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

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors

	COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
	Total Program Element (PE) Cost	57,625	52,482	36,550	30,714	34,102	43,035	39,621	39,365	Continuing	TBD
5019	Advanced RF Technology for ISR Sensors	0	4,622	4,946	3,586	4,398	4,596	5,451	5,527	Continuing	TBD
665A	Advanced Aerospace Sensors Technology	16,382	11,985	14,953	10,782	9,643	10,740	10,902	11,055	Continuing	TBD
69DF	Target Attack and Recognition Technology	41,243	35,875	16,651	16,346	20,061	27,699	23,268	22,783	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	Continuing	TBD

Note: In FY 2002, work performed under PE 0603253F, Projects 2735 and 666A, moved to this PE, Project 665A. Apparent project ramps due to realignment of the projects and higher priorities within the Science and Technology program. In FY 2003, efforts in advanced radio frequency (RF) technologies for intelligence, surveillance, and reconnaissance (ISR) sensors previously performed in this PE, Project 665A, transferred to Project 5019. Also in FY 2003, space unique tasks in this PE, Project 665A, transferred to PE 0603500F, Project 5034, in conjunction with the Space Commission recommendation to consolidate all space unique activities.

(U) A. Mission Description

Divided into three broad project areas, this program develops technologies to enable the continued superiority of sensors from aerospace platforms. The first project develops and demonstrates advanced technologies for RF sensors for aerospace ISR systems. The second project develops and demonstrates advanced technologies for electro-optical (EO) sensors, radar sensors and electronic counter-countermeasures, and components and algorithms. The third project develops and demonstrates RF and EO sensors for detecting, locating, and targeting airborne, fixed, and time-critical mobile ground targets obscured by natural or man-made means. Together, the projects in this program develop the means to find, fix, target, track, and engage air and ground targets anytime, anywhere, and in any weather. Note: In FY 2003, Congress added $1.0 million for Advanced Physical Vapor Transport and $2.1 million for the National Operational Signature Production and Research Capability

(U) B. Budget Activity Justification

This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing system upgrades and/or new sensor and electronic combat system developments that have military utility and address warfighter needs.

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

		FY 2002	FY 2003	FY 2004	Total Cost
(U)	Previous President's Budget	60,914	50,589	42,072	
(U)	Appropriated Value	61,509	53,689		
(U)	Adjustments to Appropriated Value				
	a. Congressional/General Reductions	-595	-639		
	b. Small Business Innovative Research	-1,474			
	c. Omnibus or Other Above Threshold Reprogram		-568		
	d. Below Threshold Reprogram	-1,534			
	e. Rescissions	-281			
(U)	Adjustments to Budget Years Since FY 2003 PBR			-5,522	
(U)	Current Budget Submit/FY 2004 PBR	57,625	52,482	36,550	TBD

(U) Significant Program Changes:

Funding decrease in FY 2004 due to higher priorities within the Science and Technology program.

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

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors

PROJECT: 5019

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
5019 Advanced RF Technology for ISR Sensors	0	4,622	4,946	3,586	4,398	4,596	5,451	5,527	Continuing	TBD

Note: In FY 2003, efforts in advanced radio frequency (RF) technologies for intelligence, surveillance, and reconnaissance (ISR) sensors previously performed in this PE, Project 665A, transferred to this project.

(U) A. Mission Description

This project develops and demonstrates RF aerospace surveillance sensors and signal processing for ISR sensors capable of operating in adverse clutter and jamming environments. This project provides the warfighter with sensors capable of detecting and tracking both airborne (conventional and low radar cross section) and ground-based, high-value, time-critical targets. Work includes developing aerospace environmentally-qualified (vibration, shock, temperature, and radiation-hardened) sensor capabilities (including integrated electro-optical mixed signal), as well as advanced component and subsystem technologies.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $0 No Activity

(U) $0 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $882 Configure data collection opportunities using existing assets for validation of techniques generated for advanced air moving target indication, ground moving target indication (GMTI), and foliage penetrating ground target indication. Initiate an effort to design a flexible testbed using a manned test aircraft to demonstrate multi-intelligence surveillance.

