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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

	COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	65,412	80,847	75,799	80,380	86,316	94,626	96,330	Continuing	TBD
2002	Electronic Component Technology	21,461	20,302	13,184	11,846	12,770	16,725	16,942	Continuing	TBD
2003	EO Sensors & Countermeasures Tech	11,312	14,557	14,663	15,865	15,871	16,325	16,815	Continuing	TBD
4916	Electromagnetic Tech	0	7,298	7,264	7,420	7,507	7,685	7,888	Continuing	TBD
5016	Photonic Component Technology	0	0	2,343	2,767	3,196	2,264	2,273	Continuing	TBD
5017	RF Processing for ISR Sensors	0	0	8,143	6,773	7,988	8,037	7,595	Continuing	TBD
6095	Sensor Fusion Technology	14,165	13,237	12,968	12,385	14,271	16,431	17,097	Continuing	TBD
7622	RF Sensors & Countermeasures Tech	18,474	25,453	17,234	23,324	24,713	27,159	27,720	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	Continuing	TBD

In FY 2002, work performed under PE 0602702F, Project 4600, moved to this PE, Project 4916. Apparent project ramps are due only to realignment of the projects. This realignment aligned projects with the Air Force Research Laboratory organization. Project realignment did not affect work planned for the overall program element or the budget topline. In FY 2003, space unique tasks in this PE, Projects 2002, 6095, and 7622, will be transferred to PE 0602500F, Projects 5028 and 5029, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors

(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. To achieve this progress, this program pursues simultaneous advances in: 1) generating, controlling, receiving, and processing electronic and photonic signals for radio frequency (RF) sensor aerospace applications; 2) electro-optical (EO) aerospace sensor technologies for a variety of offensive and defensive uses; 3) RF antennas and associated electronics for airborne surveillance, together with active and passive EO sensors; 4) technologies to manage and fuse on-board sensor information for timely, comprehensive situational awareness; and 5) technology for reliable, all-weather surveillance, reconnaissance, and precision strike radio frequency (RF) sensors and electronic combat systems. Note: In FY 2002, Congress added $1.2 million for Integration on Flexible Substances, $1.8 million for Adverse Weather Ballistic Imaging and Targeting System, and $1.0 million for Advanced Fourier Transform - Infrared (FT-IR) Gas Analysis.

(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)

		FY 2001	FY 2002	FY 2003	Total Cost
(U)	Previous President's Budget	67,024	84,149	81,697	
(U)	Appropriated Value	67,644	81,149		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions		-302		
	b. Small Business Innovative Research	-1,612			
	c. Omnibus or Other Above Threshold Reprogram				
	d. Below Threshold Reprogram				
	e. Rescissions	-620			
(U)	Adjustments to Budget Years Since FY 2002 PBR			-5,898	
(U)	Current Budget Submit/FY 2003 PBR	65,412	80,847	75,799	TBD

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE: February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors

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

(U) Significant Program Changes:

In FY 2002, work performed under PE 0602702F, Project 4600, moved to this PE, Project 4916. Apparent project ramps are due only to realignment of the projects. This realignment aligned projects with the Air Force Research Laboratory organization. Project realignment did not affect work planned for the overall program element or the budget topline. In FY 2003, space unique tasks in this PE, Projects 2002, 6095, and 7622, will be transferred to PE 0602500F, Projects 5028 and 5029, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

PROJECT: 2002

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2002 Electronic Component Technology	21,461	20,302	13,184	11,846	12,770	16,725	16,942	Continuing	TBD

In FY 2003, efforts in photonic component technology will move from this project into this PE, Project 5016. Also in FY 2003, space unique tasks in this project will be transferred to PE 0602500F, Projects 5028 and 5029, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

This project focuses on generating, controlling, receiving, and processing electronic signals for radio frequency (RF) sensor aerospace applications. The enabling technologies developed under this project will be used for intelligence, surveillance, reconnaissance (ISR), electronic warfare (EW), and precision engagement. The technologies developed include: solid state power devices and amplifiers; low noise and signal control components; high-temperature electronics; signal control and distribution, signal processing; multi-function monolithic integrated circuits; high-speed analog-to-digital and digital-to-analog mixed mode integrated circuits; power distribution; multi-chip modules; and high density packaging and interconnect technologies. This project also designs, develops, fabricates, and evaluates techniques for integrating combinations of these electronic component technologies. The project aims to demonstrate significantly improved military sensors of 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; they are based on Air Force and other DoD weapon systems requirements in the areas of radar, communications, EW, navigation, and smart weapons.

(U) FY 2001 ($ in Thousands)

(U) $3,313 Developed compact, affordable, multi-function receiver and phased array components for radar, EW, and other ISR sensors. Demonstrated miniature airborne digital receiver components. Designed and fabricated direct digital waveform transmitters and high-resolution (10-16 bit), ultra-low power (<3.0W) analog-to-digital converters. Demonstrated and refined advanced component evaluation methods. (In FY 2000, portions of this work were performed in Project 6096.)

(U) $4,044 Developed microwave technologies for advanced RF apertures and phased array antennas used in military ISR sensors. Fabricated a high operating temperature, high-efficiency power amplifier to allow dispersed placement of active arrays. Demonstrated S-band (2-4 GHz) silicon carbide transistors for air defense networks. Demonstrated advanced vacuum electronics components. Conducted 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 2000.)

