Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force											DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**FY 2011 Base Estimate**	**FY 2011 OCO Estimate**	**FY 2011 Total Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	114.510	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
624519: *Communications Technology*	35.871	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
624594: *Information Technology*	30.804	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
625581: *Command and Control (C2) Technology*	38.385	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
6266SP: *Space Optical Network Tech*	9.450	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, efforts in this PE moved to PE 0602788F, Dominant Information Technology.

A. Mission Description and Budget Item Justification

This program develops technology for Air Force Command, Control, and Communications (C3). Advances in C3 are required to increase warfighter readiness and effectiveness by providing the right information, at the right time, in the right format, anytime, anywhere in the world. The program has four projects. The Communication Technology project develops assured and secure communications technology and the capability to attack and exploit adversarial information and information systems. The Information Technology project develops improved and automated capabilities to generate, process, fuse, exploit, interpret, and disseminate timely and accurate information. The Command and Control Technology project investigates and develops planning, assessment, and knowledge base technologies to allow the warfighter to plan, assess, execute, monitor, and re-plan on the complex, compressed time scales required for tomorrow's conflicts. The Space Optical Networking Technology project develops the technology base for the next generation of ultra-wide-bandwidth, multi-channeled, air and space-based communications networks on and between platforms. This program is Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary technologies.

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Air Force	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	**R-1 ITEM NOMENCLATURE** PE 0602702F: *Command Control and Communications*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	115.559	0.000	0.000	0.000	0.000
Current President's Budget	114.510	0.000	0.000	0.000	0.000
Total Adjustments	-1.049	0.000	0.000	0.000	0.000
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds		0.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	-1.049	0.000	0.000	0.000	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Project: 624519: *Communications Technology*		
Congressional Add: *Space Qualification of the Common Data Link.*	1.596	0.000
Congressional Add Subtotals for Project: 624519	1.596	0.000
Congressional Add Totals for all Projects	1.596	0.000

Change Summary Explanation

Note: In FY 2010, Congress added $2.0 million for Efficient Utilization of Transmission Hyperspace. These efforts were transfered to PE 0602788F, Dominant Informantion Technology, via Form 1414. The FY 2010 President's Budget submittal did not reflect FY 2011 through FY 2015 funding. A detailed explanation of changes between the two budget positions is not provided because it cannot be made in a relevant manner.

