

UNCLASSIFIED

PE NUMBER: 0603789F
 PE TITLE: C3I Advanced Development

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2008
---	------------------------------

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development
---	--

Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	47.352	32.821	30.103	42.165	38.996	42.300	49.509	Continuing	TBD
4072 Dominant Battlespace Awareness	18.350	5.994	7.970	9.802	8.922	9.623	10.737	Continuing	TBD
4216 Battlespace Information Exchange	12.119	11.828	11.104	17.079	15.734	18.654	22.614	Continuing	TBD
4872 Aerospace Information Dominance	16.883	14.999	11.029	15.284	14.340	14.023	16.158	Continuing	TBD

(U) A. Mission Description and Budget Item Justification

This program develops and demonstrates Air Force Command, Control, Communications, and Intelligence (C3I) technologies for the warfighter. The technologies address the ability to support the global information exchange of correlated and fused information to ensure the Air Force can plan and execute missions in a dynamic, complex environment. The Dominant Battlespace Awareness project will provide affordable operational data capabilities for personnel to understand militarily relevant situations, on a consistent basis, with the precision and timeliness needed to accomplish the mission. The Battlespace Information Exchange project will develop reliable, secure, jam-resistant, inter-operable worldwide global information enterprise capabilities, providing the Air Force assured communications and reach-back capability in a distributed operational environment. It will also demonstrate offensive cyber operations technologies allowing attack and exploitation of adversary information systems by the Air Force. The Aerospace Information Dominance project provides the technology and demonstrations needed to allow the warfighter to plan, assess, execute, monitor, and re-plan on the compressed time scales required for tomorrow's conflicts, whether in combat or peacekeeping missions. Note: In FY 2008, Congress added \$1.0 million for Collaboration Gateway, \$0.8 million for Interoperability Network to Fuse and Exchange Real-Time Information, and \$3.9 million for Massively Parallel Optical Interconnects for Battlespace Information Exchange. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing upgrades and/or new system developments that have military utility and address warfighter needs

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

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	48.195	27.357	32.050
(U) Current PBR/President's Budget	47.352	32.821	30.103
(U) Total Adjustments	-0.843	5.464	
(U) Congressional Program Reductions		-0.020	
Congressional Rescissions		-0.216	
Congressional Increases		5.700	
Reprogrammings	0.200		
SBIR/STTR Transfer	-1.043		
(U) <u>Significant Program Changes:</u> Not Applicable.			

Exhibit R-2, RDT&E Budget Item Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

C. Performance Metrics
(U) Under Development.

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)				PE NUMBER AND TITLE 0603789F C3I Advanced Development			PROJECT NUMBER AND TITLE 4072 Dominant Battlespace Awareness		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
4072 Dominant Battlespace Awareness	18.350	5.994	7.970	9.802	8.922	9.623	10.737	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, integrates, and demonstrates advanced technologies to achieve Dominant Battlespace Awareness (DBA) and Predictive Battlespace Awareness (PBA) using information from all sources. DBA is the information required to support dynamic planning and execution with the accuracy, fidelity, and timeliness needed to dominate the battlespace. Technology development includes: tasking information collectors (intelligence, surveillance, and reconnaissance platforms, national intelligence sources, etc.); correlating and geo-registering the collected data; exploiting the data to extract information of military significance; fusing information from multiple sources to create a digital n-dimensional representation of the battlespace; assessing the situation; predicting adversary courses of action (COA); and archiving the results for ready use by decision makers. This is a dynamic, complex process that involves technologies for information access, extraction, fusion, processing, storage, and retrieval, as well as technologies for machine reasoning, pattern recognition, and timeline analysis.

(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and demonstrate advanced signal and data exploitation technologies for detection, tracking, identification, and targeting of time-critical targets, and information extraction technologies for situational awareness.	2.654	1.974	2.152
(U) In FY 2007: Demonstrated a baseline capability to perform advanced text exploitation of human intelligence reports and correlate and fuse the information with information from other sources. Demonstrated a prototype that is able to extract information from voluminous textual data. Initiated development of a real-time Signal Processing and Geolocation capability for emerging commercial communications used by military and asymmetrical threats. Initiated development of airborne-cued, ground-based signal processing.			
(U) In FY 2008: Continue development of a real-time Signal Processing and Geolocation capability for emerging commercial communications used by military and asymmetrical threats. Continue development of airborne-cued, ground-based signal processing.			
(U) In FY 2009: Demonstrate a real-time signal processing and geolocation capability for emerging commercial communications used by military and asymmetrical threats. Demonstrate airborne-cued ground-based signal processing. Develop multi-sensor exploitation tools to enable characterization and assessment of adversary satellites. Integrate intelligence data and analysis products to produce anticipatory ground to space awareness picture.			
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced data handling, event visualization technologies, and distributed data fusion to enable a more effective utilization of the vast amounts of	9.529	4.020	5.818

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

PROJECT NUMBER AND TITLE

4072 Dominant Battlespace Awareness

(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

data available to intelligence analysts to provide optimized situation awareness, as well as to support all phases of combat operations. Note: This effort includes \$5.8 million in FY 2007 Congressional Add funding.

