PE NUMBER: 0603789F
PE TITLE: C3I Advanced Development

Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2007

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603789F C3I Advanced Development

	Cost ($ in Millions)	FY 2006 Actual	FY 2007 Estimate	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	41.345	48.195	27.357	32.050	45.933	41.043	49.550	58.495	Continuing	TBD
4072	Dominant Battlespace Awareness	10.916	18.881	6.037	6.981	9.948	9.281	10.657	12.739	Continuing	TBD
4216	Battlespace Information Exchange	15.796	12.490	8.012	11.376	17.565	14.506	19.740	24.988	Continuing	TBD
4872	Aerospace Information Dominance	14.633	16.824	13.308	13.693	18.420	17.256	19.153	20.768	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 2007, Congress added $1.0 million for Advanced Course in Engineering, $4.8 million for Advanced Fusion for Urban Operations for Forensic Anticipation of Insurgent Activity (Note: Only to expend the recently demonstrated Intelligence Fusion System to provide dynamic situational awareness of insurgent activities as precursors to critical events), $1.0M for Hybrid Radio Frequency/Optical Communications Terminal, $2.0 million for Massively Parallel Optical Interconnects for Battlespace Information Exchange, $1.0 million for National Center for Multi-Source Information Fusion Research, $1.0 million for Non-Traditional Intelligence Surveillance and Reconnaissance and $1.8 million for Semantic Service Orientated Architecture for Dynamic Intelligence Fusion Programs. 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.

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2007
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development

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

		FY 2006	FY 2007	FY 2008	FY 2009
(U)	Previous President's Budget	41.124	37.785	31.161	38.298
(U)	Current PBR/President's Budget	41.345	48.195	27.357	32.050
(U)	Total Adjustments	0.221			
(U)	Congressional Program Reductions		-0.007		
	Congressional Rescissions	-0.033	-0.183		
	Congressional Increases		11.600		
	Reprogrammings	1.240	1.000		
	SBIR/STTR Transfer	-0.986			

(U) Significant Program Changes:

Not Applicable.

C. Performance Metrics

(U) Under Development.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2007
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 2006 Actual	FY 2007 Estimate	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	10.916	18.881	6.037	6.981	9.948	9.281	10.657	12.739	Continuing	TBD
Quantity of RDT&E Articles	0	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) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(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.	1.615	2.732	1.988	2.152

(U) In FY 2006: Developed a baseline capability to perform advanced text exploitation of Human Intelligence (HUMINT) reports and correlate and fuse the information with information from other sources. Developed and assessed the ability to extract information from voluminous textual data.

(U) In FY 2007: Demonstrate a baseline capability to perform advanced text exploitation of HUMINT reports and correlate and fuse the information with information from other sources. Demonstrate prototype that is able to extract information from voluminous textual data. Initiate development of a real-time Signal Processing and Geolocation capability for emerging commercial communications used by military and asymmetrical threats. Initiate 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

(U)

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
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 2006	FY 2007	FY 2008	FY 2009
(U) MAJOR THRUST/CONGRESSIONAL ADD:	4.964	9.808	4.049	4.829

Develop and demonstrate advanced data handling, event visualization technologies, and distributed data fusion to enable a more effective utilization of the vast amounts of data available to intelligence analysts to provide optimized situation awareness, as well as to support all phases of combat operations. Note: This effort includes $1.0 million in FY 2006 Congressional Add funding, and $5.8M in FY 2007 Congressional Add funding.

(U) In FY 2006: Developed a fusion evaluation environment, providing simulation and modeling capability, measures of performance, and operator-focused transition products to support the warfighter. Developed 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. Developed and demonstrated advanced fusion tools to enhance the capability for PBA. Used operator-focused techniques to evaluate the effectiveness of the fusion tools. Performed feature-aided tracking to monitor, assess, and predict possible courses of action. Developed initial reasoning algorithms and evidence accrual techniques for continuous knowledge development of the battlespace. Conducted Congressionally-directed effort for National Center for Multi-Source Information Fusion Research.