C. Performance Metrics

Under Development.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624519: *Communications Technology*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624519: *Communications Technology*	35.871	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, this effort moves to PE 0602788F, Project 5315, Connectivity and Protection Tech.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that enable assured, worldwide/theater, high capacity, communications and networking for Air Force Task Forces. These communication and networking technologies will provide capabilities for en-route and deployed distributed collaborative command, control, surveillance, reconnaissance, and exploitation. A rapidly deployed force requires assured connectivity with reliable, responsive, affordable information exchange via all available communications media. This project provides the technologies for multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques; lightweight, phased array antennas; and modular, programmable, low-cost software radios. It includes technologies for advanced processors and devices, advanced network protocols and services, intelligent communications management and control, advanced communications algorithms, and enabling communication signal processing techniques.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop assured and survivable information and networking technologies enabling worldwide command, control, surveillance, reconnaissance, and exploitation operations.	9.698	0.000	0.000	0.000	0.000
FY 2009 Accomplishments: In FY 2009: Completed development of airborne CBDN, synergistic with the Joint Tactical Radio System Wideband Networking Waveform's Network Service Layer and applies to extremely dynamic airborne nets. Designed and developed airborne network modeling and simulation technology. Developed cognitive networking technology that senses operating environment, learns application requirements, and adapts network protocols. Completed development of policy-based network management technologies for real-time network response to changes in INFOCON levels. Designed					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624519: *Communications Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
and developed network operations and security capability to provide policy based, mission based, cross domain, heterogeneous network quality of performance, security, configuration, and fault management. Initiated development of small hand-held multi-data rate, internet protocol compatible, covert network radios. Developed a resilient and self-regenerating information Network Centric Warfare enterprise that dynamically recognizes, characterizes, and understands novel cyber attacks and service anomalies, aids in the creation of synthetically diverse, functionally equivalent software, and continuously monitors, reconfigures, and self optimizes the mission critical enterprise to resist new attacks. Initiated development of secure data sharing to prevent the disclosure of sensitive information to untrustworthy users. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Develop improved, higher bandwidth communications and signal processing technologies to provide secure, adaptive, covert, anti-jam, and assured global battlespace connectivity. *FY 2009 Accomplishments:* In FY 2009: Completed development of quantum key distribution and cryptography technologies to effect ultra-secure communications for wired and wireless networks. Designed and demonstrated assured access anti-jam communications capability that combines multi-dimensional (space, time, frequency, coding, polarization) transmission techniques, multi-frequency, multi-wavelength, multi-path techniques, and spectrum sense and adapt techniques. Developed advanced, automated, network	3.593	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624519: *Communications Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
and bandwidth management technologies to move, manage, and process information in real-time for the warfighter. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Develop critical information transmission technologies to permit the seamless integration of aerospace weapon systems' networks. *FY 2009 Accomplishments:* In FY 2009: Completed exploring multiple technologies/techniques for tunable, high power radio frequency filtering to reduce overall radio frequency component equipment size, weight, and signal losses applicable to battlefield network operations. Conducted the Congressionally-directed Compact Laser Terminal for Airborne Network Centric Warfare effort to develop acompact, low power comsumption wavelenght tunable laser transmitter for free-space optical communications in an airborne network. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable.	4.153	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624519: *Communications Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 OCO Plans: In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Develop cyber operations technologies for enabling worldwide command, control, communications, and intelligence. *FY 2009 Accomplishments:* In FY 2009: Initiated work in Cyber Command and Control for defensive cyber operations to achieve cyber awareness and understanding. Developed defensive techniques for wireless, mobile, and embedded systems. Conducted assured end-to-end Quality of Service and Quality of Assurance integration to the information system enterprise doing malicious and non-malicious faults. Initiated work in autonomic defensive response to rapidly recover from adversary cyber attacks. Developed information system access methods. Initiated efforts to propagate through adversary networks. Developed stealth and persistence technologies enabling network discovery, propagation to new locations, and data exfiltration/infiltration. Conducted cyber intelligence gathering efforts to achieve cyber situational awareness and understanding. Conducted cyber and traditional kinetic weapon integration technology development and initiated efforts for cyber delivery to influence operations effects. Conducted the Congressionally-directed Cyber Attack Mitigation Lab effort. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.	16.831	0.000	0.000	0.000	0.000