(U) $10,018 Developed packaging and integration technologies for high performance aerospace RF sensor components. Demonstrated device and multi-chip module surface protective coatings and mixed analog/digital microwave circuits to improve reliability and lower the cost of

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 2002

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

components operating in harsh military environments. Tested advanced packaging and interconnect processes for phased array antennas and EW transmitters. (In FY 2000, portions of this work were performed in Project 6096.)

(U) $489 Developed signal control components and techniques to meet radio frequency (RF) loss levels required for future radar, electronic warfare (EW), and intelligence, surveillance, and reconnaissance (ISR) sensors. Designed micro-electro-mechanical phase shifters with a 300% improvement in RF loss performance. Developed miniature filters for high performance channelized radar and EW receivers.

(U) $1,597 Developed RF photonics technologies to demonstrate compact, affordable, wide bandwidth, high data rate aerospace sensors. Fabricated photonic components for high performance digital receivers and signal processors. (Prior to FY 2001, this work was performed in Project 6096.)

(U) $2,000 Developed three-dimensional (3-D) interconnects and packaging technologies for 3-D non-volatile memory.

(U) $21,461 Total

(U) FY 2002 ($ in Thousands)

(U) $3,294 Develop compact, affordable, multi-function receiver and phased array components for radar, EW, and other ISR sensors. Demonstrate Gallium Arsenide (GaAs), Indium Phosphide (InP), and silicon-on-insulator RF components for bench-level evaluation of radar and EW digital receiver modules. Develop a brassboard low-power (< 1.0W) analog-to-digital converter and deliver for testing in a space-qualified silicon package. Complete study and design phase of a multi-mode/multi-function digital receiver prototype module, and complete a feasibility trade study on performing wideband direct digital synthesis from aerospace platforms.

(U) $3,326 Develop microwave technologies for advanced RF apertures and phased array antennas used in military ISR sensors. Develop and demonstrate robust components for L-band and X-band transmitters and receivers that operate with limited environmental controls. The components will be greater than 60% efficient with no active cooling, provide 20 Watts of output power, designed for radiation tolerance to 1 Mrad and greater than 200 degrees Celsius operating temperature.

(U) $4,192 Develop packaging and integration technologies for high performance aerospace RF sensor components. Demonstrate ten-fold cost reduction in an aerospace 20 GHz transmitter and a Ku-to -X-Band down-converter using low-cost packaging techniques. Develop a novel, flexible membrane to enable an ultra lightweight transmit/receive subarray. Develop mixed signal multichip modules, and evaluate three-dimensional interconnects, chip coatings, and advanced design techniques to enable high density micro-electro-mechanical systems and flexible assemblies for aerospace applications.

(U) $604 Develop signal control components and techniques to meet RF loss levels required for future radar, electronic warfare, and ISR sensors.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 2002

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

Fabricate and characterize micro-electro-mechanical systems phase shifters for 300% improvement in RF loss performance operating over a 3:1 bandwidth.

(U) $4,205 Develop RF photonic technologies to demonstrate compact, affordable, wide bandwidth, high data rate aerospace sensors. Develop low-loss, low-voltage broadband modulators for compact digital receiver applications. Design high-performance components for wideband phased array antennas. Investigate the integration of photonic solutions for long time delays with the micro-electro-mechanical phase shifters for short delays to increase bandwidth.

(U) $2,502 Develop innovative transmitter and receiver concepts along with the associated component technology alternatives required for an affordable space-based radio frequency (RF) surveillance sensor system. Design architectures that maximize predicted transmitter and receiver technology payoffs, and identify long lead-time RF sub-components required for space-based moving target indication.

(U) $991 Design and develop Fourier Transform-Infrared spectrometric gas analysis techniques for applications in controlling reactant gases generated during the vapor phase epitaxial growth of semiconductor films on substrates. These techniques will also be used to monitor gas concentrations in nanostructure growths for electronic and optical devices, and in the development of new approaches to detecting chemical and biological agents.

(U) $1,188 Develop and conduct a proof of concept demonstration of the integration of active aperture components into flexible RF-compatible substrates. Integrating these components will enable robust chip placement on flexible phased array subassemblies for radar, electronic warfare, and communications systems.

(U) $20,302 Total

(U) FY 2003 ($ in Thousands)

(U) $3,597 Develop compact, affordable, multi-function receiver/exciter and phased array components for communications, Global Positioning System (GPS), radar, electronic warfare (EW), and other intelligence, surveillance, and reconnaissance (ISR) sensors. Test Gallium Arsenide and Indium Phosphide RF components (ADCs, filters, mixers, etc.) inserted into radar and EW digital receiver modules against environment scenarios. Demonstrate a brassboard low-power (< 1.0W), silicon-on-sapphire based analog-to-digital converter and completed ground-level radiation testing in a space-qualified package. Laboratory test a silicon-on-insulator mixed-signal (digital, RF, microwave, etc.) integrated circuit, for reconfigurable signal conversion.

