PE NUMBER: 0603203F
PE TITLE: Advanced Aerospace Sensors

Exhibit R-2, RDT&E Budget Item Justification								DATE February 2004	
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)					**PE NUMBER AND TITLE** 0603203F Advanced Aerospace Sensors				
Cost ($ in Millions)	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	50.988	41.124	30.634	34.010	42.947	39.603	39.426	Continuing	TBD
5019 Advanced RF Technology for ISR Sensors	4.414	4.904	3.577	4.386	4.587	5.449	5.536	Continuing	TBD
665A Advanced Aerospace Sensors Technology	11.469	14.826	10.754	9.617	10.718	10.897	11.072	Continuing	TBD
69DF Target Attack and Recognition Technology	35.105	21.394	16.303	20.007	27.642	23.257	22.818	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 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 and Budget Item Justification

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 2004, Congress added $5.0 million for the National Operational 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 2004**

BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603203F Advanced Aerospace Sensors**

(U)   <u>**B. Program Change Summary ($ in Millions)**</u>

	FY 2003	FY 2004	FY 2005
(U) Previous President's Budget	52.482	36.550	30.714
(U) Current PBR/President's Budget	50.988	41.124	30.634
(U) Total Adjustments	-1.494	4.574	
(U) Congressional Program Reductions		-0.074	
Congressional Rescissions		-0.352	
Congressional Increases		5.000	
Reprogrammings	-0.110		
SBIR/STTR Transfer	-1.384		

(U)   <u>Significant Program Changes:</u>

     Changes to this program since the previous President's Budget are due to higher Air Force priorities.

						DATE
Exhibit R-2a, RDT&E Project Justification						**February 2004**

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE
03 Advanced Technology Development (ATD)	**0603203F Advanced Aerospace Sensors**	**5019 Advanced RF Technology for ISR Sensors**

Cost ($ in Millions)		FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
5019	Advanced RF Technology for ISR Sensors	4.414	4.904	3.577	4.386	4.587	5.449	5.536	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

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 and Budget Item Justification

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) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(U) MAJOR THRUST: Develop techniques for advanced air moving target indication, ground moving target indication (GMTI), and foliage penetrating ground target indication.	0.882	1.081	1.642

(U) In FY 2003: Configured data collection opportunities using existing assets for validation of techniques generated for advanced air moving target indication, GMTI, and foliage-penetrating ground target indication. Initiated an effort to design a flexible testbed using a manned test aircraft to demonstrate multi-intelligence surveillance.

(U) In FY 2004: Collect data for multi-intelligence air 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) In FY 2005: Validate data collected for air moving target indication, ground moving target indication 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. Initiate plans for an experiment that will validate techniques for multi-intelligence sensing.

(U)

(U) MAJOR THRUST: Develop multi-intelligence sensor designs.	1.451	1.271	0.000

(U) In FY 2003: Conducted in-house development of a multi-intelligence sensor design, utilizing technologies developed in aperture development, signal processing, and radar design. Developed techniques for discriminating ground from air targets under conditions of common pulse repetition frequencies, waveforms, and receiver systems.

(U) In FY 2004: 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

Exhibit R-2a, RDT&E Project Justification	DATE February 2004

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

air targets under multi-intelligence waveform, pulse repetition frequency, and signal processing scenarios. Plan an experiment that will validate electronic protection signal processing techniques for multi-intelligence data collection systems.

(U)   In FY 2005: Not Applicable. Work completed.

(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.	1.406	1.049	1.101

(U)   In FY 2003: Developed knowledge-aided radar signal processing techniques for improved detection and false alarm control performance in ground moving target indication (GMTI) sensors. Implemented multi-dimensional adaptive processing techniques and knowledge-aided radar signal processing techniques on selected advanced computing architectures, and demonstrated these techniques for multi-mission aerospace radar applications.