(U) $1,451 Conduct in-house development of a multi-intelligence sensor design, utilizing technologies developed in aperture development, signal processing, and radar design. Develop techniques for discriminating ground from air targets under conditions of common pulse repetition frequencies, waveforms, and receiver systems.

(U) $1,406 Develop advanced radar signal processing techniques to mitigate clutter and jamming interference, and improve detection and tracking of difficult targets in hostile environments. Develop knowledge-aided radar signal processing techniques for improved detection and false alarm control performance in GMTI sensors. Implement multi-dimensional adaptive processing techniques and knowledge-aided radar signal processing techniques on selected advanced computing architectures, and demonstrate these techniques for multi-mission aerospace radar applications.

(U) $883 Develop and demonstrate photonic digital and analog mixed signal multi-gigahertz component architectures. Develop and integrate chip-scale

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

photonic and hybrid mixed signal components for radio frequency (RF) signal generation, phased array antenna beam formation, and beam control. Develop and demonstrate high-resolution wide bandwidth photonic wavelength division multiplexing and signal processing technology. Provide performance modeling, verification, and analysis of photonic and hybrid mixed signal devices for military unique applications.

(U) $4,622 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $1,081 Collect data for multi-intelligence air moving target indication, ground moving target indication (GMTI), and foliage-obscured ground target indication. Mature the design for a flexible testbed demonstrating multi-intelligence surveillance to the critical design review level.

(U) $1,271 Complete the design of a multi-intelligence surveillance system and model it in mission area simulations. Validate the system through computer simulation and emulation techniques for discerning ground and air targets under multi-intelligence waveform, pulse repetition frequency, and signal processing scenarios. Initiate plans for an experiment that will validate electronic protection signal processing techniques for multi-intelligence data collection systems.

(U) $1,246 Begin developing techniques to surveil venues denied to standoff intelligence, surveillance, and reconnaissance platforms. The emphasis is on denied access areas, such as urban canyons, inner areas of buildings, and heavily concealed targets that use advanced camoflauge, concealment, and deception techniques. Specifically, the effort will concentrate on short-range, low-cost, expendable sensors that can exploit multiple phenomenologies.

(U) $1,049 Demonstrate and evaluate advanced radar signal processing techniques to mitigate clutter and jamming interference, and improve the detection and tracking of difficult targets in hostile environments. Demonstrate and evaluate knowledge-aided radar signal processing techniques for improved detection and false alarm control performance in GMTI sensors. Continue implementing adaptive processing techniques for multi-mission conformal arrays and wideband and polarization adaptive processing techniques for multi-function radar on selected advanced computing architectures, and continue demonstrating these techniques for multi-mission aerospace radar applications.

(U) $299 Continue providing impartial performance modeling, verification, and analyses of photonic and hybrid mixed signal devices for RF signal generation, phased array antenna beam formation, and beam control, in support of government-sponsored and independent research.

(U) $4,946 Total

(U) B. Project Change Summary

Not Applicable.

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BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors / PROJECT: 5019

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

(U) Related Activities:
(U) PE 0602204F, Aerospace Sensors.
(U) PE 0603270F, Electronic Combat Technology.
(U) PE 0603500F, Multi-disciplinary Advanced Space Technology.
(U) PE 0604270F, Electronic Warfare (EW) Development.
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.

(U) D. Acquisition Strategy

Not Applicable.

(U) E. Schedule Profile

(U) Not Applicable.

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

DATE: February 2003

BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors

PROJECT: 665A

COST ($ in Thousands)	FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
665A Advanced Aerospace Sensors Technology	16,382	11,985	14,953	10,782	9,643	10,740	10,902	11,055	Continuing	TBD

Note: In FY 2003, space unique tasks in this project transferred to PE 0603500F, Project 5034, in conjunction with the Space Commission recommedation to consolidate all space unique activities. Also in FY 2003, efforts in advanced radio frequency (RF) technologies for intelligence, surveillance, and reconnaissance (ISR) sensors previously performed in this project transferred to this PE, Project 5019.

