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 0602788F: *Dominant 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**
Total Program Element	0.000	116.785	117.283	0.000	117.283	129.320	131.538	134.298	136.922	Continuing	Continuing
625315: *Connectivity and Protection Tech*	0.000	46.429	46.780	0.000	46.780	53.093	53.432	54.110	54.869	Continuing	Continuing
625316: *Info Mgt and Computational Tech*	0.000	33.674	30.804	0.000	30.804	32.506	32.266	34.769	35.617	Continuing	Continuing
625317: *Information Decision Making Tech*	0.000	16.869	18.835	0.000	18.835	17.962	18.696	20.325	20.394	Continuing	Continuing
625318: *Operational Awareness Tech*	0.000	19.813	20.864	0.000	20.864	25.759	27.144	25.094	26.042	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communication.

A. Mission Description and Budget Item Justification

This program develops enterprise-centric information technology for the Air Force. Advances in enterprise-centric information technologies 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 Connectivity and Protection Tech project provides the technologies for: multi-level, secure, seamless networks; advanced communications processors; anti-jam and low probability of intercept techniques, as well as technologies that successfully deter any adversary from attacking computer systems anytime, anywhere while allowing access to, presence on, manipulation of, and operational effects of adversary computer systems. In addition, 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. The Info Mgmt and Computational Tech project will provide advances in robust information management and dissemination technologies to ensure the delivery of high-quality, timely, secure information to the warfighter and develop technologies to produce both advanced on-demand computational processing and computer architectures with greater capacity and sophistication for addressing dynamic mission objectives under constraints imposed by AF systems. The Information Decision Making Tech project develops the technology necessary to support the commander and staff's ability to command all viable options to achieve desired effects across the full spectrum of operations. The Operational Awareness Tech project develops technologies that improve and automate their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This program is in Budget Activity 2, since it develops and demonstrates 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 0602788F: *Dominant Information Technology*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	0.000	115.278	0.000	0.000	0.000
Current President's Budget	0.000	116.785	117.283	0.000	117.283
Total Adjustments	0.000	1.507	117.283	0.000	117.283
• Congressional General Reductions		0.000			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	-0.493			
• Congressional Adds		2.000			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	117.283	0.000	117.283

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Project: 625315: *Connectivity and Protection Tech*		
Congressional Add: *Efficient Utilization of Transmission Hyperspace.*	0.000	1.992
Congressional Add Subtotals for Project: 625315	0.000	1.992
Congressional Add Totals for all Projects	0.000	1.992

Change Summary Explanation

Note: In FY 2010, Congress added $2.0 million for Efficient Utilization of Transmission Hyperspace. 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 0602788F: *Dominant Information Technology*	PROJECT 625315: *Connectivity and Protection 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
625315: *Connectivity and Protection Tech*	0.000	46.429	46.780	0.000	46.780	53.093	53.432	54.110	54.869	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Projects 4519 and 66SP.

A. Mission Description and Budget Item Justification

The Air Force requires technologies that enable assured, worldwide communications for an agile Expeditionary Aerospace Force (EAF). These communication technologies will provide en-route and deployed reachback communications for distributed collaborative military operations. A rapidly deployed EAF requires assured connectivity with reliable, responsive, and affordable information exchange via all available communications media and across all domains - air, space, and cyber. This project provides the technologies for secure, self-configuring, self-healing, seamless networks; advanced communications processors; anti-jam and low probability of intercept communications techniques; agile, dynamic policy based network management capabilities; and modular, programmable, low-cost software radios. This project also develops both the technology base for the next generation of ultra-wide bandwidth, multi-channeled air and space-based communications networks on and between platforms using the technologies for implementing photonic chip scale optical Code Division Multiple Access (CDMA) and Wavelength Division Multiplexed (WMD) transceivers and prototype networks associated with advanced fiber optics and the 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. In addition, the Air Force requires technologies to deliver a full range of options in cyberspace at par with air and space dominance in each of the areas of cyber attack, cyber defense, and cyber support to achieve the strategic capability of cyber dominance. This project provides the technologies required to successfully deter any adversary from attacking computer systems anytime, anywhere by ensuring the Air Force's ability to: 1) access, maintain presence on, and deliver effects to adversary systems; 2) detect, defend, and respond to attacks on friendly computer systems as well as provide forensic analysis concerning those attack attempts; and 3) provide cyber situational awareness to Air Force commanders.