(U)   In FY 2004: 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)   In FY 2005: Demonstrate and evaluate knowledge-aided radar signal processing techniques for improved detection and false alarm control performance in multi-intelligence sensors. Demonstrate and evaluate 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)

(U) MAJOR THRUST: Develop and demonstrate photonic digital and analog mixed signal multi-gigahertz component architectures.	0.675	0.257	0.000

(U)   In FY 2003: Developed and integrated chip-scale photonic and hybrid mixed signal components for radio frequency (RF) signal generation, phased array antenna beam formation, and beam control. Developed and demonstrated high-resolution wide bandwidth photonic wavelength division multiplexing and signal processing technology. Provided performance modeling, verification, and analysis of photonic and hybrid mixed signal devices for military unique applications.

(U)   In FY 2004: 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)   In FY 2005: Not Applicable.

(U)

(U) MAJOR THRUST: Develop and demonstrate techniques to surveil venues denied to standoff intelligence,	0.000	1.246	0.834

Exhibit R-2a, RDT&E Project Justification		DATE
		February 2004
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**

surveillance, and reconnaissance platforms.

(U) In FY 2003: Not Applicable.

(U) In FY 2004: Initiate developing techniques to surveil venues denied to standoff intelligence, surveillance, and reconnaissance (ISR) 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 radio frequency (RF) phenomenologies.

(U) In FY 2005: Continue developing techniques to surveil venues denied to standoff ISR platforms, concentrating on short-range, low-cost, expendable sensors that can exploit multiple RF phenomenologies.

(U) Total Cost

			4.414	4.904	3.577

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

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602204F, Aerospace Sensors.									
(U) PE 0603270F, Electronic Combat Technology.									
PE 0603500F,									
(U) Multi-disciplinary Advanced Space Technology.									
(U) PE 0604270F, Electronic Warfare (EW) Development.									
This project has been coordinated through the									
(U) Reliance process to harmonize efforts and eliminate duplication.									

(U) D. Acquisition Strategy

Not Applicable.

Project 5019	R-1 Shopping List - Item No. 17-5 of 17-15	Exhibit R-2a (PE 0603203F)

Exhibit R-2a, RDT&E Project Justification						DATE February 2004		
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 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
665A	Advanced Aerospace Sensors Technology	11.469	14.826	10.754	9.617	10.718	10.897	11.072	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

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 and Budget Item Justification

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) B. Accomplishments/Planned Program ($ in Millions)	FY 2003	FY 2004	FY 2005
(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.	3.166	3.316	2.104

(U) In FY 2003: Completed fabricating and testing a ground demonstration sensor and aircraft integration design. Assessed real-time data processing performance.

(U) In FY 2004: 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) In FY 2005: Demonstrate multi-spectral passive cueing in an airborne environment. Extend performance of ground demonstration sensor with integrated key systems for modular testing to flying test-bed configuration.

(U)

(U) MAJOR THRUST: Develop EO sensor technologies to detect and locate camouflaged and concealed targets for aerospace ISR applications.	3.260	3.682	4.732

(U) In FY 2003: Completed fabricating and testing a demonstration sensor for high altitude reconnaissance aircraft. Performed flight characterization. Assessed signature-based data processing performance.

(U) In FY 2004: 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 2005: Complete fabrication and testing of demonstration system for high-altitude aircraft with incorporation of emissive spectral sensing capability for day and night operations. Perform flight characterization and support

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603203F Advanced Aerospace Sensors	PROJECT NUMBER AND TITLE 665A Advanced Aerospace Sensors Technology

transition to acquisition center.

(U)

(U) MAJOR THRUST: Develop advanced electro-optical sensor technology for non-cooperative target identification.   0.809   0.941   0.000

(U) In FY 2003: Completed design and initiated developing a multi-function laser for air and ground target identification.

(U) In FY 2004: Complete developing and demonstrate a multi-function laser for air and ground target identification based on target geometry and vibration.

(U) In FY 2005: Not Applicable. Work completed.

(U)

(U) MAJOR THRUST: Develop technologies to maximize Global Positioning System (GPS) jam resistance, positional accuracy, timing accuracy, and exploitation techniques to improve offensive and defensive combat capabilities.   1.210   1.215   0.911

(U) In FY 2003: Developed advanced GPS M-Code technologies. Developed reference technologies to adaptively operate GPS in buildings, underground, and in air and space to provide precise time, position, and velocity for multiple platforms. Developed virtual flight test technology for improved assessment of GPS anti-jam technologies.