Accomplishments/Planned Programs Subtotals	34.275	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624519: *Communications Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
Congressional Add: Space Qualification of the Common Data Link. *FY 2009 Accomplishments:* In FY 2009: Conducted the Congressionally-directed Space Qualification of the Common Data Link. *FY 2010 Plans:* In FY 2010: Not Applicable.	1.596	0.000
Congressional Adds Subtotals	1.596	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (13327): *Activity Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624594: *Information Technology*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
624594: *Information Technology*	30.804	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, these efforts move to PE 0602788, Project 5318, Operational Awareness Tech and Project 5317, Information Decision Making Tech.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that improve and automate their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This project improves global awareness at all levels, enabling warfighters to understand relevant military situations on a consistent basis with the timeliness and precision needed to accomplish their missions. Global awareness is achieved by exploiting information provided by the Air Force, other government agencies, and open source information. The information is fused to support the dynamic planning, assessment, and execution cycles via the global information enterprise. Knowledge, information, and data are all archived in the global information base for continued use and historical analysis. The information technologies required to achieve this capability are developed under this project in an affordable manner and include appropriate access mechanisms for our coalition partners. This project develops high-payoff embedded information systems technologies for the next generation of distributed information integration architectures to enable global information dominance and air and space superiority. The embedded information systems technologies provide affordable, innovative, secure, net-enabled embedded information systems to the warfighter.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop innovative multi-sensor collaborative fusion technologies in a fully distributed air and space environment.	6.485	0.000	0.000	0.000	0.000
FY 2009 Accomplishments: In FY 2009: Evaluated fusion management and advance the state-of-the-art in track-to-track fusion techniques. Completed the process of probabilistic identification through the use of multi-source fusion. Increased probabilistic confidence through the inclusion of higher-level fusion techniques in the situational assessment and process refinement area. Completed the development of techniques to dynamically update advanced reasoning fusion engines to adapt to changing threat conditions.					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624594: *Information Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Completed the development and assessment of intelligence, surveillance, and reconnaissance management techniques that optimize the fusion process for identification and continuous tracking of military significant threats. Completed the development and assessment of network centric approaches to provide distributed fusion techniques to the warfighter. Developed new track algorithms that combine traditional kinematic associations with multi-INT reasoning to improve the identification and track life times of ground moving targets; taking into account the limitations of gap times, dense target environments, and large sensor data inaccuracies. Completed the development of a set of algorithms that can automatically develop, reason, and dynamically update various sub-sets of the existing intelligence preparation of the battlespace products (e.g., named areas, target areas, courses of action, units, infrastructure areas, lines of communication). Developed fused air, ground, and space information through machine-to-machine automatic fusion and dynamic re-tasking processes resulting in a single network centric operational picture. Processes examined include machine-to-machine automated multi-INT fusion, long-term automated tracking and ID of nominated targets, and automated/adaptive pattern recognition. Investigated Fusion of CybINT with traditional INTs. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Develop higher-level fusion and the enabling information/knowledge base technologies to achieve situational awareness and understanding at all command levels.	8.651	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624594: *Information Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Completed enhancement of web-based search techniques, data filtering techniques, and information aggregation methods to take advantage of the explosion of available open source data on the Web required for rapid situational awareness and understanding. Developed inferencing techniques for reasoning about the situation and for predicting enemy intent and threat possibility. Developed multi-source and automated recognition techniques to support analysis of current situations. Developed technology demonstration plans for cyber situational awareness and understanding using an autonomous set of cooperative agents under positive control to defend mission critical Air Force assets. Initiated development of technology demonstration plans for active ISR defense on wired networks to perform an adaptive response to multiple, coordinated, and sustained attacks. Conducted research to achieve the capability to analyze multiple COAs having cascading