(U) $2,545 Develop microwave technologies for advanced RF apertures and phased array antennas used in military ISR sensors. Develop and demonstrate robust components for L-band and X-band transmitter and receiver channels that operate with limited environmental controls and under severe

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 2002

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

electromagnetic stress.

(U) $3,247 Develop integration and assembly technologies for high performance aerospace phased array sensors. Demonstrate X-band, flexible RF membrane based sub-assemblies that enable integrating low-cost and low-mass transmitter and receiver channels at the subarray level.

(U) $2,171 Develop signal control and low-power consumption components and techniques to reduce both power loss and power consumption. These components will be required for future radar, EW, and ISR sensors. Characterize and mature micro-electro-mechanical systems wideband phase shifters for extended switch lifetimes. Reduce the power consumption of low-noise amplifiers while maintaining high linearity over wide bandwidths.

(U) $1,624 Refine materials and processes for two-dimensional and three-dimensional device interconnects and component protection from the environment. Verify these inteconnects and components perform on rigid, flexible, and conformal assemblies of high density mixed signal technologies (digital, analog, microwave and millimeter wave devices and components). Test interconnects and components in both packaged (non-hermetic multi-chip modules) and package-less (bare-die-chip on board) forms.

(U) $13,184 Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0602500F, Multi-disciplinary Space Tech.

(U) PE 0603203F, Advanced Aerospace Sensors.

(U) PE 0603270F, Electronic Combat Technology.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

PROJECT: 2003

COST ($ in Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
2003	EO Sensors & Countermeasures Tech	11,312	14,557	14,663	15,865	15,871	16,325	16,815	Continuing	TBD

(U) A. Mission Description

This project determines the technical feasibility of advanced electro-optical (EO) aerospace sensor technologies for a variety of offensive and defensive uses. The sensor technologies under development range from the ultraviolet 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 project's main goals is to improve EO and related technologies for the detection, tracking, and identification of non-cooperative and 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 severe weather. These technologies are critical to future air- and space-based surveillance and targeting. Other project goals include advanced EO threat warning and countermeasures.

(U) FY 2001 ($ in Thousands)

(U) $3,497 Developed day/night EO sensor component technologies to detect, locate, and identify low contrast ground and aerospace targets from high altitude and space. Developed imaging spectrometer techniques and multispectral focal plane array components. Performed laboratory and field tests on techniques and components. Assessed performance.

(U) $1,042 Developed technology for non-cooperative identification of airborne and ground-based platforms. Designed long-range sensors. Tested coherent image processing/extraction algorithms. Flight demonstrated a multifunction ladar.

(U) $891 Developed military-unique optical transmission components to enable information dominance. Demonstrated useful commercial-off-the-shelf technologies integrated with military-unique components.

(U) $2,356 Developed innovative techniques and components to target difficult objects in degraded atmospheric conditions. Fabricated components for active multispectral imaging. Assessed active imaging systems for their ability to penetrate weather and obscurants. Designed generic modules to improve capabilities of existing systems. Analyzed and demonstrated concepts based on high precision pointing, range gating, and image processing.

(U) $687 Developed countermeasure technologies against IR-guided missiles and EO threats. Designed components and refine techniques to defeat imaging missile seekers. (Prior to FY 2001, this work was conducted in Project 2000.)

(U) $1,521 Developed aerospace missile and laser warning technologies to accurately cue countermeasures. Developed temporal and spectral tracking algorithms, advancing from two-color to multispectral imaging techniques. Tested advanced sensor hardware. (Prior to FY 2001, this work was conducted in Project 2000.)

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 2003

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

(U)	$1,318	Developed optical transmitter technology capable of sensing multiple target characteristics to provide robust non-cooperative target identification. Fabricated a single imaging and non-imaging transmitter. (In FY 2001, this effort transferred from this PE, Project 2000.)
(U)	$11,312	Total

(U) FY 2002 ($ in Thousands)

(U)	$3,080	Develop technology for non-cooperative identification of airborne and ground-based platforms. Conduct ground-to-air demonstration of long-range combat identification (CID) sensors. Test coherent image processing/extraction algorithms including three-dimensional (3-D) block registration algorithms. Conduct measurements and evaluate advanced 3-D focal planes for CID application. Continue passive hyperspectral model development, validation, and performance predictions. Continue analyzing and evaluating multifunction ladar flight demonstration data for CID.
(U)	$2,799	Develop optical transmitter technology capable of sensing multiple target characteristics for robust non-cooperative target identification. Continue developing a pulsed vibration/imaging sensing system for long-range combat identification. Investigate and demonstrate critical components of a monolithic, solid state coherent ladar architecture.
(U)	$3,549	Develop innovative techniques and components to target difficult objects in degraded atmospheric conditions. Begin utility analysis of high altitude active sensors. Test components for active multispectral imaging. Demonstrate electro-optical (EO) imaging through weather and obscurants. Design and demonstrate targeting concepts based on high precision pointing, range gating, and image processing. Evaluate non-mechanical EO beam steering devices. Investigate component designs for ladar apertures.
(U)	$1,808	Develop countermeasure technologies for use against infrared- and EO-guided missiles. Continue to design components and refine techniques to defeat imaging missile seekers. Continue exploiting advanced infrared missile technology.
(U)	$1,539	Develop aerospace missile and laser warning technologies to accurately cue countermeasures. Laboratory test temporal and spectral tracking algorithms focused on multi-spectral imaging techniques. Evaluate advanced laser warning sensor component hardware for application in a space environment.
(U)	$1,782	Investigate the feasibility of designing and fabricating a 3-D Adverse Weather Ballistic Imaging and Targeting System imaging laser radar sensor for the Predator Unmannned Aerial Vehicle. This laser radar would be capable of making one-foot resolution 3-D images of targets and areas of interest through moderate cloud cover.
(U)	$14,557	Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 2003