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.	0.000	6.983	10.473	0.000	10.473

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 0602788F: *Dominant Information Technology*	PROJECT 625315: *Connectivity and Protection 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: Not Applicable. *FY 2010 Plans:* In FY 2010: Initiate development of low probability of intercept, low probability of detection waveform for hand held multi data rate radio. Design smart power control and advanced field programmable gate arrays with reduced size, weight, and power for hand held multi-data rate radio. Continue development of a resilient and self-regenerating information 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. *FY 2011 Base Plans:* In FY 2011: Complete development of low probability of intercept, and low probability of detection waveform for hand held multi data rate radio. Complete development of small form-factor networking and reachback capability. Complete design of soldier interface to integrate smart power control and advanced field programmable gate arrays with reduced size, weight, and power for hand held multi data rate radio. Continue development of a resilient and self-regenerating information 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. Develop capability to enhance trust within airborne networks. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop improved, higher bandwidth communications and signal processing technologies to provide secure, adaptive, covert, anti-jam, and assured global battlespace connectivity.	0.000	6.200	3.295	0.000	3.295

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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: Not Applicable. *FY 2010 Plans:* In FY 2010: Design and demonstrate an automated reasoning network management agent system based on semantic web technologies capable of reasoning out suggested conclusions to detected network events rather than presenting only raw data to an information manager. Complete demonstration of assured access, anti-jam communications capability that combines multi-dimensional (space, time, frequency, coding) transmission techniques to mitigate and survive in multipath fading, interference, and jamming environments via spectrum sense and adapt techniques. Complete design and demonstration of cognitive networking technology that senses operational environment, discerns application requirements, and adapts network protocols/resources. Complete development of advanced, automated, wireless airborne networking and communications link emulation capability for the assessment and evaluation of communications algorithms in a virtual military communications environment. Initiate in-house and university development of next generation advanced networking technologies for distributed military operations in an airborne environment ensuring reliable information exchange across all domains of air, space, and cyber. *FY 2011 Base Plans:* In FY 2011: Continue in-house and university development of next generation advanced networking technologies for distributed military operations in an airborne environment ensuring reliable information exchange across all domains of air, space, and cyber. Develop capability to enhance leading wireless protocols for use in the unmanned air vehicle environment. Develop capability for increased bandwidth to a variety of airborne platforms with varying data rates. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
	0.000	1.623	7.201	0.000	7.201

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop cyber defense and supporting technologies to detect, defend, and respond to attacks on computer systems as well as provide forensic analysis concerning the attacks. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Continue to develop defensive techniques for wireless, mobile, and embedded systems. Initiate vulnerability analysis and threat identification for emerging commercial wireless standards. Complete investigation of fusion of cyber intelligence (CybINT) with traditional intelligence methods (INTs) and use of CybINT collection technologies to increase situational awareness of enterprise systems and malicious activities occurring therein. Continue development of technology demonstration plans for cyber situational awareness and understanding using an autonomous set of cooperative agents under positive control to defend mission critical AF assets. Initiate development of technology demonstration plans for active intelligence, surveillance, and reconnaissance (ISR) defense on wired networks to perform an adaptive response to multiple, coordinated, and sustained attacks. *FY 2011 Base Plans:* In FY 2011: Continue to develop defensive techniques for wireless, mobile, and embedded systems. Initiate vulnerability analysis and threat identification for emerging commercial wireless standards. Continue development of technology demonstration plans for implementing enhanced cyber security technologies to provide improved security of operating systems against cyber attacks against mission critical AF assets. Develop root of trust techniques for the protection of digital devices and data both laterally within a network and vertically within a network enclave. Develop hardware and software techniques to enhance the security of traditional operating systems in order to be invisible to potential cyber attacks and effectively implement cyber rules of engagement (ROE). Develop formal models for cyber defense policies with the ability to deconflict policies generated by a diverse set of stakeholders and conforming to command intent for					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
cyber indications and warning (I&W) and ROE . Develop technologies to detect targeted or stealthy attacks of AF networks/systems and perform damage assessments of successful adversary attacks. Develop cyber forensic techniques that allow AF personnel to trace back and identify adversary attacks on AF cyber infrastructure. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop offensive cyber operations technologies to access, maintain presence on, and deliver effects to adversary systems. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Continue development of information system access methods and development of propagation techniques. Continue development of stealth and persistence technologies. Initiate development of the capability to exfiltrate information from adversary information systems for generation of actionable CybINT. Continue technology development for preparation of the battlefield and increased situational awareness and understanding. Continue development of technology to deliver D5 (deceive, deny, disrupt, degrade, and destroy) effects. Initiate efforts to develop autonomic technologies for operating within adversary information systems. Initiate development of techniques for covert communication among agents operating within adversary information systems. Initiate analysis of proprietary hardware and software systems to identify viable means of access and sustained operations within the same. Initiate efforts to develop a pub/sub architecture for exchange and exfiltration of information while operating within adversary information systems. Demonstrate ability to identify foreign languages as a part of a CybINT capability.	0.000	15.246	12.266	0.000	12.266

