PE NUMBER: 0603203F
PE TITLE: Advanced Aerospace Sensors

Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2006

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors

	Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
	Total Program Element (PE) Cost	41.607	39.782	55.150	54.992	58.971	50.688	50.563	Continuing	TBD
5019	Advanced RF Technology for ISR Sensors	3.106	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	TBD
665A	Advanced Aerospace Sensors Technology	12.489	12.913	14.492	15.480	16.741	17.065	17.307	Continuing	TBD
69DF	Target Attack and Recognition Technology	26.012	26.869	28.471	26.553	29.186	25.587	25.073	Continuing	TBD
88SP	Advanced Space Sensors	0.000	0.000	12.187	12.959	13.044	8.036	8.183	Continuing	TBD

Note: In FY 2006, efforts in Project 5019 will transfer to Project 665A within this PE. In FY 2007, Project 88SP, Advanced Space Sensors, efforts will transfer from PE 0603500F, Multidisciplinary Advanced Development Space Technology, Project 5034, Advanced Space Sensors, in order to more effectively manage and provide oversight of the efforts.

(U) A. Mission Description and Budget Item Justification

Divided into four 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 radio frequency (RF) sensors for aerospace intelligence, surveillance, and reconnaissance (ISR) systems. The second project develops and demonstrates advanced technologies for electro-optical (EO) sensors, radar sensors and electronic counter-countermeasures (ECCM), 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. The fourth project develops and demonstrates space sensor technologies including RF sensors, ISR sensors, EO sensors, laser warning sensors, targeting and attack radar sensors, and ECCM and communications. 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 2006, Congress added $5.2 million for National Operational Radar Signature Production and Research Capability. 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.

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors

(U) B. Program Change Summary ($ in Millions)

		FY 2005	FY 2006	FY 2007
(U)	Previous President's Budget	43.837	35.157	42.366
(U)	Current PBR/President's Budget	41.607	39.782	55.150
(U)	Total Adjustments	-2.230	4.625	
(U)	Congressional Program Reductions			
	Congressional Rescissions	-0.036	-0.575	
	Congressional Increases		5.200	
	Reprogrammings	-1.357		
	SBIR/STTR Transfer	-0.837		

(U) Significant Program Changes:

In FY 2007, Project 88SP, Advanced Space Sensors, efforts will transfer from PE 0603500F, Multidisciplinary Advanced Development Space Technology, Project 5034, Advanced Space Sensors, in order to more effectively manage and provide oversight of the efforts..

C. Performance Metrics

Under Development.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE: 5019 Advanced RF Technology for ISR Sensors	

Cost ($ in Millions)		FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
5019	Advanced RF Technology for ISR Sensors	3.106	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: In FY 2006, efforts in this project will transfer into Project 665A within this PE.

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates radio frequency (RF) aerospace surveillance sensors and signal processing for intelligence, surveillance, and reconnaissance (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) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Develop techniques for advanced air moving target indication (AMTI), ground moving target indication (GMTI), and foliage penetrating ground target indication.	1.426	0.000	0.000
(U) In FY 2005: Validated data collected for AMTI, GMTI, and foliage-obscured ground target indication through computer simulation and emulation techniques for discerning ground and air targets under multi-intelligence waveform, pulse repetition frequency, and signal processing scenarios. Planned experiment to validate techniques for multi-intelligence sensing.			
(U) In FY 2006: Not Applicable.			
(U) In FY 2007: Not Applicable.			
(U)			
(U) MAJOR THRUST: Develop and demonstrate advanced radar signal processing techniques to mitigate clutter and jamming interference, and improve detection and tracking of difficult targets in hostile environments.	0.961	0.000	0.000
(U) In FY 2005: Demonstrated and evaluated knowledge-aided radar signal processing techniques for improved detection and false alarm control performance in multi-intelligence sensors. Demonstrated and evaluated adaptive processing techniques for multi-mission conformal arrays and wideband and polarization adaptive processing techniques for multi-function radar on selected advanced computing architectures for multi-mission aerospace radar applications.			
(U) In FY 2006: Not Applicable.			
(U) In FY 2007: Not Applicable.			
(U)			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 5019 Advanced RF Technology for ISR Sensors