- (U) In FY 2007: Enhanced the evaluation environment for assessing the state-of-the-art and maturity of algorithms for transition to the warfighter. Demonstrated an automated process to visualize the overlaying of disparate information domains on a single screen and provide an optimal means of fusing all source intelligence data. Completed demonstration of feature-aided tracking to monitor, assess, and predict possible courses of action. Completed development and demonstrated operator-focused dynamic resource allocation algorithms and techniques for optimization and collaboration of information products. Initiated software and algorithmic development for determination of adversarial behavior within persistent surveillance data, contextual tracking, target-feature-aided tracking, multiple intelligence sources (multi-INT) association and cross-cueing and geospatial reasoning and cued exploitation. Investigated methods for combining post-event processing of intelligence data with real-time streaming intelligence data for indications and warning functions. Conducted Congressionally-directed effort for Advanced Fusion in Urban Operations for Forensic Anticipation of Insurgent Activity. Conducted Congressionally-directed effort for National Center for Multi-Source Information.
- (U) In FY 2008: Continue software and algorithmic design and development efforts for determination of adversarial behavior within persistent surveillance data, contextual tracking, target-feature-aided tracking, multi-INT association and cross-cueing and geospatial reasoning and cued exploitation. Continue to develop methods for combining post-event processing of intelligence data with real-time streaming intelligence data for indications and warning functions. Initiate the design and development of a synthetic assessment environment for the evaluation of the full range of fusion technologies to include basic correlation algorithms to higher levels of fusion algorithms tested in conjunction with command and control systems. Initiate investigation of Fusion of Cyber Intelligence (CYBINT) with traditional INTs.
- (U) In FY 2009: Demonstrate software and algorithmic design and development efforts for determination of adversarial behavior within persistent surveillance data, contextual tracking, target-feature-aided tracking, multi-INT association and cross-cueing and geospatial reasoning and cued exploitation. Demonstrate methods for combining post-event processing of Intel data with real time streaming Intel data for indications and warning functions. Continue design and development of a synthetic assessment environment for the evaluation of the full range of fusion technologies to include basic correlation algorithms to higher levels of fusion algorithms tested in conjunction with C2 systems. Continue investigation of Fusion of CYBINT with traditional INTs. Develop the capability to extract events of interest from unstructured text in order to enable automated visualization of events on timelines and maps.

(U)

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification	DATE February 2008
--	------------------------------

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE 4072 Dominant Battlespace Awareness
---	--	---

(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced data and information fusion capabilities to support multi-source capabilities, new sensor types, cognitive models, and automated fusion process management. Note: This effort contains \$1.0 million in FY 2007 Congressional Add funding. In FY 2008, efforts in this thrust move to Project 4216 in this PE.	4.416	0.000	0.000
(U) In FY 2007: Developed interoperable exploitation and data link technologies for real-time ISR management, which incorporates non-traditional ISR into the management algorithms for find, fix, track, target, engage, and access. Performed a multi-platform tracking demonstration utilizing airborne assets against a variety of advanced military and asymmetric threat scenarios. Demonstrated the capability to dynamically task sensors and assure timely, prioritized transport of information for purpose of tracking high value ground targets for long durations and potentially engaging them. Conducted Congressionally-directed effort for Non-Traditional Intelligence, Surveillance, and Reconnaissance.			
(U) In FY 2008: Not Applicable.			
(U) In FY 2009: Not Applicable.			
(U) CONGRESSIONAL ADD: Semantic Service Oriented Architectures for Dynamic Intelligence Fusion.	1.751	0.000	0.000
(U) In FY 2007: Developed and demonstrated a capability to collaboratively interact and manage sensor context sensitive knowledge across multiple platforms using Semantic Service Oriented Architectures, in conjunction with Intelligent Agent architectures, Ontological Knowledge, and Man-on-the-Look technology.			
(U) In FY 2008: Not Applicable.			
(U) In FY 2009: Not Applicable.			
(U) Total Cost	18.350	5.994	7.970

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
(U) Related Activities:									
(U) PE 0602702F, Command, Control, and Communications.									
(U) PE 0603203F, Advanced Aerospace Sensors.									
(U) PE 0603742F, Combat Identification Technology.									