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands)

(U)	$4,571	Develop technology for non-cooperative identification of airborne and ground-based platforms. Conduct air-to-air and air-to-ground demonstrations of long-range combat identification (CID) sensors. Test range-resolved coherent image processing and extraction algorithms, including three-dimensional (3-D) block registration algorithms. Conduct long-range experiments using advanced 3-D sensors for CID applications. Continue passive hyperspectral model development, validation, and performance predictions, and assess signature-based data processing performance based on ground demonstration data. Continue flights, analysis, and evaluation of multifunction ladar for identification of ground targets.
(U)	$3,149	Develop optical transmitter technology capable of sensing multiple target characteristics for robust non-cooperative target identification. Develop pulsed vibration sensing system for long range CID. Begin development of flight-capable, multi-function architectures. Integrate platform compensation techniques into new architectures. Develop breadboard multi-spectral transmitter, and predict performance for different types of targets.
(U)	$4,346	Develop innovative techniques and components to target difficult objects in degraded atmospheric conditions. Continue utility analysis of high altitude active sensors, including platform trades. Perform tower tests of an active multi-spectral imaging system. Demonstrate imaging through weather and obscurants through flight test of active imaging sensors. Design and demonstrate concepts based on high precision pointing, range gating, and image processing. Develop concepts for airborne application of non-mechanical beam steering devices, including mitigating aero-optical effects. Investigate concepts for combined radio frequency and electro-optical apertures.
(U)	$1,948	Develop countermeasure technologies for use against infrared-guided missiles and electro-optical threats. Continue to design components and refine techniques to defeat imaging missile seekers. Continue the exploitation of advanced infrared missile technology.
(U)	$649	Develop aerospace missile and laser warning technologies to accurately cue countermeasures. Laboratory test temporal and spectral tracking algorithms focused on multi-spectral imaging techniques. Initiate the testing of an advanced laser warning receiver for application in a space environment.
(U)	$14,663	Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
PROJECT: 2003	

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0602500F, Multi-disciplinary Space Tech.

(U) PE 0603253F, Advanced Sensor Integration.

(U) PE 0602301E, Intelligence System Program.

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

PROJECT: 4916

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
4916 Electromagnetic Tech	0	7,298	7,264	7,420	7,507	7,685	7,888	Continuing	TBD

In FY 2002, this work transfers to this project from PE 0602702F, Project 4600.

(U) A. Mission Description

This project develops technology for sensor systems that cover the electromagnetic spectrum--from radio frequency (RF) to optical. It develops RF antennas and associated electronics for airborne and space-based surveillance. It also investigates RF scattering phenomenology for applications in ground and air moving target indicators in extremely cluttered environments. The project develops active and passive electro-optical sensors for use in concert with RF sensors. It develops low-cost active sensors that use reliable high-performance solid state components for target detection and identification and missile threat warning. The project also develops passive multi-dimensional sensors to improve battlefield awareness and identify threats at long-range.

(U) FY 2001 ($ in Thousands)

(U) $0 Effort conducted in PE 0602702F, Project 4600.

(U) $0 Total

(U) FY 2002 ($ in Thousands)

(U) $1,792 Develop experimental and theoretical techniques for the characterization of electromagnetic scattering from targets and terrain as applied to the detection of difficult airborne and ground-based targets in clutter from airborne or space-based surveillance platforms.

(U) $1,941 Design and develop antennas for airborne and space-based surveillance. Design, analyze, and build advanced large lightweight antenna arrays. Develop new algorithms for digital beam-formed multi-beam antennas. Develop antenna front-end high-speed electronics.

(U) $1,672 Design and develop next generation electro-optical techniques and advanced components for use in detection and identification of concealed targets. Design and fabricate multifunction sensor arrays and innovative materials and device technologies for optical beamsteering. Design and develop active components and advanced integration techniques for autonomous ladar-guided munitions and other imaging applications. Develop optical processing techniques for optical aberration in aircraft-generated turbulence.

(U) $1,893 Develop hardware and software for passive multi-dimensional sensing in the thermal infrared spectral wavelength range at high frame rates. Establish the viability of tomographic hyperspectral sensing techniques for missions that have not been able to capitalize on the power of spectral target identification tools. Evaluate the applicability of these and new tomographic hyperspectral sensor concepts to the characterization of explosions and missile launches, and to the development of techniques for real-time bomb damage assessment.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 4916

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U) $7,298 Total

(U) FY 2003 ($ in Thousands)

(U) $1,933 Investigate detecting difficult airborne and ground-based targets in clutter from airborne or space-based surveillance platforms. Develop models and experimental techniques for characterizing radio frequency scatter from targets, ground clutter, and foliage.