effects in near real-time. The capability mixes kinetic and non-kinetic options, continuously forecast the direct and indirect effects of each COA, and play COAs forward in time to identify key plan dependencies, decision points, and the foreclosure of options. Conducted 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. Completed the development of a set of algorithms that can automatically develop, reason, and dynamically update various sub-sets of the existing intelligence preparation of the battlespace products (e.g., named areas, target areas, COA, units, infrastructure areas, lines of communication). *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624594: *Information Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop automatic and dynamically reconfigurable, affordable, scalable, distributed petaflop processing technologies for real-time global information systems. *FY 2009 Accomplishments:* In FY 2009: Implemented architectural features for cognitive information processing. Completed algorithm development for next generation information technologies for C2 systems. Completed architectural development for cognitive information processing. Completed development and characterization of high performance computers for quantum computing applications. Developed and characterized the next generation of high performance computers. Completed the development of a prototype chip that contains a hybrid architecture design, which will provide an emulation capability for large-scale cognitive architecture evaluations. Conducted the development of the tools, techniques, standards, and technologies required to build highly complex software-intensive systems. Initiated development of high capacity processing on demand, which will reduce the ever increasing amounts of raw data to actionable information. Provided hardware and system/support software that enables complex software to be readily composed. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.	6.656	0.000	0.000	0.000	0.000
MAJOR THRUST: Develop modeling and simulation technologies for the next generation of planning, assessment, and execution environments.	2.146	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624594: *Information Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Completed demonstrations of adversarial behavior models and modeling techniques for courses of action assessment and prediction. Conducted concept demonstrations of integrated interaction and assessment of friendly versus adversary courses of action. Completed demonstration of a prototypical dynamic situation assessment and prediction system. Investigated advanced concepts to provide approaches for a modeling toolset that enables the warfighter to build composable simulations. Investigated the ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threat(s). *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Develop real-time embedded information system technologies for complex, time-critical, embedded systems to enable affordable design and development of state-of-the-art hardware systems. *FY 2009 Accomplishments:* In FY 2009: Completed development of dynamically reconfigurable aerospace systems using adaptive computing techniques to support image/video processing and data compression. Completed development of affordable, high assurance components for real-time embedded systems supporting MLS/MSLS and mixed criticality. Completed development of methods of computation and computing processes using biologically-inspired and biologically-based computation for embedded systems application. Completed development of power-aware, polymorphic aerospace systems for mission-aware computing.	1.848	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624594: *Information Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2010 Plans: In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST/CONGRESSIONAL ADD: Develop digital information exploitation technologies for electronic communications and special signals intelligence, imagery, and measurement signatures. *FY 2009 Accomplishments:* In FY 2009: Developed the multi-intelligence processing, exploitation, and dissemination of actionable intelligence. Completed the development of more effective multi-sensor signature exploitation algorithms to enhance detection (by 50%), identification (by 25%), and assessment (10X reduction in analyst time) of difficult targets; taking into account the complementary signature features (e.g., geo-physical, materials) that can be derived from multiple MASINT sensors. Completed the development to automatically detect and identify audio protection and channelization effects in modern modulated personal communications systems with the goal of providing analysts the capability to automatically detect speech privacy and identify methods and means used. Initiated development of methods and mechanisms to achieve robust/tamper-proof self-authenticating, self-regenerating code/data and detection and eradication systems for polymorphic malware. Research included the detection and prevention of embedded malicious software (malware), system self-optimization/diagnosis/recovery, and the development of self-correcting watermarked code and data for trusted and optimized computing. *FY 2010 Plans:* In FY 2010: Not Applicable.	5.018	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 624594: *Information Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
Accomplishments/Planned Programs Subtotals	30.804	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (13550):	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Activity Not Provided											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 625581: *Command and Control (C2) Technology*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
625581: *Command and Control (C2) Technology*	38.385	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, this effort moves to PE 0602788F, Project 5316, Info Mgmt and Computational Tech.