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

PROJECT NUMBER AND TITLE

4072 Dominant Battlespace
Awareness(U) **C. Other Program Funding Summary (\$ in Millions)**

(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.

(U) **D. Acquisition Strategy**

Not Applicable.

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)				PE NUMBER AND TITLE 0603789F C3I Advanced Development			PROJECT NUMBER AND TITLE 4216 Battlespace Information Exchange		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
4216 Battlespace Information Exchange	12.119	11.828	11.104	17.079	15.734	18.654	22.614	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 communications technologies for the Air Force that implement a secure environment for worldwide information exchange of near-real-time multimedia (i.e., voice, data, video, and imagery) information. This secure environment will be rapidly deployable, mobile, interoperable, and seamless between Air and Space Operations Centers (AOC) and aircraft, either en-route or in theater. It will: a) provide interoperability across echelons, services, coalition, and multi-national force boundaries; b) support mobile information superiority, sensor-to-shooter operations, and the battle management decision process; and c) provide in-transit visibility of en route aircraft, cargo, mission status, and reachback capabilities for aircraft to operations centers in the Continental United States (e.g., updating information and mission changes to en route aircraft). Technology developments include an information assurance decision support system, advanced information management, multi-level/secure communications, secure survivable networks, mission and content-based routing, quality-of-service mechanisms, communications transmission systems, cyber situational awareness, and offensive cyber operations capabilities to attack and exploit adversary information and information systems.

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

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and demonstrate secure wideband assured networking between weapon platforms (e.g. munitions, uninhabited air systems, and aircraft), ground facilities and Special Operations Forces personnel.	3.757	0.944	1.134
(U) In FY 2007: Developed or adapted networked communications to support Special Operations Forces ground elements by connecting them into the airborne network weapon platforms and reachback to globally located command centers. Developed phase one of a small form-factor prototype information networking capability for information sharing and collaboration with other networking assets (aircraft, uninhabited air systems, ground facilities).			
(U) In FY 2008: Complete development of a small form-factor prototype information networking capability for information sharing and collaboration with other networking assets (aircraft, uninhabited air systems, ground facilities).			
(U) In FY 2009: Develop small form-factor networking and reachback capability. Begin certification of the capability in preparation for transition to the Special Operations Forces.			
(U) MAJOR THRUST: Proactively defend cyberspace through cyber situational awareness, detecting and defeating cyber threats, and surviving through adaptation and self-regeneration. Note: This effort transitions in FY 2008 from Applied Research PE 0602702F, Project 4519, into this PE.	0.000	0.772	2.710
(U) In FY 2007: Not Applicable.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT NUMBER AND TITLE		
03 Advanced Technology Development (ATD)	0603789F C3I Advanced Development	4216 Battlespace Information Exchange		
(U) B. Accomplishments/Planned Program (\$ in Millions)		<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2008: Develop technology demonstration plans for a fleet of cooperative agents trusted to defend mission critical Air Force assets by gathering cyber situational awareness information for defensive decision making. Develop secure data sharing to prevent the disclosure of sensitive information to untrustworthy users.				
(U) In FY 2009: Develop technology demonstration plans for active ISR defense on wired networks. Continue cyber situational awareness demonstration. Continue development of secure data sharing to prevent the disclosure of sensitive information to untrustworthy users.				
(U) MAJOR THRUST: Design, develop, demonstrate, test, and validate an integrated tool suite for Modeling and Simulating the Air Force's extension of the Global Information Grid, the evolving Airborne Network. This thrust will provide the Air Force with the ability to accomplish both mission and technical analyses, at the appropriate levels of fidelity, to enable the effective migration of legacy systems for the development and evolution of the Airborne Network. Note: This effort transitions in FY 2008 from Applied Research PE 0602702F, Project 4519, into this PE.		0.000	0.664	1.374
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Test and validate the modeling and simulation capability using real world scenarios to determine the accuracy and real-time nature of the capability. Establish enhancements to the current modeling capability and to assess processing requirements.				
(U) In FY 2009: Continue the validation of the enhanced modeling and simulation capability and support tool suite and make it usable by an operational person instead of programmers. Exercise the limitations of the modeling capability and apply the model to proposed future DoD networking environments.				
(U) MAJOR THRUST: Design, develop, and demonstrate the enterprise management capability to accept on-paper policy (e.g., word documents, or other Air Tasking Orders, etc.) and translate that format into network policy language to provide this "policy meta-data" to a network enterprise system in executable form in order to re-configure, re-constitute, and strengthen Air Force networks in response to strategic, tactical, and network events (e.g., changes in information condition (INFOCON), threat condition (THREATCON), defense condition (DEFCON), malicious threat, outages, etc.). Note: This effort transitions in FY 2008 from Applied Research PE 0602702F, Project 4519, into this PE.		0.000	0.776	1.023
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Design and develop an enterprise management system with the capability to translate narrative policy into machine-readable code in order to reconfigure the network in response to strategic, tactical, and network threats.				