(U) $1,850 Design and develop antennas for airborne and space-based surveillance. Design, analyze, and build advanced large lightweight antenna arrays. Develop new algorithms for digital beam forming and limited-scan phased array antennas. Develop high-speed electronics antenna front end applications and micro-electro-mechanical systems technology for delay line switching in phased arrays.

(U) $1,681 Design and develop new electro-optical techniques and components for detecting and identifying concealed targets. Design and fabricate multifunction sensor arrays and the associated materials and device technologies for optical beam steering. Design and develop active components and integration techniques for autonomous three dimensional ladar-guided munitions and other imaging applications. Develop optical processing techniques that compensate for optical aberration in aircraft-generated turbulence.

(U) $1,800 Develop hardware and software for passive multi-dimensional sensing in the thermal infrared spectral wavelength range at high frame rates. Establish viability of tomographic hyperspectral sensing techniques for aerospace applications. Demonstrate the applicability of tomographic hyperspectral sensor concepts to characterizing explosions and missile launches, and to developing techniques for real-time bomb-damage assessment.

(U) $7,264 Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:

(U) PE 0602500F, Multi-disciplinary Space Tech.

(U) PE 0602702F, Command Control and Communications

(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE: February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors	PROJECT: 4916

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

PROJECT: 5016

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
5016 Photonic Component Technology	0	0	2,343	2,767	3,196	2,264	2,273	Continuing	TBD

In FY 2003, photonic component technology work previously performed in this PE, Project 2002, will transfer to this project.

(U) A. Mission Description

This project focuses on designing and developing methods to generate, control, receive, transmit, and process opto-electronic (mixed) signals for radio frequency (RF) sensor aerospace applications. Enabling technologies developed under this project for intelligence, surveillance, reconnaissance (ISR), electronic warfare (EW), and precision engagement sensors include: low noise, aerospace environmentally-qualified signal control components (e.g., electro-optic switches, micro-opto-electronic mixed signals (MOEMS); electro-optic components for RF links; photonic signal control, distribution, and signal processing; multi-function, aerospace-qualified, opto-electronic integrated circuits; wide band photonic-based high-speed electro-optic analog-to-digital and digital-to-analog converters; and opto-electronic intraconnects and interconnects. This project designs, develops, fabricates, and evaluates techniques for integrating various combinations of photonic and electronic technologies. The main purpose is to demonstrate significantly improved military sensors of smaller size, lower weight, lower cost, lower prime power, higher reliability, and improved performance -- as compared to current systems. The device, component, and subsystem technology developments under this project are military unique and based on Air Force and other DoD weapon systems requirements in the areas of radar, sensors, communications, EW, navigation, and smart weapons.

(U) FY 2001 ($ in Thousands)
(U) $0 No Activity
(U) $0 Total

(U) FY 2002 ($ in Thousands)
(U) $0 No Activity
(U) $0 Total

(U) FY 2003 ($ in Thousands)
(U) $1,650 Develop high performance integrated photonic technology link, interconnect, and switching components and subsystems for wideband RF phased array antenna beamforming and control, and for high data rate aerospace sensors and communication systems.
(U) $693 Develop ultrafast, wideband photonic analog-to-digital mixed signal conversion component technology.
(U) $2,343 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 5016

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 0602500F, Multi-disciplinary Space Tech.
(U) PE 0603203F, Advanced Aerospace Sensors.
(U) PE 0603270F, Electronic Combat Technology.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

PROJECT: 5017

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
5017 RF Processing for ISR Sensors	0	0	8,143	6,773	7,988	8,037	7,595	Continuing	TBD

In FY 2003, efforts in radio frequency processing for intelligence, surveillance, and reconnaissance sensors previously performed in this PE, Project 7622, will transfer to this project.

(U) A. Mission Description

This project develops and assesses radar technology for affordable, reliable, all weather aerospace surveillance and reconnaissance systems. Emphasis is on detecting and tracking surface and airborne targets that have difficult to detect signatures due to reduced cross sections, concealment and camouflage measures, severe clutter, or heavy jamming. Techniques exploited include the use of multiple radio frequency phenomenologies, multi-dimensional adaptive processing, advanced waveforms, and knowledge-aided processing techniques.

(U) FY 2001 ($ in Thousands)
(U) $0 No Activity
(U) $0 Total

(U) FY 2002 ($ in Thousands)
(U) $0 No Activity
(U) $0 Total

(U) FY 2003 ($ in Thousands)
(U) $1,572 Investigate techniques for implementing distributed airborne sensor systems to increase sensitivity and improve location accuracy. These techniques include sparse arrays with maneuvering platforms and improved location accuracy using interfermetric methods combined with knowledge-based responsive mode selections.
(U) $2,098 Investigate techniques for multi-intelligence data acquisition from a single platform. Investigate common waveform techniques, knowledge-based scheduling, and advanced target detection for both unconcealed and concealed targets. Determine the electromagnetic compatibility issues associated with simultaneously hosting and operating multiple radars, electronic support measure receivers, integrated communications, and electronic attack components on a single platform. Investigate methods to mitigate unintentional interference sources to multi-intelligence platforms from the ground and in the air, such as commercial broadcast assets, civilian radar assets, and commercial communications systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 5017