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

		FY 2005	FY 2006	FY 2007
(U)	MAJOR THRUST: Develop and demonstrate techniques to surveil venues denied to stand off ISR platforms.	0.719	0.000	0.000
(U)	In FY 2005: Developed techniques to surveil venues denied to stand off ISR platforms, concentrating on short-range, low-cost, expendable sensors that can exploit multiple RF phenomenologies.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Not Applicable.			
(U)	Total Cost	3.106	0.000	0.000

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
(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.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE: 665A Advanced Aerospace Sensors Technology	

Cost ($ in Millions)		FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
665A	Advanced Aerospace Sensors Technology	12.489	12.913	14.492	15.480	16.741	17.065	17.307	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: In FY 2006, efforts in Project 5019 within this PE will transfer to this project.

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates aerospace sensor and processing technologies for intelligence, surveillance, and reconnaissance (ISR) and target and attack radar applications in both manned and unmanned platforms, including electro-optical (EO) 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 in adverse clutter and jamming environments. 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) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Develop 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.	2.033	2.520	4.175

(U) In FY 2005: Demonstrated multi-spectral passive cueing in an airborne environment. Extended performance of ground demonstration sensor with integrated key systems for modular testing to flying test-bed configuration.

(U) In FY 2006: Complete multi-spectral passive cueing demonstration in an airborne environment. Begin development of a multi-function active/passive EO/infrared (IR) sensor demonstration system to detect, locate, and identify difficult targets in both obscured and urban environments for ISR applications. Analyze advanced passive and multi-function active sensing methods to optimize detection and identification of difficult targets. Perform preliminary design for multi-mode unmanned aerial vehicle based sensor, including platform integration plans. Design and fabricate optical components for long wave infrared spectral/polarimetric imager for high altitude sensor. Conduct in-house target/background characterization studies with modified long wave infrared imaging spectrometer.

(U) In FY 2007: Continue development of a multi-function active/passive EO/IR sensor demonstration system to detect, locate, and identify difficult targets in both obscured and urban environments for ISR applications. Finalize analysis of advanced passive and multi-function active sensing methods to optimize detection and identification of difficult targets. Complete design for multi-mode unmanned aerial vehicle based sensor, including platform integration plans. Initiate development of coarse to fine sensing methodologies which progress from wide area search to pinpoint identification and characterization. Incorporate long wave infrared spectral/polarimetric imager into high altitude

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 665A Advanced Aerospace Sensors Technology