(U) A. Mission Description

This project develops and demonstrates aerospace sensor technologies for manned and unmanned platforms, including electro-optical (EO) sensors, targeting and attack radar sensors, and electronic counter-countermeasures for radars. It provides aerospace platforms with the capability to precisely detect, track, and target both airborne (conventional and low radar cross section) and ground-based, high-value, time-critical targets. Project activities include developing multi-function radar and electronic combat technology. Desired warfighting capabilities include the ability to detect concealed targets in difficult background conditions.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $2,619 Developed integrated EO sensor technology to search, detect, locate, and identify air and ground targets at ranges significantly longer than currently achievable, including targets that are camouflaged, low-observable, or employ other means of deception. Designed and began demonstrating active and passive sensor components of an affordable, integrated targeting capability.

(U) $3,557 Developed EO sensor technologies to detect and locate camouflaged and concealed targets for aerospace ISR applications. Continued fabricating a demonstration sensor for high altitude reconnaissance aircraft. Performed initial system utility demonstrations, and developed signature-based data processing techniques.

(U) $942 Develop advanced radar signal processing techniques to mitigate clutter and jamming interference and improve detection and tracking of difficult targets. Design processing architecture for evaluating multi-dimensional adaptive processing techniques. Demonstrate these techniques for multi-mission aerospace radar applications.

(U) $3,070 Developed, tested, evaluated, and demonstrated the RF sensor techniques required to detect, track, and target high-value, time-critical targets that are concealed through stealth or deceptive techniques. Demonstrated technologies to increase detection range for low-observable targets. Initiated concept design study for a 'mini' unmanned aerial vehicle RF sensor to detect, track, and target high-value, time-critical targets that are difficult to detect through either stealth or concealment.

(U) $818 Developed advanced EO sensor technology for non-cooperative target identification. Completed design and began developing a multi-function laser for air and ground target identification.

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

(U)	$1,009	Developed advanced multi-function sensor component technologies for radar, electronic warfare, navigation, and communications applications. Initiated evaluating very high density two-dimensional and three-dimensional interconnects for phased array transmit/receive modules on manned and unmanned platforms. Completed testing a multi-chip module version of a monobit receiver for electronic warfare applications. Developed advanced radio frequency (RF) photonic signal control and distribution technologies for phased array apertures.
(U)	$1,894	Develop and demonstrate advanced modular, sharable, digital RF sensor technologies for aerospace sensor suites performing intelligence, surveillance, and reconnaissance (ISR) applications. Demonstrate a multi-channel radar digital receiver with channel match greater than 60dB and jammer cancellation.
(U)	$1,569	Developed technologies to maximize Global Positioning System (GPS) jam resistance, positional accuracy, and exploitation techniques to improve offensive and defensive combat capabilities. Designed advanced GPS M-Code technology. Developed geo-registration and precise target location technology supporting multi-sensor and distributed sensor integration.
(U)	$904	Developed deposition techniques for high growth rate, high quality silicon carbide semiconductor substrates to enable advanced physical vapor transport techniques.
(U)	$16,382	Total

(U) FY 2003 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$3,166	Develop integrated electro-optical (EO) sensor technology to search, detect, locate, and identify air and ground targets at ranges significantly longer than currently achievable, including targets that are camouflaged, low-observable, or employ other means of deception. Complete fabricating and testing a ground demonstration sensor and aircraft integration design. Assess real-time data processing performance.
(U)	$3,260	Develop EO sensor technologies to detect and locate camouflaged and concealed targets for aerospace ISR applications. Complete fabricating and testing a demonstration sensor for high altitude reconnaissance aircraft. Perform flight characterization. Assess signature-based data processing performance.
(U)	$1,325	Develop advanced EO sensor technology for non-cooperative target identification. Complete design and begin developing a multi-function laser for air and ground target identification.
(U)	$1,210	Develop technologies to maximize GPS jam resistance, positional accuracy, timing accuracy, and exploitation techniques to improve offensive and defensive combat capabilities. Develop advanced GPS M-Code technologies. Develop reference technologies to adaptively operate GPS in buildings, underground, and in air and space to provide precise time, position, and velocity for multiple platforms. Develop virtual flight test technology for improved assessment of GPS anti-jam technologies.