(U) In FY 2007: Continue to enhance the evaluation environment for assessing the state-of-the-art and maturity of algorithms for transition to the warfighter. Demonstrate 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. Complete demonstration of feature-aided tracking to monitor, assess, and predict possible courses of action. Complete development and demonstrate operator-focused dynamic resource allocation algorithms and techniques for optimization and collaboration of information products. Initiate software and algorithmic development for determination of adversarial behavior within persistent surveillance data, contextual tracking, target-feature-aided tracking, multible intelligence sources (multi-INT) association and cross-cueing and geospatial reasoning and cued exploitation. Investigate methods for combining post-event processing of intelligence data with real-time streaming intelligence data for indications and warning functions. Conduct Congressionally-directed effort for Advanced Fusion in Urban Operations for Forensic Anticipation of Insurgent Activity. Conduct 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

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE 4072 Dominant Battlespace Awareness

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	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.				
(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 $2.8 million in FY 2006 Congressional Add funding, and $1.0M in FY 2007 Congressional Add funding. In FY 2008, efforts in this thrust move to Project 4216 in this PE.	4.337	4.541	0.000	0.000
(U)	In FY 2006: Developed initial inter operable exploitation technologies for real-time ISR management. Enhanced ISR resource management development through incorporation of information sharing and network centric operations. Developed tools for mission/task-based priority and quality of service utilization of assets and fusion-focused ISR tasking, and explored the synergy between the two. Performed a multi-platform interoperability and limited tracking demonstration effort for integration of resource management, information management, and communications management capabilities. Conducted Congressionally-directed effort for Net-Centric Dissimilar Data Fusion Program.				
(U)	In FY 2007: Continue development of 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. Perform a multi-platform tracking demonstration utilizing airborne				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
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	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	assets against a variety of advanced military and asymmetric threat scenarios. Demonstrate 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. Conduct Congressionally-directed effort for Non-Traditional Intelligence, Surveillance, and Reconnaissance.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Semantic Service Oriented Architectures for Dynamic Intelligence Fusion	0.000	1.800	0.000	0.000
(U)	In FY 2006: Not Applicable				
(U)	In FY 2007: Develop and demonstrate 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	10.916	18.881	6.037	6.981

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

	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total Cost
(U) Related Activities:										
(U) PE 0602702F, Command, Control, and Communications.										
(U) PE 0603203F, Advanced Aerospace Sensors.										
(U) PE 0603742F, Combat Identification Technology.										
(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.										

Exhibit R-2a, RDT&E Project Justification		DATE: February 2007
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE: 4072 Dominant Battlespace Awareness

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2007
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 2006 Actual	FY 2007 Estimate	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	15.796	12.490	8.012	11.376	17.565	14.506	19.740	24.988	Continuing	TBD
Quantity of RDT&E Articles	0	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, Service, 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)	FY 2006	FY 2007	FY 2008	FY 2009
(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.	3.273	3.876	0.954	1.134
(U) In FY 2006: Examined and 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.				
(U) In FY 2007: Continue to develop or adapt 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. Develop 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)				

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	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(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	0.000	0.782	2.886
(U)	In FY 2006: Not Applicable.				
(U)	In FY 2007: Not Applicable.				
(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)					
(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 efort transitions in FY 2008 from Applied Research PE 0602702F, Project 4519, into this PE.	0.000	0.000	0.670	1.374
(U)	In FY 2006: Not Applicable.				
(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)					
(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	0.000	0.000	0.784	1.019

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
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	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	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.				
(U)	In FY 2006: Not Applicable.				
(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.				
(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)					
(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	0.000	1.393	2.680
(U)	In FY 2006: Not Applicable.				
(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: Continue development and demonstrate selected offensive cyber operations capabilities. Demonstrate and integrated kinetic and cyber operations planning and execution capability. Develop cyber command and control (Cyber C2) operations functions.				
(U)					
(U)	MAJOR THRUST/CONGRESSIONAL ADD: Develop and demonstrate advanced expert system decision algorithms to prioritize and control resources for global reach. This effort contains $2.8 million in FY 2006 Congressional Add funding.	3.456	0.540	0.000	0.000

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603789F C3I Advanced Development	PROJECT NUMBER AND TITLE 4216 Battlespace Information Exchange

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U)	In FY 2006: Transitioned the combined Intelligent Information Manager, Integrated Network Controller, and the Global Media Access Controller to jump start Network Centric communications. Conducted Congressionally-directed efforts for Information for Global Reach, and Enable Network Centric Warfare.				
(U)	In FY 2007: Complete 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)					
(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 $3.9 million in FY 2006 and $2.0 million in FY 2007 Congressional Add funding.	7.139	6.080	3.429	2.283
(U)	In FY 2006: Developed mechanisms to enable integrated management of communications and sensor resources. Assessed communications needed to support ground moving target tracking, multi-intelligence exploitation and fusion, and sensor resource management systems and techniques. Established a framework for integration and development of a common-coordinated management function for command, control, intelligence, surveillance, and reconnaissance networking. Developed mission/task-based priority and quality of service utilization of communications assets to enable fusion-focused ISR tasking, feature-aided tracking, group tracking, and use of Level 3 type fusion information. Investigated the complexities of multi-intelligence exploitation and incorporated enhancements into the development. Continued to develop and demonstrate an efficient on-board optical interconnectivity solution that addresses all intra and inter-platform communications, including telemetry/command/control, and payload related data exchange needs of unmanned airborne vehicles and micro satellite platforms.				
(U)	In FY 2007: Demonstrate 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. Develop and demonstrate a survivable, mobile, deployable extension of the global information enterprise to support rapid, decisive and sustainable air power, command and control weapons data links, and ISR assets. Conduct Congressionally-directed effort for Massively Parallel Optical Interconnects to Battlespace Information				