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	sensor. Conduct flight test to demonstrate target detection capability.			
(U)				
(U)	MAJOR THRUST: Develop EO sensor technologies to detect and locate camouflaged and concealed targets for aerospace ISR applications.	4.570	1.645	0.831
(U)	In FY 2005: Completed integration and testing of a demonstration sensor for high altitude reconnaissance aircraft. Performed flight characterization and assessed signature-based data processing performance.			
(U)	In FY 2006: 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)	In FY 2007: Complete fabrication and testing of demonstration system for high altitude aircraft incorporating reflective and emissive spectral sensing capability for day and night operations. Perform flight characterization and support transition to acquisition center.			
(U)				
(U)	MAJOR THRUST: Develop technologies to maximize positional accuracy, timing accuracy, and exploitation techniques to improve offensive and defensive combat capabilities.	0.881	1.787	2.422
(U)	In FY 2005: Designed critical experiments for assured reference technologies to maximize positional accuracy, timing accuracy, and exploitation techniques for network centric engagement. Developed automatic multi-intelligence sensor data registration technology for improved geo-location performance. Expanded virtual flight test simulation technology for improved assessment of precise reference sensing networks.			
(U)	In FY 2006: Develop critical experiments using virtual flight test simulation to characterize assured reference technologies for net centric warfare. Design follow-on distributed position, navigation, and timing (PNT) advanced technology demonstration to optimize time-sensitive targeting, battlespace awareness, and persistent ISR capabilities. Improve report, track, and image georegistration technologies for multi-intelligence sensor data.			
(U)	In FY 2007: Demonstrate critical experiments using virtual flight test simulation to characterize assured reference technologies for net centric warfare. Develop follow-on distributed PNT advanced technology demonstration to optimize time-sensitive targeting, battlespace awareness, and persistent ISR capabilities. Develop sensor phenomenology-based georegistration for imagery and perform lab tests of multi-intelligence georegistration.			
(U)				
(U)	MAJOR THRUST: Develop, test, evaluate, and demonstrate lightweight, low power, compact radio frequency (RF) sensors to detect, track, and target high-value, time-critical targets that are difficult to detect through either stealth or concealment and enable persistent ISR from an unmanned aerial vehicle (UAV). Develop and validate long-range ISR sensor technologies and techniques for the detection and track of advanced air and ground targets. Advanced target characteristics include targets with low radar cross section, concealment capabilities, or electronic	2.528	6.449	5.948

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 665A Advanced Aerospace Sensors Technology

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
counter-countermeasures.			
(U) In FY 2005: Demonstrated in the laboratory evolved multi-intelligence techniques. Demonstrated "mini" UAV concept of operation and RF sensor performance improvements in the detection, tracking, and targeting of high-value, time-critical targets. Developed RF receiver technologies to detect, characterize, and encode difficult signals to assist in the detection and location of high-value, time-critical targets.			
(U) In FY 2006: Flight test a lightweight, low profile multi-function active electronically scanned array on an airborne test bed to demonstrate integrated radar technology capability. Analyze data from flight test and predict system performance on target platforms using advanced computational techniques. Demonstrate accurate, real-time detection and location with enhanced millimeter wave sensor. Begin demonstration of the RF sensors for an integrated EO/RF sensor suite for UAVs with severe size, weight, and power constraints, to enable single platform persistent ISR capability compatible with a system of systems architecture. Construct a multi-intelligence sensor suite ground test bed to emulate an airborne moving platform. Perform risk reduction efforts for airborne implementations. Conduct radar systems engineering support fostering the transition of developed enabling technologies and concepts to weapon systems and ISR assets. Initiate integrated electronic support measures (ESM)/passive radar concept for enhanced target detection and tracking. Initiate development program for threat analysis/mitigation of passive multistatic, multi-intelligence sensing.			
(U) In FY 2007: Continue demonstration of the RF sensors of an integrated EO/RF sensor suite for UAVs with severe size, weight, and power constraints, to enable single platform persistent ISR capability compatible with a system of systems architecture. Develop highly integrated receiver-aperture technologies for improved functionality and greatly reduced size, weight, and power. Continue experiments with the ground test bed providing input into a design for an airborne multi-intelligence experiment. Continue radar systems engineering support fostering the transition of developed enabling technologies and concepts to weapon systems and ISR assets. Further develop an integrated ESM/passive radar concept for enhanced target detection and tracking. Develop program for threat analysis/mitigation of passive multistatic, multi-intelligence sensing.			
(U)			
(U) MAJOR THRUST: Develop weapons guidance quality track radar performance in advanced jamming environments. Develop and demonstrate advanced radar signal processing techniques to mitigate clutter and jamming interference, and improve detection and tracking of difficult targets in hostile environments.	0.377	0.512	1.116
(U) In FY 2005: Evaluated advanced radar techniques, sub-systems, and methods to establish and maintain weapons guidance quality track radar performance in advanced jamming environment. Validated and tested high fidelity fire control radar and weapon system simulation model to evaluate system and sub-system requirements and performance.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 665A Advanced Aerospace Sensors Technology