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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: Continue development of information system access methods and development of propagation techniques. Continue development of stealth and persistence technologies. Continue development of the capability to exfiltrate information from adversary information systems for generation of actionable CybINT. Continue technology development for preparation of the battlefield and increased situational awareness and understanding. Continue development of technology to deliver D5 effects. Continue development of autonomic technologies for operating within adversary information systems. Continue development of techniques for covert communication among agents operating within adversary information systems. Continue analysis of proprietary hardware and software systems to identify viable means of access and sustained operations within the same. Continue development of a publish/subscribe architecture for exchange and exfiltration of information while operating within adversary information systems. Initiate development of techniques to deliver PsyOps via cyber channels. Develop deception techniques to allow misdirection and confusion of adversary attempts to probe and infiltrate AF systems. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Investigate the range of cyber technologies as needed to achieve information and cyber dominance. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Initiate development of technologies to support a polymorphic cyber infrastructure that avoids exposure to threats and can proactively escape from incoming threats before they affect friendly information systems. Initiate development of techniques to support evasion and escape maneuvers in cyberspace. Initiate development of technology to provide a trusted verification of	0.000	5.159	3.681	0.000	3.681

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
information system hardware resources. Initiate the development of remote rendering services and thin client technology to protect end user information systems from network-delivered threats. Initiate challenge problem and university research investigations for development of cyber domain capabilities supporting AF information systems. *FY 2011 Base Plans:* In FY 2011: Continue development of polymorphic cyber technologies. Complete development of technologies to support a polymorphic cyber infrastructure that avoids exposure to threats and can proactively escape from incoming threats before they affect friendly information systems. Continue challenge problem and university research investigations for development of cyber domain capabilities supporting AF information systems. Complete the development of remote rendering services and thin client technology to protect end user information systems from network-delivered threats. Develop methods for network interfaces that automatically shift systems from one address space to another in a rapid, synchronized and secure manner. Initiate work to define and develop an effects-based strategic approach to cyber defense that focuses on avoiding the threat. Initiate development of technical means to render adversary cyber capabilities irrelevant and ineffective by introducing fundamental information assurance (IA) mechanisms into systems. Initiate development of a code transformation tool to thwart malicious code attacks, thus rendering adversary cyber weapons completely ineffective. Initiate development of a code transformation tool to thwart malicious code attacks. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop methods and technologies for controlled operation of information systems during attacks and fault conditions, and for guaranteeing the correctness of data and codes. *FY 2009 Accomplishments:* In FY 2009: Not Applicable.	0.000	2.043	2.709	0.000	2.709