UNCLASSIFIED

Exhibit R-2a, RDT&E Project Justification		DATE February 2008		
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE 4216 Battlespace Information Exchange		
	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	
(U) B. Accomplishments/Planned Program (\$ in Millions)				
(U) In FY 2009: Develop and demonstrate reconfiguration of network based-policy in response to strategic, tactical, and network events (e.g., changes in information condition (INFOCON), threat condition (THREATCON), defense condition (DEFCON), malicious threat, outages, etc.).				
(U) MAJOR THRUST: Develop and demonstrate offensive cyber operations capabilities in a series of experimental cyber craft technology demonstrations. These demonstrations will integrate capabilities developed from ongoing offensive cyber programs in the areas of gaining access to systems, performing operations in a stealthy manner, gathering intelligence from the compromised systems, and launching cyber "effects" against the systems. Note: This effort transitions in FY 2008 from Applied Research PE 0602702F, Project 4519, into this PE.	0.000	1.379	2.130	
(U) In FY 2007: Not Applicable.				
(U) In FY 2008: Initiate development of offensive cyber capabilities to access, remain stealthy, gather intelligence, and affect adversary information and information systems. Develop technology demonstration plans for cyber operations.				
(U) In FY 2009: Analyze development of selected offensive cyber operations capabilities, integrated kinetic and cyber operations planning and execution capabilities, and cyber command and control (Cyber C2) operations functions.				
(U) MAJOR THRUST: Develop and demonstrate advanced expert system decision algorithms to prioritize and control resources for global reach.	0.524	0.000	0.000	
(U) In FY 2007: Completed the transition of the combined Intelligent Information Manager, Integrated Network Controller, and the Global Media Access Controller.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate intelligent networking transport and management technology to provide assured, seamless, battlespace connectivity to the Air Force with a greatly reduced footprint. Note: This effort includes \$2.0 million in FY 2007 Congressional Add funding, and \$3.9 million in FY 2008 Congressional Add funding.	5.894	7.293	2.733	
(U) In FY 2007: Demonstrated improved battle management command, control, and communications networked collaboration capabilities by making improvements in routing, mobile ad-hoc networks, and adaptive protocols to show the effectiveness for ISR platforms. Developed and demonstrated a survivable, mobile, deployable extension of the global information enterprise to support rapid, decisive and sustainable air power, command and control				

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

PROJECT NUMBER AND TITLE

4216 Battlespace Information Exchange

(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

weapons data links, and ISR assets. Conducted Congressionally-directed effort for Massively Parallel Optical Interconnects to Battlespace Information Exchange.

- (U) In FY 2008: Continue improvements in the battle management command, control and communications networked collaborative capability by demonstrating Air Force airborne networking, in a coalition and multi-service environment, enabling aircraft to access each other's ISR airborne and ground information environments. Initiate the development of advanced, automated, network and bandwidth management technologies to move, manage, and process information in real-time to provide dynamic Quality of Assurance/Quality of Service for the warfighter. Initiate investigation to provide assured access (anti-jam) covert high capacity spectrum dominance for global networking, while denying the adversary the same. Conduct Congressionally-directed effort for Massively Parallel Optical Interconnects for Battle Information Exchange to expand the number of wavelengths by utilizing FY 2007 developments in flip-chip mounting of different lasers to a common dielectric silicon optical bench (SiOB). This represents a significant breakthrough in optoelectronic device technology.

- (U) In FY 2009: Complete improvements in the battle management command, control, and communications networked collaborative capability by demonstrating Air Force airborne networking, in a coalition and multi-service environment, enabling aircraft to access each other's intelligence, surveillance, and reconnaissance airborne and ground information environments. Continue investigation to provide assured access (anti-jam) covert high capacity spectrum dominance for global networking, while denying the adversary the same.