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U)	In FY 2006: Demonstrate and evaluate adaptive processing techniques for multi-mission conformal arrays and wideband and polarization adaptive processing techniques for multi-function radar. Implement novel space-time adaptive processing techniques that are robust to heterogeneous data. Develop multi-sensor waveform transmission and signal processing techniques on selected advanced computing architectures			
(U)	In FY 2007: Demonstrate and evaluate novel space-time adaptive processing techniques that are robust to heterogeneous data. Demonstrate and evaluate multi-sensor waveform transmission and signal processing techniques on selected advanced computing architectures			
(U)				
(U)	CONGRESSIONAL ADD: Phase Diversity - Imaging Through Volume Turbulence.	1.100	0.000	0.000
(U)	In FY 2005: Investigated current operational slant and horizontal-path imaging scenarios to determine the impact of turbulence on operational performance. Extended the Phase-Diverse Speckle (PDS) algorithm to improve performance in the volume-turbulence imaging scenario. Conducted simulations to evaluate candidate algorithmic approaches. Investigated strategies for increased efficiencies in the PDS algorithm implementation to achieve near-real-time processing. Conducted a data collection to benchmark improvement in imaging quality in the volume-turbulence imaging scenario.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Testbed for Accelerated Transition - Advanced Multi-Discriminant Sensing.	1.000	0.000	0.000
(U)	In FY 2005: Developed an indoor laser radar (LADAR) test bed facility to test, characterize, and demonstrate advanced multi-mode LADARs. Established an initial capability for vibration LADAR.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Not Applicable.			
(U)	Total Cost	12.489	12.913	14.492

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602204F, Aerospace Sensors.									
(U) PE 0603205F, Flight Vehicle									

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603203F Advanced Aerospace Sensors**	PROJECT NUMBER AND TITLE **665A Advanced Aerospace Sensors Technology**

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

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.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE: 69DF Target Attack and Recognition Technology	

Cost ($ in Millions)		FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
69DF	Target Attack and Recognition Technology	26.012	26.869	28.471	26.553	29.186	25.587	25.073	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

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) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Develop modeling and simulation to show enhanced global awareness and precision engagement capability for warfighters. Note: Efforts complete in FY 2005.	1.411	0.000	0.000
(U) In FY 2005: Analyzed enhanced capability to find and identify time-critical targets using automated target recognition processing in a distributed common ground station. Completed an analysis of an enhanced capability to find and track targets under trees and camouflage by employing foliage penetration radar and automated sensor fusion technologies. Developed and employed air and ground target signature generation models to support automated target signature exploitation in automatic target recognizer and multi-sensor fusion algorithms. Generated synthetic target and scene signatures for automated signature exploitation of radio frequency (RF) and electro-optical (EO) sensor data. Analyzed advanced ground target signature generation methods.			
(U) In FY 2006: Not Applicable.			
(U) In FY 2007: Not Applicable.			
(U)			
(U) MAJOR THRUST: Develop common open system technology integration for real-time information in- and	1.639	0.000	0.000

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 69DF Target Attack and Recognition Technology