A. Mission Description and Budget Item Justification

The Air Force requires command and control technologies that will provide the next generation of weapon systems with improved processing and presentation of information for real-time, distributed battle management and control. Technologies in this project must be capable of taking advantage of future net-centric environments including new structured and ad hoc processes in response to rapidly changing warfare challenges. Technologies being developed will increase capability, quality, and information interoperability, while reducing the cost of C2 systems and infrastructure. Technology development in this project focuses on planning and assessing techniques knowledge bases, distributed information systems, and information management and distribution services. Advances in planning and assessment technologies will vastly improve the military decision making process within C2 systems. Advances in the ability to rapidly detect, classify, identify, and continuously track objects and events will improve the awareness and understanding and prediction of adversarial intentions, allowing the development of various courses of action to counter their intentions. Advances in the development of very large comprehensive knowledge bases to rapidly formulate and create new knowledge are needed by the Expeditionary Aerospace Force. Advances in distributed intelligent information systems will allow automatic rapid reconfiguration of C2 centers to respond to varying crisis levels, as required, by a Net-Centric Aerospace Force. Advances in robust information management and dissemination technologies will ensure the delivery of high-quality, timely, secure information to the warfighter.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Investigate and develop technologies for the rapid development and application of next generation knowledge bases for aerospace C2 systems.	5.177	0.000	0.000	0.000	0.000
FY 2009 Accomplishments: In FY 2009: Developed foundations, technology, and tools to enable effective, practical automated reasoning of the scale and complexity required for computers to perform complex tasks in the real-					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 625581: *Command and Control (C2) Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
world requiring intelligence. Investigated and developed specialized cognitive architectures using self-aware, learning agents that can generate well-focused knowledge bases for automated intelligent extraction, correlation, and classification of link patterns for discovering relevant linkages between entities. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Investigate, analyze, and develop technologies for automatic rapid reconfiguration of distributed intelligent information systems to varying crisis levels. *FY 2009 Accomplishments:* In FY 2009: Developed advanced interactive displays suitable for rapid deployment in harsh environments with C2 applications and command centers. Developed advanced techniques and AOC-based applications for information visualization for use in conjunction with multiple, heterogeneous data sets. Developed technologies to improve the fidelity, accuracy, and interconnection of computer-based wargames used to prepare contingency plans and response strategies. Developed technologies for a holistic tool set that commanders can use to probe, study, analyze, visualize, reason, and predict activities in the battlespace. Developed capabilities to be more agile within a net centric enabled environment. Conducted the development of 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 humans	10.518	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 625581: *Command and Control (C2) Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
(analytical reasoning). Developed dynamic workflow and workload management capabilities to manage the command and control constellation of resources. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Investigate and develop technologies to securely share information via publish, subscribe, and query with coalition partners as part of the Global Information Grid. *FY 2009 Accomplishments:* In FY 2009: Completed cross-domain information sharing research and development to include collaborative monitoring and management of multi-national enterprise resources. Developed techniques and tools that will ensure availability, integrity, and survivability of information within a coalition net-centric environment. Investigated technologies, which can determine the pedigree of information in a coalition environment and assess the trustworthiness of the marked up information to be shared throughout the coalition. Investigated and prototyped the application of information fusion and information management technologies such as fuselets to extend composite views of events across a multi-domain enterprise into fused events. Developed publish/subscribe/query technologies for application to a CBDN system for intelligent network management of user information. *FY 2010 Plans:* In FY 2010: Not Applicable.	7.036	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 625581: *Command and Control (C2) Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 Base Plans: In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Develop next generation monitoring, planning, execution, and assessment technologies and tools. *FY 2009 Accomplishments:* In FY 2009: Investigated application of decision support sciences and advanced decision-making concepts to C2 activities within a coalition AOC. Developed intelligent information systems capable of supporting joint/coalition C2 for various missions in a dynamically changing environment. Developed tools to increase situational awareness and understanding through intelligent information processing. Conducted the application of system-of-systems and federation-of-systems engineering in the creation of joint C2 capabilities. Explored the application of intelligent software agents as virtual battle staff members to enhance various C2 processes. Developed capability for a full-spectrum analysis for effects attainment at all levels of a campaign, linking leading indicators to desired and undesirable effects. The capability utilizes causal reasoning, linking effects to actions to desired end-state, develops non-deterministic, non-linear causal linkages, and is capable of reasoning through uncertainty and ambiguity. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable.	7.132	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 625581: *Command and Control (C2) Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2011 OCO Plans: In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Investigate and develop technologies to implement flexible, high performance, secure, scalable, and survivable information management and dissemination services. *FY 2009 Accomplishments:* In FY 2009: Developed high-payoff publish, subscribe, and query laboratory prototypes, which provide higher levels of performance, security, and scalability capable of exceeding commercial products and support Air Force net-centric environment needs. Developed the security policy enforcement between COI Infospheres at various levels of security classification. Investigated methods and techniques for dynamically evolving the net-centric environment so as to avoid system crashes or latency by exploiting information technologies based on quality of service mechanism. Initiated integration of information services across operational boundaries and dissimilar infrastructure based systems. Developed information transformation services and adaptive information management services that learn, self-configure, self-manage, and are self-healing. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.	2.008	0.000	0.000	0.000	0.000
MAJOR THRUST: Develop distributed collaboration technologies, advance collaboration science, virtual environments, and predictive simulation tools.	6.514	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 625581: *Command and Control (C2) Technology*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Completed development of advanced information technologies for collaborative decision-making and knowledge management in support of capability-based planning and next generation planning, execution, and assessment environments. Completed prototyping distributed collaborative environment technologies for advanced decision support for high-profile system concepts, such as the Global Strike Concept of Operations and operations other then war. Studied collaboration services on demand that will exploit dynamic information services matching end user devices (laptops, cell phones, etc.) with appropriate information formats. Supported context aware collaborative user interfaces and semantic interoperability. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
Accomplishments/Planned Programs Subtotals	38.385	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (13773): *Activity Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
• PE 0603617F: *C3 Applications.*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 625581: *Command and Control (C2) Technology*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE 0303401F: *Communications-Computer Systems (C-CS) Security RDT&E.*											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 6266SP: *Space Optical Network Tech*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
6266SP: *Space Optical Network Tech*	9.450	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Note