(U)

CONGRESSIONAL ADD: Hybrid Radio Frequency - Optical Communications Terminal.

0.975

0.000

0.000

- (U) In FY 2007: Conducted Congressionally directed effort for Hybrid Radio Frequency - Optical Communications Terminal. Developed parts and subsystems that can be used in either optical or RF communications systems, and be used simultaneously for RF and optical communications. Integrated RF and Optical hardware into a common subsystem. Developed the signaling protocols combining optical and RF characteristics. Developed packaging concepts for the combined RF and optical techniques.

- (U) In FY 2008: Not Applicable.

- (U) In FY 2009: Not Applicable.

(U)

- (U) CONGRESSIONAL ADD: Cyber Security - Advanced Course in Engineering.

0.969

0.000

0.000

- (U) In FY 2007: Developed training program in cyber security through the completion of research topics covering the areas of security policy, computer security, cryptography, steganography, digital forensics, network security, network defense, network attack, wireless security, and next generation security.

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE 4216 Battlespace Information Exchange
--	---	--

(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) In FY 2008: Not Applicable.			
(U) In FY 2009: Not Applicable.			
(U)			
(U) Total Cost	12.119	11.828	11.104

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	

(U) Related Activities:
 (U) PE 0602702F, Command, Control, and Communications.
 (U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.

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

Exhibit R-2a, RDT&E Project Justification

DATE
February 2008

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)				PE NUMBER AND TITLE 0603789F C3I Advanced Development			PROJECT NUMBER AND TITLE 4872 Aerospace Information Dominance		
Cost (\$ in Millions)	FY 2007 Actual	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
4872 Aerospace Information Dominance	16.883	14.999	11.029	15.284	14.340	14.023	16.158	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

In order to achieve information dominance, the Air Force must be able to plan, assess, monitor, and replan missions rapidly across the full spectrum of operations (air, space and cyberspace) at all levels of war (strategic, operational, and tactical) and during all phases of conflict (pre-conflict, conflict and stability operations). This project develops and demonstrates technologies necessary for dynamic decision making. It provides the technology and demonstrations needed to enable the warfighter to monitor, assess, plan, and execute (MAPE) on the complex and compressed time scales required for tomorrow's conflicts, whether they are combat or operations other than war. It will develop and demonstrate a new generation of planning and assessment technologies that enable a new paradigm of network enabled operations, allowing decision makers to determine the desired operational effects and prosecute the mission accordingly. This project will develop innovative capabilities that will realize a strategy-to-task approach to warfare, exploiting anticipatory environments and agile command and control concepts. It will develop and demonstrate distributed information technologies that provide the decision maker and staff with seamless access to tailored multi-media, multi-spectral data, within a mobile, dynamic, scalable, globally distributed Air and Space Operations Center (AOC). This project will also develop knowledge-based intelligent information technologies to support robust, real-time, large-scale Air Force command and control systems.

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

	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) MAJOR THRUST: Develop and demonstrate distributed information technologies that are scalable and reconfigurable and provide seamless access to tailored multi-media, multi-spectral data for decision makers and staff in mobile, dynamic, scalable, globally distributed command and control centers.	5.493	4.134	1.526
(U) In FY 2007: Investigated a core set of functionality and supporting infrastructure, including multi-level security repositories for next generation operation centers, enabling the ability to plan, direct, coordinate, and control air forces and operations across security boundaries in a coalition environment. Developed execution of the air space planning and re-planning options to enable dynamic deconfliction capabilities; avoiding hazardous conditions. Demonstrated highly efficient business processes and tools to support information exchange between operations centers and other command and control centers. Prototyped and demonstrated intelligent agents that use physics-based modeling to provide accurate, detailed advice necessary to make informed decisions. Developed command and control decision-support capabilities. Initiated investigation of the processes and procedures to normalize the use of information operations with precision munitions to achieve desired effects against our adversaries within the air, space, and cyberspace domains. Developed peer-to-peer and publish/subscribe information distribution systems and adaptive embedded computing techniques operating within a persistent surveillance system for very high resolution, wide-area, and global positioning system-coded surveillance images. Initiated development of polymorphic computing technology for persistent surveillance systems using faster			

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

PROJECT NUMBER AND TITLE

4872 Aerospace Information
Dominance(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

processing and greatly reduced size, weight, and power.