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	out-of-the-cockpit to improve aircrew combat and joint battlespace situational awareness, target nomination, and target engagement capabilities. Note: Efforts complete in FY 2005.			
(U)	In FY 2005: Integrated and flight-tested common situational awareness technology equipment suite on representative special operations aircraft to assess integrated system performance capabilities, aircrew workload reduction, and product maturity levels. Developed a laboratory incremental technology product approach to match transition of common situational awareness system components with special operations user acquisition resources for both fixed-wing and vertical lift aircraft.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	MAJOR THRUST: Develop and test an automatic target recognition (ATR) system for tracking and identifying moving and stationary ground targets for use in strike and reconnaissance platforms.	2.113	5.107	4.019
(U)	In FY 2005: Finalized transition plans for advanced stationary target identification techniques and algorithms developed in the laboratory with synthetic aperture radar processing. Analyzed requirements and affordable risk reduction for transition of advanced moving target classification and identification techniques and algorithms via planned sensor upgrades to strike and reconnaissance platforms. Developed advanced moving target classification and identification techniques and algorithms for integration with high range resolution radar and other moving target indication processing techniques.			
(U)	In FY 2006: Develop radar-based air-to-ground moving target algorithm for tactical and reconnaissance platforms. Continue analysis and identification of legacy systems hardware/software upgrades required for algorithm transition to strike and reconnaissance platforms.			
(U)	In FY 2007: Perform a laboratory demonstration of a radar based air-to-ground moving target algorithm for tactical and reconnaissance platforms. Refine this capability for integration into candidate radar systems and platform specific product development roadmaps. Provide transition plans of the moving target algorithm technology to operational strike and reconnaissance platforms.			
(U)				
(U)	MAJOR THRUST: Develop and assess multi-sensor ATR for Air Force intelligence, surveillance, and reconnaissance (ISR); strike; and weapon systems.	4.564	5.635	5.596
(U)	In FY 2005: Assessed the performance of Air Force and Defense Advanced Research Projects Agency (DARPA) multi-sensor ATR fusion algorithms using the Air Force ATR evaluation test facility for application to Air Force ISR, strike, and weapon systems. Characterized both single and multiple sensor contributions from radar and EO, including hyperspectral imaging sensors with automated exploitation. Automated data collection planning for			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 69DF Target Attack and Recognition Technology

(U) B. Accomplishments/Planned Program ($ in Millions) FY 2005 FY 2006 FY 2007

transition (database development and upgrade) of algorithms. Improved ATR research and development (R&D) computer and networking infrastructure via software, hardware, and network integration enhancements. Improved processing capabilities and the expansion of the Department of Defense-wide repository for R&D sensor data. Developed an integrated computational and collaborative environment to accelerate the transition of ATR and sensor fusion technologies. Developed synthetic data generation capability to augment and enhance existing R&D and operational data sets. Showed impact of automated multi-sensor ATR and fusion capability in terms of timeline reduction for time-critical targeting to image analysts and decision-makers in the experimental Air Operations Centers.

(U) In FY 2006: Further assess the performance of Air Force and DARPA multi-sensor ATR fusion algorithms using the Air Force ATR evaluation test facility for application to Air Force ISR, strike, and weapon systems. Further characterize both single and multiple sensor contributions from radar and EO, including hyperspectral imaging sensors with automated exploitation. Complete the automation of data collection planning for transition of algorithms. Complete the initial ATR R&D computer and networking infrastructure via software, hardware, and network integration enhancements. Complete the initial processing capabilities and the on-line DoD-wide repository for R&D sensor data. Complete the on-line integrated computational and collaborative environment to accelerate the transition of ATR and sensor fusion technologies. Further develop synthetic data generation capability to augment and enhance existing R&D and operational data sets. Further assess impact of automated multi-sensor automatic target recognition and fusion capability in terms of timeline reduction for time-critical targeting to image analysts and decision-makers in the experimental Air Operations Centers. Initiate the modeling of platform and sensor systems in simulated operational environments. Initiate assessment of moving target tracking and identification approaches for multiple sensor types. Initiate evaluation of automated exploitation and rapid response technology enhancements for post-conflict force protection, stability, and security operations.