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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: Initiate development of assured end-to-end quality of service (QoS) and quality of information assurance (QoIA) integration to the information system during attacks and faults to provide the ability to degrade gracefully in a controlled trade space. Initiate development of novel software protection techniques to guarantee the incorruptibility of data and executable codes. *FY 2011 Base Plans:* In FY 2011: Complete development of assured end-to-end QoS and QoIA integration to the information system during attacks and faults to provide the ability to degrade gracefully in a controlled trade space. Continue development of novel anti-tamper software protection techniques to guarantee the incorruptibility of data and executable codes. Initiate development of defensive cyber technologies to increase system survivability while under a cyber attack. Develop capability to detect and repair malicious modifications to mission-critical data. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop and assess optical network technologies for application in the space environment. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Design and develop a flight test system with a Dense Wavelength Division Multiplexed (DWDM) broadcast architecture consisting of an optical backbone with single mode fiber optic cable, tunable laser transmitters, 32 channel receivers, a passive star coupler, and expanded beam connectors. Continue development of 40 channel multi wavelength optical network for on-board air and space applications.	0.000	4.818	3.586	0.000	3.586

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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: Install the flight test system in a tactical avionics platform, such as an F-16. Perform and complete in-flight verification of the DWDM single mode system by testing data integrity, switching times and latency, total throughput, reconfigurability, bit error rates, and wavelength to wavelength switching during flight operations. Complete development of 40 channel multi wavelength optical network for on-board air and space applications. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Design and develop flight ready systems consisting of high capacity RF and optical components and architectures for next generation platform communications. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Complete characterization of higher throughput RF waveform data link technology. Initiate development of prototype hardware and software with advanced coding and higher order modulation for higher throughput RF waveform generation. *FY 2011 Base Plans:* In FY 2011: Complete the fabrication of several flight test ready RF waveform data link systems. Conduct flight testing. Complete ground tests of RF waveform generation to demonstrate high capacity persistent sensor data transmission. Complete the fabrication of prototype hardware and software for higher throughput RF waveform generation. Complete the fabrication of several flight test ready RF waveform data link systems. Initiate development of next generation of high capacity data links supporting transmission requirements of airborne and spaceborne sensors.	0.000	2.365	3.569	0.000	3.569

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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: N/A					
Accomplishments/Planned Programs Subtotals	0.000	44.437	46.780	0.000	46.780

	FY 2009	FY 2010
Congressional Add: Efficient Utilization of Transmission Hyperspace. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Conduct Congressionally-directed effort for Efficient Utilization of Transmission Hyperspace.	0.000	1.992
Congressional Adds Subtotals	0.000	1.992

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 (14332): *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.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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
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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
625316: *Info Mgt and Computational Tech*	0.000	33.674	30.804	0.000	30.804	32.506	32.266	34.769	35.617	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Projects 4519 and 5581.

A. Mission Description and Budget Item Justification

The Air Force requires the capability to maximize the value, sharing, management, and use of its information and information assets in achieving its mission objectives as the importance of information grows in the current net centric environment. Technology development 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. Advances in robust information management focus on quality of service and flow of information within the enterprise, information transformation and brokering, secure information sharing across and among domains, and collaboration of workflow within the enterprise. Technologies addressed in this project include the ability to globally share, discover, and access information across organizational, functional, and coalition boundaries and between and among domains, the timely delivery of information to tactical assets, the tailoring and prioritization of information based on mission needs and importance, and the scaling, robustness, and collaboration features required of the Air Force net-centric information management environment. In addition, the Air Force requires the development of superior, intelligent, on-demand computing to enable information superiority. Technology development in this project focuses on producing: 1) computer architectures with greater capacity and sophistication for addressing constrained, dynamic mission objectives, 2) "game-changing" computing power to the warfighter, 3) disruptive computing technology power at the edge and the power behind grid services, and 4) interactive and real-time computing improving the usability of high performance computing to the Air Force. It includes technologies in computational sciences and engineering, computer architectures, and software intensive systems.

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 to securely share information via publish, subscribe, and query with coalition partners as part of the Global Information Grid (GIG).	0.000	10.433	8.670	0.000	8.670
FY 2009 Accomplishments: In FY 2009: Not Applicable.					