- (U) In FY 2008: Complete development of capabilities that allow a networked enabled operations center to plan, direct, coordinate Air Force assets across security boundaries in a coalition environment. Develop and demonstrate the capability to accomplish dynamic air space management and de-confliction of manned and unmanned aircraft focused on air control measure parsing, timely conflict identification, advanced visualization and seamless collaboration. Develop a campaign of experimentation to quantitatively measure transformational command and control concepts enabled by net centric warfare capabilities. Demonstrate command and control decision-support capabilities. Continue to develop the capability to normalize the use of information operations with precision munitions to achieve desired effects against our adversaries within the air, space and cyberspace domains. Complete development of peer-to-peer and publish/subscribe/query information distribution systems and adaptive embedded computing techniques operating within a persistent surveillance system for very high resolution, wide-area, and global positioning system-coded surveillance images. Continue the development of polymorphic (adaptable) computing technology for persistent surveillance systems using faster processing and greatly reduced size, weight, and power requirements for processing hardware. Continue the development and application of Multi-Level Security/Multiple Single Levels of Security (MLS/MSLS) middleware technologies for persistent surveillance systems to support user access/denial of information at multiple security levels.

- (U) In FY 2009: Initiate the development of capabilities to allow seamless information sharing for enhanced situational awareness and understanding by the decision maker. Continue the development of an initial capability to plan and measure effectiveness of information operations in conjunction with precision munitions to determine successful achievement of command intent in time and location to achieve "self-synchronization." Continue campaign of experimentation to quantitatively measure transformational command and control concepts enabled by net centric warfare capabilities. Complete the development of polymorphic (adaptable) computing technology for persistent surveillance systems using faster processing and greatly reduced size, weight, and power requirements for processing hardware. Continue the development and application of MLS/MSLS middleware technologies for persistent surveillance systems to support user access/denial of information at multiple security levels.

(U)

- (U) MAJOR THRUST: Develop and demonstrate the integration of planning tools and information-based intelligent agents for adaptive preplanning and decision support tools for Air Force command and control systems.

3.998

1.235

0.690

- (U) In FY 2007: Demonstrated tools and technologies to revolutionize air mobility information superiority to respond swiftly and effectively to global demands across all spectrums of operations from humanitarian relief to a major conflict. Demonstrated advanced reasoning techniques for mobility courses-of-action development. Demonstrated

Exhibit R-2a, RDT&E Project Justification		DATE February 2008
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE 4872 Aerospace Information Dominance

(U) B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
<p>the use of common mobility ontology to improve automation of decision support tools for increased situational awareness, planning, and execution management. Developed technologies to enable a Combat Air Force (CAF), Mobility Air Force (MAF), civilian shared situational awareness/synchronization to achieve desired "effects," and ensure mission success in a global environment. Demonstrated improved synchronization among Global Strike and Global Mobility Force participants within multiple theaters and global Civil air traffic management (ATM). Demonstrated the capability to support collaborative command and control, including dynamic and intermittent participation of players. Developed additional automated machine-to-machine exchange capabilities between CAF aircraft, MAF aircraft, their respective command and control elements, and civil ATM agencies, and demonstrated improved information sharing and interoperability between CAF and MAF mission planning and execution systems for improved velocity, efficiency, safety, and mission success. Developed appropriate virtual staff members to maintain a vision of command and control processes during human absences providing a 24/7 coverage.</p> <p>(U) In FY 2008: Complete development of improved synchronization among Global Strike and Global Mobility Force participants within multiple theaters and global Civil ATM. Complete automated machine-to-machine exchange of selected information capabilities between CAF aircraft, MAF aircraft, and their respective command and control elements. Complete multi-mission optimization capability by exploiting information discovery and delivery, advanced, multi-constraint and distributed optimization techniques, and evaluation models to support mobility operations with special emphasis on increased efficiency and decreased routine workload across functional and supervisory positions. Demonstrate capability for cross-functional collaboration that will increase situation awareness and understanding during mission planning and execution to allow the planning and execution teams to self-synchronize, ensuring a highly coordinated effort. Complete development of next generation tools and technologies to revolutionize air mobility information dominance to respond swiftly to global demands across all spectrums of operations from humanitarian relief to a major conflict.</p> <p>(U) In FY 2009: Initiate development of capabilities to be more agile within a net centric enabled environment. Develop timely option generation selection and coordination capabilities that account for uncertainty and missing and erroneous information, and supports intuitive decision making process between man and machine collaborating on complex, dynamic problems exploiting the respective strengths of machines (process lots of data) and human (analytical reasoning). Develop dynamic workflow and workload management capabilities to manage the command and control constellation of resources.</p> <p>(U) MAJOR THRUST: Develop and demonstrate an effects-based approach for the next generation of planning and assessment techniques that enable decision makers to determine the desired operational effects (nth-order) at the</p>	4.483	3.570	3.300

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

PROJECT NUMBER AND TITLE

4872 Aerospace Information
Dominance(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

right place at the right time, anywhere, anytime.