(U) In FY 2007: Continue to assess the performance of Air Force and DARPA multi-sensor ATR fusion algorithms using the Air Force ATR evaluation test facility for application to Air Force ISR, strike, and weapon systems. Continue characterizing both single and multiple sensor contributions from radar and EO, including hyperspectral imaging sensors with automated exploitation. Collect, process, archive, and distribute R&D sensor data for automated exploitation technology development and assessment. Support automated exploitation technology development and assessment with collaborative computing environment. Complete development of synthetic data generation capability to augment collected R&D and operational data sets. Augment the Department of Defense-wide repository of R&D sensor data with multi-sensor imagery and tracking data collected at warfighter-sponsored exercises. Continue to show impact of automated multi-sensor ATR and fusion capability in terms of timeline reduction for time-critical targeting to image analysts and decision-makers in the experimental Air

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 69DF Target Attack and Recognition Technology

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	Operations Centers. Initiate modeling of existing and emergent sensor systems for assessing automated exploitation technologies in simulated operational environments. Continue assessment of moving target tracking and identification approaches for multiple sensor types. Initiate evaluation of technology enhancements for post-conflict force protection, stability, and security operations.			
(U)				
(U)	MAJOR THRUST: Develop and demonstrate a moderate confidence ATR and advanced cueing capability for stationary and moving targets.	1.858	3.528	9.303
(U)	In FY 2005: Performed critical experiments based upon results from studies and analyses of which combination of sensors, modes, and fusion processing techniques would provide combat identification of the highest confidence. Performed engineering-level analyses and critical experiments to determine what sensor technologies and fusion techniques may provide a near-term combat identification capability of the highest confidence achievable. Carried out a technology demonstration effort of promising near-term sensor technologies and fusion processing techniques. Conducted characterization studies of advanced stationary and moving target radar data to determine its utility for automatic target recognition and advanced cueing (ATR/C) and combat identification. Refined tool development to support sensor system, sensor management, and system performance analyses. Performed advanced multi-sensor data collections on stationary and moving targets.			
(U)	In FY 2006: Continue developing high confidence combat identification capability to determine which combination of sensors, modes, and fusion processing techniques provide a high confidence combat identification capability for stationary and moving ground targets. Initiate critical experiments to refine high-level, near-term fusion processes. Continue characterization studies of advanced stationary and moving target radar data to determine utility for ATR/C and combat identification. Start a technology demonstration effort of promising near-term, multi-sensor technologies and fusion processing techniques. Continue analyses and characterization studies for advanced, multi-sensor, multi-platform fusion processing techniques. Refine tool development to support sensor system, sensor management, and system performance analyses. Perform advanced multi-sensor data collection(s) on stationary and moving targets.			
(U)	In FY 2007: Further develop high confidence combat identification capability to determine which combination of sensors, modes, and fusion processing techniques provide a high confidence combat identification capability for stationary and moving ground targets. Further the technology demonstration effort of promising near-term, multi-sensor technologies and fusion processing techniques. Continue critical experiments of advanced multi-sensor, multi-platform technologies and fusion processing techniques for strike and ISR assets. Further characterize studies of advanced stationary and moving target multi-sensor data to determine utility for ATR/C and combat identification. Further refine tool development to support sensor system, sensor management, and system performance analyses.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 69DF Target Attack and Recognition Technology