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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: Continue research into cross domain information sharing technologies. Investigate cognitively assisted information technologies to provide automated assistance to the current labor-intensive process of human review and release of sensitive information to other security domains and enclaves. Develop secure cross domain discovery and sharing of web services. Complete development of content-based dissemination mechanisms and quality of service provisioning. Initiate development of novel information management techniques as applied to all domains through in-house and university research leading to enhanced information flow across the net-centric assets of the GIG. *FY 2011 Base Plans:* In FY 2011: Complete research efforts to improve the timeliness and accuracy of the human review process using advanced information technology. Initiate development of tools and safeguards required to quickly and reliably transfer information from a higher classification domain to a lower classification domain, as well as to coalition partners. Various methods will be explored to include machine comprehension, statistical analysis, and hidden content mining. Initiate research into cross domain service authorization and discovery. Complete development of secure cross-domain information brokering for the discovery and sharing of web services. Continue development of novel information management techniques as applied to all domains through in-house and university research leading to enhanced information flow across the net-centric assets of the GIG. Develop information assurance techniques for tamper proof systems, resilient distrbuted data stores and out-of-band security to allow defense of DoD COTS information systems. Develop methods to evaluate commercial products for malicious implants over the entire supply chain caused by either external or internal threats. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Investigate and develop technologies to implement agile, high performance, secure, scalable, and survivable information management and dissemination services.	0.000	13.819	8.755	0.000	8.755

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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: Not Applicable. *FY 2010 Plans:* In FY 2010: Develop service components that provide information management sharing mechanisms as infrastructure components within a service oriented architecture (SOA). Collections of the service components may be assembled to establish a robust and reliable information sharing substrate, eliminating application complexity and management responsibility. Develop mechanisms to federate and share information across disbursed locations and establish the means to maintain provenance and authoritative control over the information. Develop information sharing mechanisms to efficiently share and synchronize dynamic information sources where information changes are in the seconds and require secure disperse dissemination. Develop prioritized queuing mechanisms to maximize value of delivered information based upon its context. Demonstrate decentralized information management through advanced infospherics research. Initiate development of tactical information dominance capabilities that include unmanned aerial systems (UAS), "wide-body" assets and high-altitude platforms. *FY 2011 Base Plans:* In FY 2011: Develop service components that provide information management sharing mechanisms as infrastructure components within a SOA. Expand on the SOA techniques so they can be applied to tactical airborne operations. Continue development of the mechanisms to share information in a decentralized manner between peers with any centralized policy management operating through the distributed entities transparent and non-dependent on any individual entity. Continue development of SOA substrate that will provide guaranteed levels of information dissemination to specific user applications based on mission based operational context and derived policy. Complete research into dynamic information management system infrastructure. Initiate nano-computer technology development to provide high performance, secure, scalable, and survivable information dissemination.					

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 0602788F: *Dominant Information Technology*	PROJECT 625316: *Info Mgt and Computational Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Initiate quantum information sciences technology to provide enhanced computing applications. Develop information management capabilities in support of force protection. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop collaborative services technologies and virtual environments to facilitate the development and fielding of next generation decision support systems. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Based on study results, begin development of an information service orchestration framework that leverages open system standards and technologies to implement workflow capabilities that can adapt the execution of information services to the changing requirements of dynamic military environments. *FY 2011 Base Plans:* In FY 2011: Not Applicable. Effort eliminated due to higher Air Force priorities. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A	0.000	0.657	0.000	0.000	0.000
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: Not Applicable.	0.000	4.082	6.707	0.000	6.707