- (U) In FY 2007: Developed improved technologies to support effects-based planning, execution, and assessment by enabling the generation, tasking, and assessment of effects-based dynamic air execution orders. Developed improvements to support operations center personnel in assessing course of action options, based upon commander's intent, predictive battlespace awareness tools, and the ability to reason over models of the "enemy as a system." Developed technologies to capture, assess, and integrate cause-and-effect (first, second, and third order) relationships endemic to this "enemy as a system." Developed advanced information technologies to shorten the current execution timelines, while also allowing significant reductions in the number of personnel required in an operations center. Developed a streaming Air Tasking Order (ATO) prototype capability. Developed real-time operational assessment demonstration in a streaming ATO environment that will enable an effects-based approach to operational assessment, which will allow greater visibility into whether or not desired effects are being achieved.
- (U) In FY 2008: Demonstrate concepts and technologies supporting effects-based planning, execution, and assessment by enabling the generation, tasking, and assessment of effects-based tasking. Demonstrate technologies to allow operations center personnel to assess, in near-real-time, various courses of action options based upon command intent. Develop technologies to capture and assess integrated cause-and-effect (first, second, and third order) relationships endemic to this "enemy as a system." Complete the operational concept and architecture for effects based assessment to drive software development and experimentation to determine the ability of developed capabilities to assist warfighters in conducting accurate and timely assessments. Complete the development of techniques to continually assess status of planned actions against adversary systems to determine whether predicted effects are actually achieved. Initiate an analysis of cascading effects in real-time for diverse courses of action. Initiate research to forecast actionable futures to support a decision maker's ability to appraise and plan the "best" blue course of action for Rapid, Decide, Act, and Adapt (RDAA). Initiate investigation of ability to forecast potential adversaries and events-based on indications of known evidence and projected known and/or anticipated threat(s).
- (U) In FY 2009: Demonstrate technology to meet the needs for effects-based assessment in an operational environment. Design, develop, and demonstrate the capabilities for continuous effects-based assessment in a dynamic tasking environment. Demonstrate techniques to accomplish up-to-date awareness on whether the execution of the battle plan is meeting the desired effects. Investigate the methods to enable a decision support environment that enables the decision maker to anticipate and shape all aspects of the future battlespace. Initiate development of predictive battlespace awareness tools with the ability to reason over models of the "enemy as a system." Continue analysis of cascading effects in real-time for diverse courses of action. Continue research to forecast actionable futures to

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

PROJECT NUMBER AND TITLE

4872 Aerospace Information
Dominance(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

support a decision maker's ability to appraise and plan the "best" blue course of action for RDAA. Continue investigation of ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threat(s). Initiate assured end-to-end Quality of Service and Quality of Assurance integration to the information system enterprise during malicious and non-malicious faults.

(U)

(U) MAJOR THRUST: Develop and demonstrate high performance computing for size, weight, and power-limited applications, and emulate older computing components. Note: This effort transitions in FY 2008 from Applied Research PE 0602702F, Project 4594, into this PE.

0.000

1.343

1.081

(U) In FY 2007: Not Applicable.

(U) In FY 2008: Develop high performance computing for size, weight, and power-limited applications. Transition power efficient processors to DoD users by addressing power, programmability, and radiation issues. Develop and demonstrate emulation of older computing components and boards, allowing re-use of existing software while gaining the advantages of modern semiconductor processing technology.

(U) In FY 2009: Complete development of high performance computing for size, weight, and power-limited applications. Support the resulting hardware and software transition to the users. Initiate development of reliably autonomic small platforms for unmanned operations. Initiate analysis of hardware and system/support software that enables complex software to be readily composed.

(U)

(U) MAJOR THRUST: Demonstrate how a publish, subscribe, and query information management paradigm can enable vertical and horizontal integration of Air Force command, control, communication, computers, intelligence, surveillance, and reconnaissance information systems. Develop advanced prototypes of a Community of Interest (COI) infosphere that support information management requirements of various Air Force net-centric COI's. Demonstrate how such an infosphere can interact with and enhance the current net-centric operations infrastructure.