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

(U)	$1,828	Develop, test, evaluate, and demonstrate the radio frequency (RF) sensor techniques required to detect, track, and target high-value, time-critical targets that are difficult to detect through either stealth or concealment. Evaluate 'mini' unmanned aerial vehicle concept of operation and RF sensor performance improvements in the detection, tracking, and targeting of high-value, time-critical targets.
(U)	$233	Provide concept definition and system analysis of a fire control radar system for airborne applications.
(U)	$963	Demonstrate deposition techniques for high growth rate, high quality silicon carbide semiconductor substrates to enable advanced physical vapor transport techniques.
(U)	$11,985	Total

(U) FY 2004 ($ in Thousands)

(U)	$0	Accomplishments/Planned Program
(U)	$4,583	Continue developing integrated electro-optical (EO) sensor technology to search, detect, locate, and identify air and ground targets at ranges significantly longer than currently achievable, including targets that are camouflaged, low-observable, or employ other means of deception. Extend performance of ground demonstration sensor to flying test-bed configuration. Ground test aircraft integration components. Extend design to integrate key subsystems for modular testing.
(U)	$4,956	Continue developing EO sensor technologies to detect and locate camouflaged and concealed targets for aerospace intelligence, surveillance, and reconnaissance applications. Extend performance of a demonstration sensor for high altitude reconnaissance aircraft to incorporate an emissive spectral sensing capability. Fabricate, laboratory integrate, and test emissive spectrometer components.
(U)	$2,159	Continue developing advanced EO sensor technology for non-cooperative target identification. Complete developing a multi-function laser for air and ground target identification based on target geometry and vibration.
(U)	$1,240	Demonstrate precise reference aerospace sensing technologies to adaptively operate undergound and in buildings. Design geo-registration technologies to maximize navigation warfare exploitation techniques for enhanced offensive and defensive combat capabilities. Develop virtual flight test simulation technology to assess advanced Global Positioning System anti-jam techniques.
(U)	$1,519	Continue developing, testing, evaluating, and demonstrating the RF sensor techniques required to detect, track, and target high-value, time-critical targets that are difficult to detect through either stealth or concealment. Test 'mini' unmanned aerial vehicle concept of operation and RF sensor performance improvements in the detection, tracking, and targeting of high-value, time-critical targets.
(U)	$496	Develop advanced radar techniques, sub-systems, and methods to establish and maintain track radar performance of weapons-guidance quality in advanced jamming environments. Devise integrated high-fidelity fire control radar and weapon system simulation model to evaluate system and sub-system requirements and performance.

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued
(U) $14,953 Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:
(U) PE 0602204F, Aerospace Sensors.
(U) PE 0603205F, Flight Vehicle Technology.
(U) PE 0603707F, Weather Systems Advanced Development.
(U) PE 0603500F, Multi-disciplinary Advanced Development Space Technology.
(U) PE 0602111N, Weapons Technology.
(U) PE 0602232N, Space and Electronic Warfare (SEW) Technology.
(U) PE 0604249F, LANTIRN Night Precision Attack.
(U) PE 0603270F, Electronic Combat Technology.
(U) A Memorandum of Agreement has been established between Air Force Research Laboratory and Defense Advanced Research Projects Agency to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments.
(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.

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BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors / PROJECT: 69DF

COST ($ in Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
69DF	Target Attack and Recognition Technology	41,243	35,875	16,651	16,346	20,061	27,699	23,268	22,783	Continuing	TBD

Note: In FY 2003, efforts in advanced radio frequency technologies for intelligence, surveillance, and reconnaissance previously performed in this project transferred to this PE, Project 5019.