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

(U)	$3,940	Develop multi-mission aerospace microwave processing algorithms to detect and locate advanced cruise missiles, slowly moving ground targets, and stationary targets in severe clutter and jamming environments. Study multi-mission adaptive radar algorithms to support various operational modes, including air and ground target detection, ground target imaging, electronic protection, and passive radio frequency emission detection. Study advanced waveforms for achieving transmitter adaptivity and simultaneous multi-mode operation to improve interference rejection, self protection, and target identification by exploiting diversities in frequencies, delays, polarizations, modulations, and codings. Develop knowledge-aided radar signal processing techniques for improved detection and false alarm control performance in ground moving target indication sensors.
(U)	$533	Study and analyze technology for detecting and precisely locating concealed targets using standoff aerospace platforms. Initiate investigating emerging adaptive processing techniques for knowledge-aided multi-mission processing and resource management. Initiate the study of adaptive processing techniques for multi-mission conformal arrays. Initiate the study of wideband and polarization adaptive processing techniques for multi-function radar.
(U)	$8,143	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 0602500F, Multi-disciplinary Space Tech.
(U) PE 0603203F, Advanced Aerospace Sensors.
(U) PE 0603270F, Electronic Combat Technology.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

PROJECT: 6095

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
6095 Sensor Fusion Technology	14,165	13,237	12,968	12,385	14,271	16,431	17,097	Continuing	TBD

In FY 2003, space unique tasks in this project will be transferred to PE 0602500F, Project 5029, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

This project develops the technologies required to perform management and fusion of on-board sensor information for timely, comprehensive situational awareness, automatic target recognition (ATR), integrated fire control, and bomb damage assessment. This project determines the feasibility of technologies and concepts for fire control that help to precisely locate, identify, and target airborne and surface targets. The project emphasizes finding reduced signature targets and targets of opportunity. It will enable new covert tactics for successful air-to-air and air-to-surface strikes.

(U) FY 2001 ($ in Thousands)

(U) $5,720 Developed, evaluated, and demonstrated single and multi-sensor lethality algorithms to dramatically improve air combat capability. Performed a live-feed to ground station emulation to evaluate real-time information-into-the-cockpit targeting schemes, and to optimize adaptive resource allocation methods. Completed demonstration of real-time, on-board ATR and information fusion using live threat emitter data.

(U) $3,119 Developed, evaluated, and demonstrated single and multi-sensor radar target signature models to support ATR in strike operations. Transitioned the ground target signature database to an operational air-to-ground ATR system. Developed physics-based dynamic complex synthetic aperture radar scene simulation capability using advanced modeling and simulation techniques. Developed innovative target recognition techniques using advanced scattering phenomenology analysis. Transitioned advanced phenomenology-based target recognition techniques to the intelligence community.

(U) $1,257 Developed, evaluated, and demonstrated feasibility of multi-sensor ATR algorithms for on- and off-board sensor-to-shooter image and data fusion to rapidly attack time-critical targets. Developed full, collaborative sensor-to-shooter algorithm environment utilizing the most advanced DoD laboratory capabilities from across the country. Evaluated sensor-to-shooter technologies and developed operational concepts.

(U) $134 Developed sensors to provide precise time, position, and velocity measurements to enable multiple-platform, sensor-to-shooter operations in jamming environments. Developed Global Positioning System (GPS) specific jamming mitigation techniques for operation in hostile radio frequency environments. Assessed the advantages for signal tracking of collocating an inertial measurement unit with the phase center of a GPS antenna, and devised techniques to exploit this capability for navigation and strike. Designed and implemented methods to enable GPS receivers to simultaneously handle strong signals from nearby differential reference sources and the weak signals from GPS satellites to

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 6095

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

improve jam-resistance and positional accuracy.

(U) $3,935 Developed and demonstrated enabling automatic target recognition (ATR) technologies for future intelligence, surveillance, and reconnaissance (ISR) applications. Evaluated 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, continued developing high-impact technologies needed to provide extremely high altitude, long-range targeting and attack capabilities.

(U) $14,165 Total

(U) FY 2002 ($ in Thousands)

(U) $1,954 Develop and evaluate single and multi-sensor ATR lethality algorithms to dramatically improve capability to rapidly find, track, and target time critical mobile targets. Perform laboratory demonstration of adaptive resource allocation methods for ATR. On embedded high-performance computing systems, develop real-time ATR algorithms for time-critical targets. Develop and evaluate algorithms and concepts for detecting and targeting targets under trees.

(U) $2,547 Develop and evaluate single and multi-sensor radar target signature models to support ATR in strike operations. Develop target signature models for multi-sensor fusion of synthetic aperture radar, electro-optical multispectral systems, and signals intelligence in reconnaissance ground stations. Sensor fusion will provide the ability to maintain tracks of vehicle groupings through multiple platforms and missions with a high probability of detection and a less than 1% false alarm rate.

(U) $1,788 Develop precision time, position, and velocity sensors capable of operating in jamming environments enabling multiple platform sensor-to-shooter operations. Continue development of Global Positioning System specific jamming mitigation techniques for operation in hostile radio frequency environments.

(U) $5,039 Develop and demonstrate enabling ATR technologies for intelligence, surveillance, and reconnaissance applications. Continue evaluating physics-based and adaptive learning techniques.