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	Continue advanced multi-sensor data collection(s) on stationary and moving targets.			
(U)				
(U)	MAJOR THRUST: Develop and demonstrate an ATR capability integrated with advanced georegistration techniques and innovative change detection algorithms.	2.927	5.508	3.569
(U)	In FY 2005: Integrated ATR/C, georegistration, and change detection techniques. Demonstrated initial integrated time-critical targeting capability leveraging the advanced real-time contingency cell, the Targets Under Trees program products and the technology developments associated with DARPA's Dynamic Tactical Targeting program.			
(U)	In FY 2006: Complete integration and field test of ATR/C, georegistration, and change detection techniques. Continue to utilize the advanced recognition capability test bed to integrate and upgrade time-critical targeting (TCT) capability and support transition to the warfighter. Complete integration and field testing of a capability that continuously tracks TCTs and reduces the kill chain through a reduction in strike platforms target acquisition time. Begin design and development of an autonomous multi-sensor management and data exploitation system supporting an all-weather mission for tactical platforms, including unmanned aerial vehicles (UAVs). Initiate critical experiments to investigate concealed target identification (ID) phenomenology. Continue data collection, modeling, and analysis for ID sensors, platforms, and concept of operations.			
(U)	In FY 2007: Continue to utilize the advanced recognition capability test bed to integrate and upgrade TCT capability to support the transition to the warfighter of technology products that detect concealed targets and improve ability to dynamically track TCTs. Continue development of an autonomous multi-sensor management and data exploitation system supporting an all-weather mission for tactical platforms, including UAVs. Initiate design and conduct concept demonstration of a concealed target ID sensor and exploitation capability. Initiate the development of an advanced tracking capability that utilizes advanced radar features to fingerprint and associate vehicle observations and integrates multiple radar sensors to maintain continuous track through difficult terrain and in dense traffic.			
(U)				
(U)	MAJOR THRUST: Develop Identify Friend, Foe, or Neutral air-to-ground capability using cooperative and non-cooperative identification techniques. Note: This work is an outgrowth of other work within this project.	0.000	1.966	5.984
(U)	In FY 2005: Not Applicable.			
(U)	In FY 2006: Conduct design studies to develop technologies to improve the performance of ATR and combat ID systems used to sort friend/foe/neutral entities during air-to-ground attack of stationary and moving ground vehicles. Studies will include ground target database enhancements, advanced algorithms for non-cooperative ID of moving targets, and RF tags for cooperative target ID. Define techniques to make ground target databases more robust and affordable for application using multiple sensors, for operation using real or synthetic data, and for modeling denied targets. Develop advanced algorithms to closely couple tracking with ID functions, exploit unique RF			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 69DF Target Attack and Recognition Technology

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	phenomenology, and integrate cooperative and non-cooperative ID methods. Assess RF tag systems versus warfighter requirements to define a system architecture, define techniques to assure secure data exchange without threat of exploitation, and define interfaces for cross-S ervice or coalition interoperability.			
(U)	In FY 2007: Finalize design studies and initiate critical experiments to verify improved ground target ID capabilities resulting from ground target database enhancements, ID algorithm enhancements, and advanced RF tags. Refine advanced ID algorithms and laboratory test with operational sensor data to measure improved confidence/reliability of target ID. Finalize RF tag design and conduct simulation testing to confirm improved pilot/system operator situation awareness, verify friendly ID confirmations, and perform initial interoperability assessments. Improve exploitation tools to allow automatic screening large volumes of ISR imagery. Develop technology for wide area detection, tracking, and ID against difficult, asymmetric targets at long range. Develop and integrate emerging technologies to enable small UAVs with EO/IR sensors to provide persistent ISR.			
(U)				
(U)	CONGRESSIONAL ADD: National Operational Signature Production and Research Capability.	11.500	5.125	0.000
(U)	In FY 2005: Refined the signature modeling and simulation capability for database production support to critical combat identification systems. Broadened enhancements to the target and threat radar signature prediction codes and tools to support a deployed non-cooperative combat identification system.			
(U)	In FY 2006: Conduct Congressionally-directed effort for National Operational Signature Production and Research Capability.			
(U)	In FY 2007: Not Applicable.			
(U)	Total Cost	26.012	26.869	28.471

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602204F, Aerospace Sensors.									
(U) PE 0603253F, Advanced Sensor Integration.									
(U) PE 0603500F, Multi-Disciplinary Advanced Space Technology.									

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603203F Advanced Aerospace Sensors**	PROJECT NUMBER AND TITLE **69DF Target Attack and Recognition Technology**

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

(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.

Exhibit R-2a, RDT&E Project Justification

DATE: **February 2006**

BUDGET ACTIVITY: **03 Advanced Technology Development (ATD)**

PE NUMBER AND TITLE: **0603203F Advanced Aerospace Sensors**

PROJECT NUMBER AND TITLE: **88SP Advanced Space Sensors**

Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
88SP Advanced Space Sensors	0.000	0.000	12.187	12.959	13.044	8.036	8.183	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

Note: In FY 2007, efforts will transfer from PE 0603500F, Multidisciplinary Advanced Development Space Technology, Project 5034, Advanced Space Sensors, to this project in order to more effectively manage and provide oversight of the efforts.