(U) A. Mission Description

This project develops and demonstrates advanced technologies for attack management, fire control, and target identification and recognition. This includes developing and demonstrating integrated and cooperative fire control techniques to provide for adverse-weather precision air strikes against multiple targets per pass and at maximum weapon launch ranges. Specific fire control technologies under development include attack management, sensor fusion, automated decision aids, advanced tracking for low radar cross section threats, and targeting using both on-board and off-board sensor information. This project also evaluates targeting techniques to support theater missile defense efforts in surveillance and attack. These fire control technologies will provide force multiplication and reduce warfighter exposure to hostile fire. This project also develops and demonstrates target identification and recognition technologies for positive, high confidence cueing, recognition, and identification of airborne and ground-based, high-value, time-critical targets at longer ranges than are currently possible. The goal is to apply these technologies to tactical air-to-air and air-to-surface weapon systems so they are able to operate in all weather conditions, during day or night, and in high-threat, multiple target environments. Model-based vision algorithms and target signature development techniques are the key to target identification and recognition. This project is maturing these technologies in partnership with the Defense Advanced Research Projects Agency, and evaluating the techniques to support theater missile defense efforts in surveillance and attack. Fire control and recognition technologies developed and demonstrated in this project are high leverage efforts, providing for significant advancements in operational capabilities largely through software improvements readily transitionable to new and existing weapon systems.

(U) FY 2002 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $1,043 Developed advanced global awareness and precision engagement automated targeting technologies for rapid detection, location, and attack of time-critical targets. Integrated modeling, simulation, and analysis testbed to determine automatic target recognition (ATR) and information fusion algorithms for time-critical targeting, emphasizing the difficult targeting missions where weather, terrain, foliage, camoflauge, or deception techniques obscure or conceal the targets of interest during most of their deployment cycles.

(U) $3,080 Developed common, open system technologies for integrating real-time information in- and out-of-the-cockpit to improve aircrew situational awareness, target nomination, and target engagement capabilities. Demonstrated a capability to fuse all-source threat, target, and survivor location data for use on special operations forces aircraft.

(U) $2,568 Developed and evaluated radar ATR algorithms for tracking and identifying moving and stationary ground targets. Continued demonstrating

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(U) A. Mission Description Continued

(U) FY 2002 ($ in Thousands) Continued

affordable risk reduction for transition via planned sensor upgrades to strike and reconnaissance platforms. These algorithms will significantly impact the capability to find, fix, track, target, engage, and assess time-critical targets in all phases of deployments, including active and passive communication and emission states; during hide in foliage; and either moving or stationary.

(U) $873 Developed automatic target recognition (ATR) solutions using hyperspectral imaging data and other candidate sensor inputs. Developed target and background phenomenology technology to recognize and identify targets using hyperspectral imaging data. Conducted performance analyses on candidate algorithms using hyperspectral imaging data.

(U) $2,646 Continued testing and integrating Defense Advanced Research Projects Agency multi-sensor ATR fusion algorithms into the Air Force ATR evaluation test facility for application to Air Force intelligence, surveillance, and reconnaissance, strike, and weapon systems. Demonstrated impact to image analysts and Air Operation Center decision makers of automated multi-sensor ATR and fusion capability on sensor-to-shooter timeline reductions for time-critical targeting.

(U) $23,854 Developed technology to detect and identify targets under trees. Designed and fabricate a very high frequency (VHF) foliage penetration radar. Developed and implemented VHF radar change detection algorithms for robust target detection with a low false alarm rate. Performed VHF radar data collections for algorithm development and foliage penetration characterization. Developed imagery exploitation algorithms for target identification sensor fusing techniques. Performed high fidelity modeling of the VHF radar, change detection capability, data fusion process, and weapon effectiveness. Developed integration plans for a warfighter-selected operational platform. Developed and demonstrated air-to-ground radar imaging technology and reliable combat identification technology to enable capability to detect and target difficult, concealed, and non-cooperative targets.

(U) $7,179 Continued developing a National Radar Signature Production and Research Capability. Developed, validated, and began integrating data libraries discriminating friend, foe, and neutral targets into aircraft radar signature computer modeling and simulation tools.