(U) $1,909 Develop ATR and Sensor Fusion performance assessment technology. Conduct ATR performance evaluation theory research.

(U) $13,237 Total

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 6095

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands)

(U)	$3,976	Continue integrating, evaluating, and demonstrating single and multi-sensor ATR and sensor fusion algorithms for rapidly finding, tracking, and targeting mobile targets. Continue integrating real-time ATR algorithms, for time-critical targets, on embedded high-performance computing systems. Complete laboratory demonstration of adaptive resource allocation methods. Continue integrating and evaluating algorithms and concepts for detecting and targeting targets under trees. Complete developing single sensor ATR performance assessment technology, and multi-sensor and sensor fusion assessment technology. Continue ATR performance evaluation theory research. Complete the first single sensor automatic target recognition (ATR) performance prediction model.
(U)	$3,853	Develop, evaluate, and demonstrate target signature models to support ATR and sensor fusion algorithm development and testing for reconnaissance and strike mission applications. Develop target signature models for signature exploitation of synthetic aperture radar, electro-optical multispectral systems, and signals intelligence sensors. Demonstrate the ability to generate synthetic air and ground target signatures with sufficient fidelity to support automatic recognition of targets in operationally realistic mission environments. Develop modeling and simulation tools that can estimate warfighter effectiveness enhancements due to inserting ATR and sensor fusion aids into the reconnaissance and strike components of the time-critical targeting kill chain.
(U)	$4,508	Develop and demonstrate enabling ATR, sensor management, and sensor fusion technologies for target detection, tracking, and identification in intelligence, surveillance, and reconnaissance (ISR) and combat identification (CID) applications. Complete the evaluation of adaptive learning techniques for target identification. Initiate laboratory demonstration of adaptive sensor management algorithms for target detection, tracking, and ID. Continue evaluation of physics-based techniques for target detection and identification for ISR and CID applications.
(U)	$631	Develop precision time, position, and velocity sensors capable of operating in jamming environments. These sensors will enable multiple platform sensor to shooter operations. Continue development of Global Positioning System specific jamming mitigation techniques for operation in hostile radio frequency environments with emphasis on synergistically integrating anti-jam technologies. Develop virtual flight test technology for improved assessment of reference sensors.
(U)	$12,968	Total

(U) B. Project Change Summary

Not Applicable.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)		DATE: February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors	PROJECT: 6095

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 0602500F, Multi-disciplinary Space Tech.
(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.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2002

BUDGET ACTIVITY: 02 - Applied Research

PE NUMBER AND TITLE: 0602204F Aerospace Sensors

PROJECT: 7622

COST ($ in Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
7622 RF Sensors & Countermeasures Tech	18,474	25,453	17,234	23,324	24,713	27,159	27,720	Continuing	TBD

In FY 2003, efforts in radio frequency (RF) processing for intelligence, surveillance, and reconnaissance (ISR) sensors will transfer from this project to this PE, Project 5017. Also in FY 2003, space unique tasks in this project will be transferred to PE 0602500F, Project 5029, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

This project develops and assesses RF sensing concepts for aerospace applications through modeling and simulation. This project also develops and evaluates technology for fire control radar, electronic combat (EC), and integrated radar and EC systems. It emphasizes the detecting and tracking of surface and airborne targets with RF signatures that are difficult to detect due to reduced radar cross sections, concealment and camouflage measures, severe clutter, or heavy jamming. This project also develops the RF warning and countermeasure technology for advanced EC applications. Specifically, it develops techniques and technologies to detect and counter the links and sensors of threat air defense systems and hostile command and control networks. The project also exploits emerging technologies and components to provide increased capability for offensive and defensive RF sensors, including radar warning, RF EC, and electronic intelligence applications.

(U) FY 2001 ($ in Thousands)

(U) $4,988 Developed aerospace microwave sensor technologies for detecting, locating, and engaging airborne and ground targets. Developed 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. Conducted airborne radar data collection. Performed laboratory analysis for application of advanced surveillance techniques. (This effort incorporated work previously performed under PE 0602702F, Project 4506.)

(U) $4,451 Developed 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. Analyzed individual algorithms for improved air and ground moving target indication algorithm performance. Developed adaptive processing techniques that incorporate knowledge-based approaches.

(U) $1,127 Developed technology for detecting and attacking concealed targets. Evaluated 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) $3,008 Develop affordable radio frequency 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

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 7622

(U) A. Mission Description Continued

(U) FY 2001 ($ in Thousands) Continued

techniques, and techniques to degrade modern communication networks. (Prior to FY 2001, this work was conducted in this PE, Project 2000.)

(U) $3,708 Develop technology for generic software modules to enable low-cost block upgrades to electronic warfare receivers. Design threat identification software modules for next-generation threat warning receivers. (Prior to FY 2001, this work was conducted in this PE, Project 2000.)

(U) $1,192 Developed affordable antenna technology for use in operational and future aerospace platform electronic receivers and apertures. Demonstrated, in the laboratory, an integrated ensemble of low-frequency direction-finding antennas. Developed highly precise, wideband, interferometric multimode direction-finding antennas. Demonstrated a micro-electro-mechanical phase shifter controlled array. Demonstrated design tools to predict antenna performance. (Prior to FY 2001, this work was conducted in this PE, Project 2000.)