2.909

2.917

4.432

(U) In FY 2007: Ramped down information engineering efforts that allow existing and new Air Force systems to utilize COI infosphere prototypes. Developed next generation COI infospheres to provide real-time performance, security to Air Force standards, and high levels of scalability. Initiated study of tactical information management to enable information exchange across the enterprise to the tactical edge. Initiated the development of information management infrastructure to federate information among COI infospheres and across distinct information based communities.

(U) In FY 2008: Develop tactical and federated COI infospheres to manage information objects from diverse sources and data environments within and across the tactical edge. Apply adaptor technology to allow existing Air Force

Exhibit R-2a, RDT&E Project Justification

DATE

February 2008

BUDGET ACTIVITY

03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE

0603789F C3I Advanced Development

PROJECT NUMBER AND TITLE

4872 Aerospace Information
Dominance(U) **B. Accomplishments/Planned Program (\$ in Millions)**FY 2007FY 2008FY 2009

systems to rapidly integrate with and utilize COI information sources, with a special emphasis on distributed and decentralized information brokering technology to enhance systems integration of information sources across the global information enterprise adapting to infrastructure and topology constraints. Complete information engineering efforts focusing on Unit Command and Control (Unit C2) and the Installation Control Center goals of providing unit decision makers with an integrated, standardized enterprise capability to control and manage resources to execute assigned missions; providing the ability to collaborate and synchronize unit enterprise activities with the warfighting headquarters; and sharing information real time in the accomplishment of normal day-to-day operations or in generating aircraft to support the wartime Air Tasking Order. Initiate the development of technologies that enable a generic methodology for the dissemination of information across multiple security level boundaries. Develop capability integrating tactical and edge user information management requirements. Initiate development of information transformation services and adaptive information management services that learn, self-configure, self-manage, and self-heal. Initiate a study on collaboration services on demand that will exploit dynamic information services matching end user devices (laptops, cell phones, etc.) with appropriate information formats. Continue to support development of COI Infospheres in the areas of context aware collaborative user interfaces and semantic interoperability.

(U) In FY 2009: Develop and demonstrate technologies that enable pub/sub/query information dissemination across multiple security level boundaries. Initiate the study of discovery and filter technology to assess, evaluate, and convert unstructured information into structured information feeds. Demonstrate capability integrating tactical and edge user information management requirements. Continue development of information transformation services and adaptive information management services that learn, self-configure, self-manage, and are self-healing. Continue study on collaboration services on demand that will exploit dynamic information services matching end user devices (laptops, cell phones, etc.) with appropriate information formats. Continue to support context aware collaborative user interfaces and semantic interoperability.

(U)

(U) CONGRESSIONAL ADD: Collaboration Gateway.

0.000

1.000

0.000

(U) In FY 2007: Not Applicable.

(U) In FY 2008: Conduct Congressionally-directed effort for Collaboration Gateway to develop the capabilities of the Collaboration Gateway Architecture to support cross-domain audio conferencing, white-boarding, interoperability of commercial collaboration tools, and enhanced federated information search & retrieval capabilities.

(U) In FY 2009: Not Applicable.

(U)

Exhibit R-2a, RDT&E Project Justification	DATE February 2008
--	------------------------------

BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE 4872 Aerospace Information Dominance
---	--	--

(U) <u>B. Accomplishments/Planned Program (\$ in Millions)</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) CONGRESSIONAL ADD: Interoperability Network to Fuse and Exchange Real-Time Information.	0.000	0.800	0.000
(U) In FY 2007: Not Applicable.			
(U) In FY 2008: Conduct Congressionally-directed effort for Interoperability Network to Fuse and Exchange Real-Time Information to demonstrate a threat agent network capable of providing chemical detection, intrusion detection, physical security, surveillance, command and control, wireless connectivity between the screening and environmental monitoring sites and to the command center and other existing technology at Liberty Island National Monument using the Integrated Information Management System (IIMS).			
(U) In FY 2009: Not Applicable.			
(U) Total Cost	16.883	14.999	11.029

(U) <u>C. Other Program Funding Summary (\$ in Millions)</u>									
	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>	<u>FY 2010</u>	<u>FY 2011</u>	<u>FY 2012</u>	<u>FY 2013</u>	<u>Cost to</u>	<u>Total Cost</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Complete</u>	
(U) Related Activities:									
(U) PE 0602702F, Command, Control, and Communications.									
(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.									
(U) <u>D. Acquisition Strategy</u> Not Applicable.									