronic combat systems. Emphasis is on acquisition of surface and airborne targets with difficult to detect signatures due to reduced radar cross sections, concealment and camouflage measures, severe clutter, and/or heavy jamming. This project also develops the RF warning and countermeasure technology for advanced electronic combat applications. Specifically, it analyzes the links and sensors of threat air defense systems and command and control networks and develops appropriate countermeasure techniques and technologies. The program also exploits emerging technologies to provide increased capability for radar warning, RF electronic combat, and electronic intelligence applications.</p> <p>(U) <b><u>FY 1999 (\$ in Thousands)</u></b></p> <p>(U) \$3,570      Developed advanced microwave sensor technologies, such as electronic protection, multi-dimensional image processing, and adaptive algorithms for high-performance, lower life cycle cost air-to-air radar and target detection. Tested integrated RF techniques. Developed adaptive algorithms for interference and lobe cancellation. Developed radar engineering tools to evaluate targeting errors.</p> <p>(U) \$3,650      Developed advanced airborne sensors for air-to-ground targeting and attack with robust performance in adverse weather, severe jamming, natural clutter, or concealment by foliage or camouflage. Developed improved targeting scenes for synthetic aperture radars (SAR). Developed analytical tools to predict SAR performance.</p> <p>(U) \$1,419      Developed technology for information transmission between airborne vehicles and cooperating assets with high fidelity, low probability of detection, and high jam resistance to improve strike effectiveness. Integrated a communication asset management system. Completed a preliminary design for a non-linear adaptive interference limiter to reduce interference.</p> <p>(U) \$8,639      Total</p> <p>(U) <b><u>FY 2000 (\$ in Thousands)</u></b></p> <p>(U) \$1,256      Develop aerospace microwave sensor technologies for air-to-air radar and target detection that supports surveillance, reconnaissance, protection, targeting, attack, and electronic warfare. Design electromagnetic interference mitigation techniques. Validate advanced radar performance/cost analysis tools.</p> <p>(U) \$1,748      Develop adaptive microwave processing algorithms for detecting and locating advanced cruise missiles and slow airborne and ground targets. Design techniques to mitigate clutter and jamming on airborne monostatic and bistatic radars.</p> <p>(U) \$1,566      Develop advanced aerospace sensors for air-to-ground targeting and attack, providing synthetic aperture radar targeting solutions for</p>									
Project 627622			Page 20 of 22 Pages				Exhibit R-2A (PE 0602204F)		

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>627622</b>
(U) <u>A. Mission Description Continued</u>		
(U) <u>FY 2000 (\$ in Thousands) Continued</u>		
	maneuvering tactical aircraft in a hostile environment. Perform an independent assessment of various current and future airborne and space surveillance sensors.	
(U) \$732	Develop technology for detecting and attacking concealed targets. Develop innovative foliage- and ground-penetrating radar waveforms and targeting algorithms.	
(U) \$980	Develop technology to accurately determine algorithm and sensor performance from airborne and space-based platforms in realistic airborne surveillance and combat scenarios. Test bistatic adjuncts on unmanned aerial vehicles. (Prior to FY 2000, this work was performed in PE 0602702F, Project 624506.)	
(U) \$1,190	Develop electromagnetic technologies for advanced surveillance systems applications for the detection of low-observable airborne targets within severe clutter from airborne or space-based surveillance platforms. (Prior to FY 2000, this effort was conducted under PE 0602702F, Project 624600.)	
(U) \$1,395	Develop radio frequency (RF) space protection technology. Investigate techniques to provide warning and countermeasures against RF interference with satellite operations.	
(U) \$8,867	Total	
(U) <u>FY 2001 (\$ in Thousands)</u>		
(U) \$4,169	Develop aerospace microwave sensor technologies for detecting, locating, and engaging airborne and ground targets. Develop high fidelity analytical tools for evaluating and predicting the performance of integrated air moving target indication, ground moving target indication, and synthetic aperture radar modes. Conduct airborne radar data collection. Perform laboratory analysis for application of advanced surveillance techniques. (This effort incorporates work previously performed under PE 0602702F, Project 624506.)	
(U) \$3,544	Develop aerospace microwave processing algorithms for detecting and locating advanced cruise missiles and slow airborne targets, as well as stationary and moving ground targets in severe clutter and jamming environments. Analyze individual algorithms for improved air and ground moving target indication algorithm performance. Develop adaptive processing techniques that incorporate knowledge-based approaches.	
(U) \$3,849	Develop technology for detecting and attacking concealed targets. Evaluate innovative foliage- and ground-penetrating radar waveforms and targeting algorithms, devising techniques to prevent discovery by the enemy, and assessing potential for detecting buried command and control centers.	
(U) \$2,970	Develop affordable RF jamming technology and concepts that enhance aerospace vehicle survivability by degrading enemy radar, missile, and command and control systems. Evaluate ability to detect covert/featureless waveforms. Test optimized deception countermeasure techniques, and techniques to degrade modern communication networks. (Prior to FY 2001, this work was conducted in Project 622000.)	
(U) \$2,555	Develop technology for generic software modules to enable low-cost block upgrades to electronic warfare receivers. Design threat identification	
Project 627622	Page 21 of 22 Pages	Exhibit R-2A (PE 0602204F)

UNCLASSIFIED

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE February 2000
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
<b>02 - Applied Research</b>	<b>0602204F Aerospace Sensors</b>	<b>627622</b>
<p>(U) <b><u>A. Mission Description Continued</u></b></p> <p>(U) <b><u>FY 2001 (\$ in Thousands) Continued</u></b></p> <p>(U) \$5,984 software modules for next-generation threat warning receivers. (Prior to FY 2001, this work was conducted in Project 622000.)</p> <p>(U) \$5,984 Develop affordable antenna technology for use in operational and future aerospace platform electronic receivers and apertures. Laboratory demonstrate an integrated ensemble of low-frequency direction-finding antennas. Develop highly precise, wideband, interferometric multimode direction-finding antennas. Demonstrate a micro-electro-mechanical phase shifter controlled array. Demonstrate design tools to predict antenna performance. (Prior to FY 2001, this work was conducted in Project 622000.)</p> <p>(U) \$23,071 Total</p> <p>(U) <b><u>B. Project Change Summary</u></b> Not Applicable.</p> <p>(U) <b><u>C. Other Program Funding Summary (\$ in Thousands)</u></b></p> <p>(U) Related Activities:</p> <p>(U) PE 0603203F, Advanced Aerospace Sensors.</p> <p>(U) PE 0603253F, Advanced Avionics Integration.</p> <p>(U) PE 0602782A, Command, Control, Communications Technology.</p> <p>(U) PE 0602232N, Navy C3 Technology.</p> <p>(U) PE 0603792N, Advanced Technology Transition.</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> Not Applicable.</p> <p>(U) <b><u>E. Schedule Profile</u></b></p> <p>(U) Not Applicable.</p>		
Project 627622	Page 22 of 22 Pages	Exhibit R-2A (PE 0602204F)