Note: In FY 2010, this effort moves to PE 0602788, Project 5315, Connectivity and Protection Tech.

A. Mission Description and Budget Item Justification

This project develops the technology base for the next generation of ultra-wide bandwidth, multi-channeled, air- and space-based communications networks on and between platforms. As the application of laser-based, point-to-point communications between satellites emerges, air- and space-based optical networks, whose communications capacities are thousands of times greater than current communications satellites, become a realistic possibility. This project will assess and adapt the emerging communication and information technologies for applications in air and space. This project will explore technologies for implementing photonic chip scale optical Code Division Multiple Access (CDMA) and Wavelength Division Multiplexed (WDM) transceivers and prototype networks, built to demonstrate the benefits associated with the advanced fiber optic, wireless, platform, and satellite networks that can be built from them. This project will develop and demonstrate technology to integrate current Radio Frequency (RF) with high data rate optical laser communications, along with network management techniques, tools, and software to support them. These technologies have potential applications in specific military systems including reliable, high bandwidth, jam-resistant communications at the theater level, and multiplexing of multiple DoD users onto a common networking infrastructure for reduced manning and logistics.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop and assess optical network technologies for application in the space environment. *FY 2009 Accomplishments:* In FY 2009: Developed 40 channel multi wavelength optical network for on-board air and space applications.	2.815	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 6266SP: *Space Optical Network Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2010 Plans: In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
MAJOR THRUST: Develop and assess existing and emerging Optical CDMA and WDM modulation schemes and protocols for use in space-based optical networks. *FY 2009 Accomplishments:* In FY 2009: Initiated flight demonstration of multi-gigabit, multi-wavelength optical communications bus interface chip for space and air platforms. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.	1.705	0.000	0.000	0.000	0.000
MAJOR THRUST: Develop and demonstrate heterogeneous, seamless, secure, self-configuring high capacity air/space/surface wireless networks.	4.930	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602702F: *Command Control and Communications*	PROJECT 6266SP: *Space Optical Network Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
FY 2009 Accomplishments: In FY 2009: Completed the development and start the characterization of higher throughput RF waveform data link technology for operation under adverse weather conditions. Initiated the design of an integrated RF/laser communications airborne qualifiable brassboard. *FY 2010 Plans:* In FY 2010: Not Applicable. *FY 2011 Base Plans:* In FY 2011: Not Applicable. *FY 2011 OCO Plans:* In FY 2011 OCO: Not Applicable.					
Accomplishments/Planned Programs Subtotals	9.450	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
• PE Not Provided (13930):	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Activity Not Provided											

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.