(U) $41,243 Total

(U) FY 2003 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $2,006 Develop modeling and simulation to show enhanced global awareness and precision engagement capability for warfighters, as enabled by automated targeting technologies for rapid detection, location, and prosecution of time-critical targets. Employ the modeling, simulation, and analysis testbed to analyze and demonstrate ATR and information fusion algorithms for time-critical targeting, emphasizing the difficult targeting missions where weather, terrain, foliage, camouflage, and deception techniques obscure or conceal the targets of interest. Develop and employ air and ground target signature generation models to support automated target signature exploitation in automatic target recognizer and

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

multi-sensor fusion algorithms. Generate synthetic target signatures for automated signature exploitation of radio frequency and electro-optical (EO) sensor data.

(U) $1,818 Continue common open system technology integration for real-time information in- and out-of-the-cockpit to improve aircrew combat and joint battlespace situational awareness, target nomination, and target engagement capabilities. Demonstrate initial capability to fuse all-source threat, imagery, target, and survivor location data using an airborne platform digitally linked to airborne combat search and rescue assets.

(U) $5,160 Continue developing and testing an automatic target recognition (ATR) system for tracking and identifying moving and stationary ground targets for use in strike and reconnaissance platforms. Integrate advanced stationary target identification techniques and algorithms with synthetic aperture radar processing. Advance the state-of-the-art for moving target identification techniques and algorithms by providing technology maturation and risk reduction. Continue analysis of requirements and affordable risk reduction for transition via planned sensor upgrades to strike and reconnaissance platforms.

(U) $3,766 Test and integrate Air Force and Defense Advanced Research Projects Agency multi-sensor ATR fusion algorithms into the Air Force ATR evaluation test facility for application to Air Force intelligence, surveillance, reconnaissance, strike, and weapon systems. Characterize single and multi-sensor contributions from radar and EO (including hyperspectral imaging) sensors with automated exploitation. Continue demonstrating, to image analysts and Air Operation Centers decision makers, the impact of automated multi-sensor ATR and fusion capability on timeline reductions for time-critical targeting.

(U) $12,201 Develop technology to detect, identify, and engage targets under trees (TUT). Characterize performance of foliage penetration radar sensors and algorithms for robust target detection and tracking with low probability of false alarms. Develop TUT-specific intelligence preparation of the battlefield tools for improved tracking, detection, sensor management, and target identification and location. Develop tools for multi-intelligence georegistration. Perform end-to-end modeling for the TUT family of systems, providing measures of effectiveness that encompass the entire kill chain cycle. Perform virtual simulations to identify system integration issues, human decision functions, and system processes. Develop integration plans with warfighter-selected operational systems. Test system functionality, including fusion and georegistration, and concepts of employment.

(U) $8,900 Continue developing and demonstrating a moderate confidence automatic target recognition and advanced cueing (ATR/C) capability for stationary and moving targets under the Air-to-Ground Radar Imaging effort. Continue developing a follow-on, high confidence combat identification capability under the Reliable Combat Identification for Surface Targeting effort. Characterize advanced stationary and moving target radar data to determine its utility for ATR/C and combat identification. Develop tools to support sensor system, sensor management, and system performance analyses. Characterize the performance of identification techniques for multiple moving targets. Perform advanced multi-sensor data collection on stationary and moving targets. Determine which combination of sensors, modes, and fusion processing

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(U) A. Mission Description Continued

(U) FY 2003 ($ in Thousands) Continued

techniques would provide combat identification of the highest confidence.

(U) $2,024 Continue developing a National Operational Signature Production and Research Capability. Continue expanding the database and begin creating the signature modeling and simulation capability to consistently and expediently expand database production support for critical combat identification systems.

(U) $35,875 Total

(U) FY 2004 ($ in Thousands)

(U) $0 Accomplishments/Planned Program

(U) $943 Continue developing modeling and simulation to show enhanced global awareness and precision engagement capabilities for warfighters as enabled by automated targeting technologies for rapid detection, location, and prosecution of time-critical targets. Employ the modeling, simulation, and analysis testbed to analyze and demonstrate automatic target recognition (ATR) and information fusion algorithms for time-critical targeting, emphasizing the difficult targeting missions where weather, terrain, foliage, camouflage, and deception techniques obscure or conceal the targets of interest during their deployment cycles. Emphasize analysis testbed demonstrations in operationally realistic environments, using operationally realistic data and processes. Continue to develop and employ air and ground target signature generation models that support automated target signature exploitation in automatic target recognizer and multi-sensor fusion algorithms. Generate synthetic target signatures for automated signature exploitation of radio frequency and electro-optical sensor data.