(U) $18,474 Total

(U) FY 2002 ($ in Thousands)

(U) $2,199 Develop aerospace microwave sensor technologies for detecting, locating, and engaging airborne and ground targets. Conduct airborne radar target and clutter phenomenology data collections used to evaluate, validate, and improve engineering tools supporting intelligence, surveillance, and reconnaissance, and multi-intelligence sensor concept studies and system analyses. Demonstrate sensor performance through in-flight experiments and simulations.

(U) $3,551 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. Develop multi-mission adaptive radar algorithms to support various operational modes including air and ground target detection, ground target imaging, electronic protection, and passive radio frequency (RF) emission detection. Develop advanced waveforms to achieve transmit adaptivity and simultaneous multi-mode operation. Improve interference rejection, self-protection, and target identification by exploiting diversity in frequency, delay, polarization, modulation, and coding.

(U) $1,276 Develop technology for detecting and precisely locating concealed targets using standoff aerospace platforms. Develop and evaluate technology for airborne ground-penetrating radar. Develop and evaluate signal processing algorithms for improving detection and false alarm performance in foliage-penetrating radar.

(U) $1,735 Develop affordable RF jamming technology and concepts that enhance aerospace vehicle survivability by degrading enemy radar, missile, and command and control systems. Develop multifunction electronic warfare (EW) technique waveforms. Evaluate exploitations of advanced RF threats. Develop optimized EW techniques to degrade modern radar, communication, and missile threat systems.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
	PROJECT: 7622

(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$2,797	Develop technology to enable low-cost upgrades to RF signal receivers. Model threat identification algorithms for next-generation threat warning receivers. Evaluate state-of-the-art digital receiver subsystems. Design advanced very-high frequency receiver improvements for detecting targets under trees. Design novel RF photonic analog-to-digital converter circuitry for order-of-magnitude gains in performance accuracy versus current state-of-the-art.
(U)	$3,816	Develop affordable antenna technology for use in operational and future aerospace platform electronic receivers and apertures. Evaluate wideband, high precision, interferometric, multimode, direction-finding antennas in the laboratory. Develop design tools to predict antenna performance installed on host platform models. Develop robust ultra-wideband front end electronics to handle large signals.
(U)	$2,790	Develop and validate, via a global infosphere experiment, the radar architectures, aperture technology, and signal processing to support a space-based moving target indication sensor. Use the collaborative engineering environment to model and assess radio frequency (RF) architectures and signal processing techniques. Analyze the utility of a space-based sensor architecture.
(U)	$1,983	Design and validate multi-intelligence sensor technologies for total battlefield awareness. Evaluate single platform technologies for common waveform utilization, knowledge-based function scheduling, and superior difficult target detection for both in-the-clear and concealed targets. Develop and evaluate hybrid sensor systems, including space/air/ground combinations delivering improved location accuracies and tracking strategies.
(U)	$5,306	Develop and analyze concepts for a multi-mission unmanned aerial vehicle based sensor suite capable of detecting and tracking advanced aerial targets and both exposed and concealed ground targets. Determine enabling technologies required for full target surveillance capability.
(U)	$25,453	Total

(U) FY 2003 ($ in Thousands)

(U)	$6,956	Develop affordable RF jamming technology and concepts that enhance aerospace vehicle survivability by degrading enemy radar, missile, and command and control systems. Develop multifunction electronic warfare (EW) technique waveforms. Continue exploitation evaluations against new, advanced RF threats. Develop optimized EW techniques to degrade modern radar, communication, and missile threat systems. Initiate phase calibration development.
(U)	$5,357	Develop technology to enable affordable upgrades to RF signal receivers. Model threat identification algorithms for next generation threat warning receivers. Evaluate state-of-the-art radar and EW digital receiver subsystems with Gallium Arsenide and Indium Phosphide RF components (ADCs, filters, mixers, etc.) for laboratory environment scenario testing. Design advanced very high frequency receiver improvements for detecting targets under trees.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE February 2002
BUDGET ACTIVITY: 02 - Applied Research	PE NUMBER AND TITLE: 0602204F Aerospace Sensors
PROJECT: 7622	

(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

(U)	$4,042	Develop robust, ultra wide bandwidth antenna technology for use in operational and future aerospace platform electronic apertures. Demonstrate prototype wideband, high precision interferometric multimode direction finding antennas. Develop design tools to predict antenna performance installed on host platform models. Demonstrate components and techniques that increase fivefold the signal handling capability of an aperture.
(U)	$879	Develop and evaluate innovative multi-function RF sensing concepts for aerospace applications through modeling and simulation with an emphasis on system engineering.
(U)	$17,234	Total

(U) B. Project Change Summary

Not Applicable.

(U) C. Other Program Funding Summary ($ in Thousands)

(U) Related Activities:
(U) PE 0602500F, Multi-disciplinary Space Tech.
(U) PE 0603203F, Advanced Aerospace Sensors.
(U) PE 0603253F, Advanced Avionics Integration.
(U) PE 0602782A, Command, Control, Communications Technology.
(U) PE 0602232N, Navy C3 Technology.
(U) PE 0603792N, Advanced Technology Transition.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.