(U) In FY 2004: Demonstrate precise reference aerospace sensing technologies to adaptively operate underground 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 GPS anti-jam techniques.

(U) In FY 2005: Design critical experiments for assured reference technologies to maximize positional accuracy, timing accuracy, and exploitation techniques for network centric engagement. Develop automatic multi-intelligence sensor data registration technology for improved geo-location performance. Expand virtual flight test simulation technology for improved assessment of precise reference sensing networks.

(U)

(U) MAJOR THRUST: 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.   1.828   0.393   2.617

(U) In FY 2003: Evaluated "mini" unmanned aerial vehicle (UAV) concept of operation and RF sensor performance improvements in the detection, tracking, and targeting of high-value, time-critical targets.

(U) In FY 2004: Laboratory test "mini" UAV concept of operation and RF sensor performance improvements in the detection, tracking, and targeting of high-value, time-critical targets.

(U) In FY 2005: Demonstrate in the laboratory evolved multi-intelligence techniques. Demonstrate "mini" UAV concept of operation and RF sensor performance improvements in the detection, tracking and targeting of high-value, time-critical targets. Develop RF receiver technologies to detect, characterize, and encode difficult signals to assist in the detection, and location of high-value, time-critical targets.

(U)

Exhibit R-2a, RDT&E Project Justification	DATE February 2004

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) MAJOR THRUST: Develop weapons guidance quality track radar performace in advanced jamming environments.	0.233	0.406	0.390
(U) In FY 2003: Developed a concept definition and a system analysis of a fire control radar system for airborne applications.			
(U) In FY 2004: 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.			
(U) In FY 2005: Evaluate advanced radar techniques, sub-systems and methods to establish and maintain weapons guidance quality track radar performance in advanced jamming environment. Validate and test high fidelity fire control radar and weapon system simulation model to evaluate system and sub-system requirements and performance.			
(U)			
(U) MAJOR THRUST: Develop technology for aerospace sensors compatible with hypersonic flight parameters.	0.000	4.873	0.000
(U) In FY 2003: Not Applicable.			
(U) In FY 2004: Define a technically feasible, operationally effective sensor suite and concept of operations for use on the Hypersonic Reconnaissance/Attack Vehicle. Develop a feasibility analysis and sensor performance simulation tool. Recommend airframe configurations that will maximize the effectiveness of the vehicle as a reconnaissance platform in a hypersonic environment.			
(U) In FY 2005: Not Applicable. Work completed.			
(U)			
(U) CONGRESSIONAL ADD: Advanced Physical Vapor Transport.	0.963	0.000	0.000
(U) In FY 2003: Demonstrated deposition techniques for high growth rate, high-quality silicon carbide semiconductor substrates to enable advanced physical vapor transport techniques.			
(U) In FY 2004: Not Applicable.			
(U) In FY 2005: Not Applicable.			
(U) Total Cost	11.469	14.826	10.754

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

	FY 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602204F, Aerospace Sensors.									
(U) PE 0603205F, Flight Vehicle Technology.									
(U) PE 0603707F, Weather Systems									

Project 665A	R-1 Shopping List - Item No. 17-8 of 17-15	Exhibit R-2a (PE 0603203F)

Exhibit R-2a, RDT&E Project Justification	DATE February 2004

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)**

Advanced Development.
PE 0603500F,

(U) Multi-disciplinary Advanced Development Space Technology.

(U) PE 0602111N, Weapons Technology.

PE 0602232N, Space and
(U) Electronic Warfare (SEW) Technology.

(U) PE 0604249F, LANTIRN Night Precision Attack.

(U) PE 0603270F, Electronic Combat Technology.

A Memorandum of Agreement has been established between Air Force Research Laboratory and Defense Advanced Research
(U) Projects Agency to jointly develop the technology required to detect high-value, time-critical targets in a variety of environments.

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

(U) **D. Acquisition Strategy**
Not Applicable.