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	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	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.				
(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 (ISR) airborne and ground information environments. Continue 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. Continue investigation to provide assured access (anti-jam) covert high capacity spectrum dominance for global networking, while denying the adversary the same.				
(U)					
(U)	CONGRESSIONAL ADD: Griffith Institute - Accelerated Course in Engineering.	0.964	0.000	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for Griffith Institute - Accelerated Course in Engineering.				
(U)	In FY 2007: Not Applicable.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Hybrid Radio Frequency - Optical Communications Terminal.	0.964	0.994	0.000	0.000
(U)	In FY 2006: 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.				
(U)	(U) In FY 2007: Continue Congressionally directed effort for Hybrid Radio Frequency - Optical Communications Terminal. Continue development of parts and subsystems that can be used in either				

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	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	optical or RF communications systems, and be used simultaneously for RF and optical communications. Integrate RF and Optical hardware into a common subsystem. Develop the signaling protocols combining optical and RF characteristics. Develop 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	0.000	1.000	0.000	0.000
(U)	In FY 2006: Not Applicable.				
(U)	In FY 2007: Develop 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.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	Total Cost	15.796	12.490	8.012	11.376

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

	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total Cost
(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 2007

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 2006 Actual	FY 2007 Estimate	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	14.633	16.824	13.308	13.693	18.420	17.256	19.153	20.768	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

Note: Increased funding in FY 2006 and out reflects increased emphasis on developing high payoff information distribution and effects-based planning technologies. In FY 2006, efforts from Project 4925 move to this Project.

(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)	FY 2006	FY 2007	FY 2008	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.	3.928	5.479	4.169	2.143
(U) In FY 2006: Investigated a core set of functionality and supporting infrastructure 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 joint Service collaborative planning of mission packages with tailorable and exportable information reports/briefings associated with air space management and deconfliction. Continued developing highly efficient business processes and tools to support information exchange between operations centers and other command and control centers. Explored the integration of intelligent agents that use physics-based modeling to provide accurate, detailed advice necessary to make informed decisions. Applied appropriate system of systems and federation of systems engineering principles to create joint command and control decision-support capabilities.				

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

	FY 2006	FY 2007	FY 2008	FY 2009

(U) In FY 2007: Continue to investigate 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. Develop execution of the air space plan and re-planning options to enable dynamic deconfliction capabilities; avoiding hazardous conditions. Demonstrate highly efficient business processes and tools to support information exchange between operations centers and other command and control centers. Prototype and demonstrate intelligent agents that use physics-based modeling to provide accurate, detailed advice necessary to make informed decisions. Develop command and control decision-support capabilities. Initiate 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. Develop 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. Initiate development of polymorphic computing technology for persistent surveillance systems using faster processing and greatly reduced size, weight, and power.

(U) (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

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(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
of information at multiple security levels.				
(U) (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 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)				
(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	2.282	3.983	1.245	0.694
(U) In FY 2006: Developed 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. Developed advanced reasoning techniques for mobility courses-of-action development. Applied the use of advanced computer mark-up languages and developed a common mobility ontology to improve automation of decision support tools for increased situational awareness, planning, and execution management. Investigated the feasibility of a capability-centric versus system/program-centric global warfighting response by "bridging the seams" between disparate processes and systems in the Combat Air Force (CAF), Mobility Air Force (MAF), and Civil Air Traffic Management (ATM) domains. Developed improved synchronization among Global Strike and Global Mobility Force participants within multiple theaters and global Civil ATM. Developed the capability to support collaborative command and control, including dynamic and intermittent participation of players. Developed automated machine-to-machine exchange of selected information between CAF aircraft, MAF aircraft, their respective command and control elements, and civil ATM agencies. Explored the feasibility of virtual staff members to maintain a vision of command and control processes during human absences providing a 24/7 coverage.				