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates space sensor technologies, including radio frequency sensors; intelligence, surveillance, and reconnaissance sensors (ISR); electro-optical sensors; laser warning sensors; targeting and attack radar sensors; and electronic counter-countermeasures (ECCM) and communications. By developing multi-function radar, laser, electronic combat, and ECCM technologies for space applications, this project provides space platforms with the capability to precisely detect, track, and target air- and ground-based, high-value, time-critical targets, while remaining invulnerable to hostile and natural threats.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Reduce technology risk for space sensor platform payload components and exploitation of infrastructure integration.	0.000	0.000	0.756
(U) In FY 2005: Not Applicable.			
(U) In FY 2006: Not Applicable.			
(U) In FY 2007: Integrate space-sensor technologies into a complete radar payload simulation test bed with selected hardware in the loop and demonstrate system design feasibility.			
(U)			
(U) MAJOR THRUST: Develop and demonstrate technologies to maximize Global Positioning System (GPS) jam resistance, positional accuracy, timing accuracy, and exploitation techniques to improve offensive and defensive combat capabilities.	0.000	0.000	1.540
(U) In FY 2005: Not Applicable.			
(U) In FY 2006: Not Applicable.			
(U) In FY 2007: Develop space-based distributed position, navigation, and timing technologies to achieve optimal sensor fusion for a common operational picture. Develop multi-ship virtual flight test simulation technology to assess networked clusters of "mini" unmanned aerial vehicles, ISR platforms, and space-based platforms.			
(U)			
(U) MAJOR THRUST: Develop space laser warning sensor technologies for timely alert to advanced laser acquisition/tracking sensors, including detecting and locating both high power (dazzle/damage) and low-power (laser-guided ordnance) signals.	0.000	0.000	2.282
(U) In FY 2005: Not Applicable.			

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	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Flight demonstration of false alarm package space-flight components. Initiate on-orbit testing, data collection, and system evaluation with false alarm phenomenology suite. Initiate fabrication of advanced space-qualified laser warning sensors for rapid detection and characterization of laser designators, trackers, dazzlers, and weapons. Initiate testing with space-based laser threat scenario testbed for satellite-as-a-sensor technology evaluations.			
(U)				
(U)	MAJOR THRUST: Develop advanced laser communication component and sub-system technology to support a network-level topology for Airborne ISR.	0.000	0.000	5.000
(U)	In FY 2005: Not Applicable.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Begin development of an integrated wideband radio frequency (RF)/electro-optical (EO) communication terminal and shared aperture antenna for evaluation and testing in an air network layer. Continue development of technologies for shared RF/EO apertures to service high bandwidth communication needs. Continue testing applicability of shared apertures to maintaining air network link connectivity under in weather conditions. Expand flight demonstrations of air network layer technologies RF, optical and combined RF/optical communication terminals.			
(U)				
(U)	MAJOR THRUST: Develop and demonstrate geodesic phased array antenna to achieve enhanced satellite operations over current reflector antennas. Improve operational capacity and efficiency to support satellite control network.	0.000	0.000	2.609
(U)	In FY 2005: Not Applicable.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Analyze system requirements and complete the design of the multi-beam geodesic dome antenna. Finalize RF and mechanical designs of the geodesic dome panels to demonstrate critical performance characteristics. Complete evaluation of the transmit/receive modules, the radiating element, beamformer array panels, and the antenna resource manager computer.			
(U)				
(U)	Total Cost	0.000	0.000	12.187

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 88SP Advanced Space Sensors

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost

(U) Related Activities:

(U) PE 0602204F, Aerospace Sensors.

(U) PE 0602500F, Multi-Disciplinary Space Technology.

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

(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.