Exhibit R-2a, RDT&E Project Justification							DATE February 2004	

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 2003 Actual	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	Cost to Complete	Total
69DF	Target Attack and Recognition Technology	35.105	21.394	16.303	20.007	27.642	23.257	22.818	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

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

(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 2003	FY 2004	FY 2005
(U) MAJOR THRUST: 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.	1.236	1.133	1.586

(U)   In FY 2003: Employed the modeling, simulation, and analysis testbed to analyze and demonstrate automatice 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. 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 signatures for automated signature exploitation of RF and electro-optical sensor data.

(U)   In FY 2004: Demonstrate the analysis testbed in operationally realistic environments, using operationally realistic data and processes. Continue developing and employing air and ground target signature generation models that

Exhibit R-2a, RDT&E Project Justification	DATE February 2004

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

support automated target signature exploitation in automatic target recognizer and multi-sensor fusion algorithms. Continue generating synthetic target signatures for automated signature exploitation of radio frequency (RF) and electro-optical (EO) sensor data.

(U) In FY 2005: Initiate an analysis of an enhanced capability to find and identify time-critical targets using automated target recognition processing in the Distributed Common Ground Station. Complete 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. Continue developing and employing air and ground target signature generation models to support automated target signature exploitation in automatic target recognizer and multi-sensor fusion algorithms. Continue generating synthetic target and scene signatures for automated signature exploitation of RF and EO sensor data. Analyze advanced ground target signature generation methods.

(U)

(U) MAJOR THRUST: Develop 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.	1.818	1.328	1.842

(U) In FY 2003: Demonstrated 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) In FY 2004: Incrementally upgrade common situational awareness open system technologies to integrate special below line-of-sight threat geo-location and 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) In FY 2005: Integrate and flight-test common situational awareness technology equipment suite on representative special operations aircraft to assess integrated system performance capabilities, aircrew workload reduction, and product maturity levels. Initiate a laboratory incremental development 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)

(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.	5.160	2.686	2.374

(U) In FY 2003: Integrated advanced stationary target identification techniques and algorithms with synthetic aperture radar processing. Advanced the state-of-the-art for moving target identification techniques and algorithms by providing technology maturation and risk reduction. Continued analysis of requirements and affordable risk reduction for transition via planned sensor upgrades to strike and reconnaissance platforms.

Project 69DF   R-1 Shopping List - Item No. 17-11 of 17-15   Exhibit R-2a (PE 0603203F)

299

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
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) In FY 2004: Demonstrate a stationary ground target classification and identification capability using advanced ATR 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 and identification techniques and algorithms for integration with high range resolution radar and other moving target indication processing techniques.

(U) In FY 2005: Finalize transition plans for advanced stationary target identification techniques and algorithms developed in the laboratory with synthetic aperture radar processing. Continue analyzing 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. Continue developing advanced moving target classification and identification techniques and algorithms for integration with high range resolution radar and other moving target indication processing techniques.

(U)

(U) MAJOR THRUST: Develop multi-sensor automatic target recognition (ATR) for Air Force intelligence, surveillance, reconnaissance (ISR), strike, and weapon systems.	3.766	3.689	5.127

(U) In FY 2003: Tested and integrated Air Force and Defense Advanced Research Projects Agency (DARPA) multi-sensor ATR fusion algorithms into the Air Force ATR evaluation test facility for application to Air Force ISR, strike, and weapon systems. Characterized single and multi-sensor contributions from radar and electro-optical (including hyperspectral imaging) sensors with automated exploitation. Continued 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) In FY 2004: Assess the performance of Air Force and DARPA 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 hyperspectral imaging) sensors with automated exploitation. Initiate developing tools to automate data collection planning for transition of algorithms. Improve 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) In FY 2005: Continue to assess the performance of Air Force and DARPA multi-sensor automatic target recognition fusion algorithms using the Air Force ATR evaluation test facility for application to Air Force intelligence, surveillance, reconnaissance, strike, and weapon systems. Continue characterizing both single and multiple sensor contributions from radar and EO (including hyperspectral imaging) sensors with automated exploitation. Automate

Exhibit R-2a, RDT&E Project Justification		DATE February 2004

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

data collection planning for transition (database development and upgrade) of algorithms. Continue improving ATR R&D computer and networking infrastructure via software, hardware, and network integration enhancements. Continue improving processing capabilities and the expansion of the DoD-wide repository for research and development (R&D) sensor data. Continue developing an integrated computational and collaborative environment to accelerate the transition of ATR and sensor fusion technologies. Continue developing synthetic data generation capability to augment and enhance existing R&D and operational data sets. Continue to show 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.