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

	FY 2006	FY 2007	FY 2008	FY 2009

(U) In FY 2007: Demonstrate 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. Demonstrate advanced reasoning techniques for mobility courses-of-action development. Demonstrate the use of common mobility ontology to improve automation of decision support tools for increased situational awareness, planning, and execution management. Develop technologies to enable a CAF, MAF, civilian shared situational awareness/synchronization to achieve desired "effects" and ensure mission success in a global environment. Demonstrate improved synchronization among Global Strike and Global Mobility Force participants within multiple theaters and global Civil ATM. Demonstrate the capability to support collaborative command and control, including dynamic and intermittent participation of players. Develop additional automated machine-to-machine exchange capabilities between CAF aircraft, MAF aircraft, their respective command and control elements, and civil ATM agencies, and demonstrate improved information sharing and interoperability between CAF and MAF mission planning and execution systems for improved velocity, efficiency, safety, and mission success. Develop appropriate virtual staff members to maintain a vision of command and control processes during human absences providing a 24/7 coverage.

(U) In FY 2008: Complete development of improved synchronization among Global Strike and Global Mobility Force participants within multiple theaters and global Civil air traffic management (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.

(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

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	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.				
(U)					
(U)	MAJOR THRUST: Develop, demonstrate, and integrate a broad range of technologies that have application within embedded information architecture applicable to manned and unmanned vehicles. Note: In FY 2006, this effort completed.	0.804	0.000	0.000	0.000
(U)	In FY 2006: Developed and demonstrated a Time Sensitive Target automated decision-aiding capability for an Advanced Technology Aerospace Operations Center type of facility in a spiral fashion.				
(U)	In FY 2007: Not Applicable.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(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 right place at the right time, anywhere, anytime.	3.711	4.468	3.600	4.481
(U)	In FY 2006: Developed new concepts and technologies supporting effects-based planning, execution, and assessment by enabling the generation, tasking, and assessment of effects-based dynamic air execution orders. Developed capabilities to support air operations center personnel in developing and assessing, in near-real-time, various 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." Investigated advanced information technologies to shorten the current execution timelines, while also allowing significant reductions in the number of personnel required in operation centers. Developed warfighter-accepted operational concepts and architecture views for a Streaming Air Tasking Order (ATO) generator and dynamic effects-based assessment capability. Developed initial spiral developments of concept demonstrations of a Streaming ATO generation capability. This will enable more responsive and continuous planning, execution, and assessment within the operations center.				
(U)	In FY 2007: Develop improved technologies to support effects-based planning, execution, and assessment by enabling the generation, tasking, and assessment of effects-based dynamic air execution				

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orders. Develop 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." Develop technologies to capture, assess, and integrate cause-and-effect (first, second, and third order) relationships endemic to this "enemy as a system." Develop advanced information technologies to shorten the current execution timelines, while also allowing significant reductions in the number of personnel required in an operations center. Develop a streaming ATO prototype capability. Develop 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 (COA) 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 support a decision maker's

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(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
ability to appraise and plan the "best" blue course of action for Rapid, Decide, Act and Adapt (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 (QoS) and Quality of Assurance (QoA) 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	0.000	1.354	0.693
(U) In FY 2006: Not Applicable.				
(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 development of tools, techniques, standards, and technologies to build highly complex software-intensive systems.				
(U)				
(U) (U) MAJOR THRUST/CONGRESSIONAL ADD: 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. Note: This effort includes $1.3 million in FY 2006 Congressional Add funding.	3.908	2.894	2.940	5.682
(U) In FY 2006: Developed initial next generation COI infosphere prototypes to provide real-time performance, security to Air Force standards, and high levels of scalability to meet Air Force net-centric operational needs. Supported information engineering efforts allowing various existing and new Air				

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	FY 2006	FY 2007	FY 2008	FY 2009

Force systems to utilize COI infosphere prototypes. Conducted Congressionally-directed efforts for secure Battlespace Information Exchange.

(U) In FY 2007: Ramp down information engineering efforts that allow existing and new Air Force systems to utilize COI infosphere prototypes. Develop next generation COI infospheres to provide real-time performance, security to Air Force standards, and high levels of scalability. Initiate study of tactical information management to enable information exchange across the enterprise to the tactical edge. Initiate 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 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 (ICC) 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 (ATO). 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 are self-healing. 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.

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

	FY 2006	FY 2007	FY 2008	FY 2009
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) Total Cost	14.633	16.824	13.308	13.693

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

	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total Cost
(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.