(U) $1,386 Incrementally upgrade common situational awareness open system technologies to integrate special threat awareness receiver system that provides aircrew with integrated air defense system threat intent data for enhancing in-flight threat response options and aircraft self-protection capabilities. Demonstrate a laboratory capability to fuse all-source threat, target, survivor location, and threat intent data for use across special operations and other tactical aviation platforms. Conduct limited flight evaluations of key system components to assess system performance capabilities in low-altitude, terrain-masked threat environments.

(U) $2,832 Finalize developing and integrating advanced stationary target identification techniques and algorithms with synthetic aperture radar processing. Demonstrate a stationary ground target classification/identification capability using these advanced techniques in real-time in a laboratory setting using operational computer hardware devices. Develop transition plans and perform transition risk reduction tasks for integrating this capability into operational strike and reconnaissance platforms. Develop advanced moving target classification/identification techniques and algorithms for integration with high range resolution radar and other moving target indication processing techniques.

(U) $3,510 Assess the performance of Air Force and Defense Advanced Research Projects Agency multi-sensor ATR fusion algorithms using the Air Force ATR evaluation test facility. Continue characterizing both single and multiple sensor contributions from radar and electro-optical (including

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(U) A. Mission Description Continued

(U) FY 2004 ($ in Thousands) Continued

hyperspectral imaging) sensors with automated exploitation. Initiate developing tools to automate data collection planning for transition of algorithms. Improve automatic target recognition (ATR) research and development computer and networking infrastructure via software, hardware, and network integration enhancements. Improve processing capabilities and expand DoD-wide repository of Research and Development (R&D) sensor data. Develop an integrated computational and collaborative environment to accelerate the transition of ATR and sensor fusion technologies. Utilize synthetic data generation capability to augment and enhance existing R&D and operational data sets. Continue to show timeline reduction for time-critical targeting impact of automated multi-sensor ATR and fusion capability to image analysts and decision-makers in the experimental Air Operations Centers.

(U) $4,831 Continue developing and demonstrate technology to detect and identify targets under trees (TUT). Characterize performance of foliage penetration radar sensors and algorithms for robust target detection and tracking with low probability of false alarm. Develop and demonstrate TUT-specific intelligence preparation of the battlefield tools for improved tracking, detection, sensor management, and target identification and location. Develop and integrate tools for multi-intelligence georegistration with fusion architecture. Perform end-to-end modeling for TUT family of systems, providing measures of effectiveness that encompass the entire kill chain cycle. Perform virtual simulation of the TUT family of systems in an operationally realistic environment. Finish system functionality test, including fusion and georegistration tests, and study of possible trades in concepts of employment.

(U) $811 Continue mission-level and system-of-systems studies and analyses to determine which combination of sensors, modes, and fusion processing techniques would provide a high confidence combat identification capability for stationary and moving ground targets.

(U) $2,338 Develop and demonstrate ATR capability integrated with advanced geo-registration techniques and innovative change detection algorithms. Initiate a spiral development activity focused on time-critical targeting. Develop initial capability for an advanced real-time contingency cell in support of initial experiments for the Combined Air Operations Center.

(U) $16,651 Total

(U) B. Project Change Summary

Not Applicable.

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

(U) Related Activities:

(U) PE 0602204F, Aerospace Sensors.

(U) PE 0603253F, Advanced Sensor Integration.

(U) PE 0603500F, Multi-disciplinary Advanced Space Technology.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2A Exhibit)	DATE: February 2003
BUDGET ACTIVITY: 03 - Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors
PROJECT: 69DF	

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

(U) PE 0603762E, Sensor and Guidance Technology.
(U) PE 0603270F, Electronic Combat Technology.
(U) Theater Missile Defense System Program Office.
(U) Low Altitude Night Targeting and Infrared Navigation (LANTIRN) System Program Office.
(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.