(U)

(U)	MAJOR THRUST: Develop technology to detect, identify, and engage targets under trees (TUT).	12.201	4.979	0.000

(U) In FY 2003: Characterized performance of foliage penetration radar sensors and algorithms for robust target detection and tracking with low probability of false alarms. Developed TUT-specific intelligence preparation of the battlefield tools for improved tracking, detection, sensor management, and target identification and location. Developed tools for multi-intelligence georegistration. Performed end-to-end modeling for the TUT family of systems, providing measures of effectiveness that encompass the entire kill chain cycle. Performed virtual simulations to identify system integration issues, human decision functions, and system processes. Developed integration plans with warfighter-selected operational systems. Tested system functionality, including fusion and georegistration, and concepts of employment.

(U) In FY 2004: Demonstrate TUT-specific intelligence preparation of the battlefield tools for improved tracking, detection, sensor management, and target identification and location. Integrate tools for multi-intelligence georegistration with fusion architecture. Finish system functionality test, including fusion and georegistration tests, and perform study of possible trades in concepts of employment.

(U) In FY 2005: Not Applicable. Work completed.

(U)

(U)	MAJOR THRUST: Develop and demonstrate a moderate confidence automatic target recognition and advanced cueing (ATR/C) capability for stationary and moving targets.	8.900	0.000	2.087

(U) In FY 2003: Continued developing a follow-on, high confidence combat identification capability under the Reliable Combat Identification for Surface Targeting effort. Characterized advanced stationary and moving target radar data to determine its utility for ATR/C and combat identification. Developed tools to support sensor system, sensor management, and system performance analyses. Characterized the performance of identification techniques for multiple moving targets. Performed advanced multi-sensor data collection on stationary and moving targets. Determined which combination of sensors, modes, and fusion processing techniques would provide combat identification of the highest confidence.

(U) In FY 2004: Not Applicable. Air Force realignment of projects due to higher priorities within the Science and

Exhibit R-2a, RDT&E Project Justification		DATE February 2004
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

Technology program provided additional funding in FY 2003, but no additional funding in FY 2004. Beginning in FY 2005, this effort is supported by planned-for core funding.

(U) In FY 2005: Perform 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. Perform 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. Initiate a technology demonstration effort of promising near-term sensor technologies and fusion processing techniques. Continue 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. Refine tool development to support sensor system, sensor management, and system performance analyses. Perform advanced multi-sensor data collections on stationary and moving targets.

(U)

(U) MAJOR THRUST: Develop and demonstrate an automatic target recognition (ATR) capability integrated with advanced geo-registration techniques and innovative change detection algorithms.	0.000	2.579	3.287

(U) In FY 2003: Not Applicable.

(U) In FY 2004: 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. Perform 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) In FY 2005: Integrate ATR with automatic target cueing, geo-registration, and Change Detection techniques. Demonstrate 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 the Defense Advanced Research Projects Agency Dynamic Tactical Targeting program.

(U)

(U) CONGRESSIONAL ADD: National Operational Signature Production and Research Capability.	2.024	5.000	0.000

(U) In FY 2003: Continued expanding the database and began creating the signature modeling and simulation capability to consistently and expediently expand database production support for critical combat identification systems.

(U) In FY 2004: Mature the signature modeling and simulation capability to consistently and expediently expand database production support for critical combat identification systems. Expand and enhance the target and threat radar signature prediction codes and tools to support a deployed non-cooperative combat identification system.

(U) In FY 2005: Not Applicable.

(U) Total Cost	35.105	21.394	16.303

Exhibit R-2a, RDT&E Project Justification	DATE February 2004

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) **D. Acquisition Strategy**
  Not Applicable.