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 0602788F: *Dominant Information Technology*	PROJECT 625316: *Info Mgt and Computational 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: Continue the development of the tools, techniques, standards, and technologies required to build highly complex software-intensive systems. Continue the development of high capacity processing on demand which will reduce the ever increasing amounts of raw data to actionable information. Provide hardware and system/support software that enables complex software to be readily composed. Evaluate current processor functionality and identify functionality necessary for system on chip capability. Initiate architectures for cognitive systems. Identify nodal design hierarchy for modular system. Initiate scalable quantum information science testbed for optimized information searching and processing. Develop algorithms and simulations of select computationally challenging and relevant problems. Initiate development of next generation advanced computing techniques, enabling superior information processing for AF warfighters through in-house and university research. *FY 2011 Base Plans:* In FY 2011: Continue the development of the tools, techniques, standards, and technologies required to build highly complex software-intensive systems. Complete development of algorithms and simulations of select computationally challenging and relevant problems in the scalable quantum information science testbed for optimized information searching and processing. Complete design of petaflops embedded processing on-demand. Demonstrate increased control of power of fabricated prototype. Complete architectures for cognitive systems. Demonstrate hierarchical prototype. Continue development of next generation advanced computing techniques, enabling superior information processing for AF warfighters through in-house and university research. Initiate development of advanced processing capabilities to enable the collection and processing of information as close to the sensor as feasible. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
	0.000	1.873	3.293	0.000	3.293

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 0602788F: *Dominant Information Technology*	PROJECT 625316: *Info Mgt and Computational Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop secure, manageable cross domain discovery services that allow appropriate access to approved services outside of existing domain. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Initiate investigation of current lightweight directory access protocol (LDAP) best practices and design multi-level LDAP capability. Investigate current state of the art in web services discovery. Identify best of breed capabilities and apply security to fulfill cross-domain discovery requirements. Develop flexible sensor interfaces to support rapid sensor replacement and configuration without modification of backend hardware or software infrastructure. Evaluate impact of emerging tactical radios. Develop prioritized delivery mechanisms by integrating information management and networking complementary capabilities. *FY 2011 Base Plans:* In FY 2011: Complete implementation of multi-level LDAP prototype solution into a fully SOA compliant architecture, leveraging the existing multi-level repository (MLR) technology. Implement secure web services discovery prototype using multi-level LDAP authentication within a SOA compliant architecture. Measure prototype scalability, performance, security, and ease of management. Develop a flexible fusion container to allow upstream processing without affecting core critical infrastructure. Demonstrate application to tracking of evasive non-linear targets. Initiate development of advanced technologies to effectively manage large data storage warehouses within the ISR enterprise. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop the architectural mechanisms that form the basis for predictable software and high assurance systems.	0.000	2.810	3.379	0.000	3.379

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 0602788F: *Dominant Information Technology*	PROJECT 625316: *Info Mgt and Computational 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: Not Applicable. *FY 2010 Plans:* In FY 2010: Initiate development and design of a modular trusted computing base architecture composed of the foundational hardware and software necessary to ensure overall system security. Enhance system performance of multi-core and multi-threaded microprocessors through resiliency mechanisms. *FY 2011 Base Plans:* In FY 2011: Complete prototype design and demonstrate functionality of a modular trusted computing base architecture. Develop trusted, automated cyber defense capability to reduce response time down to milli-seconds vice hours . Develop methods to use emerging commercial high assurance processors, virtualization, secure system development, self-protecting data for the hardening of commercial off-the-shelf products. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	33.674	30.804	0.000	30.804

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 (14555): *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.

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 0602788F: *Dominant Information Technology*	**PROJECT** 625316: *Info Mgt and Computational Tech*

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 0602788F: *Dominant Information Technology*	PROJECT 625317: *Information Decision Making 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
625317: *Information Decision Making Tech*	0.000	16.869	18.835	0.000	18.835	17.962	18.696	20.325	20.394	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Project 5581.

A. Mission Description and Budget Item Justification

The Air Force requires advances in technologies enabling the effective execution of military objectives that will vastly improve the ability to support the commander and staff's ability to command all viable options to achieve desired effects 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 through stability operations). Technology development in this project addressing this requirement include anticipatory decision support and course of action development, planning, scheduling and assessment, and the real time effective portrayal of complex data sets.

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
MAJOR THRUST: Develop next generation monitoring, planning, and assessment technologies enabling aerospace commanders to develop effects based campaigns.	0.000	3.698	5.683	0.000	5.683
FY 2009 Accomplishments: In FY 2009: Not Applicable.					
FY 2010 Plans: In FY 2010: Continue development of decision support sciences applications and advanced decision-making concepts for activities focused on integrated command and control (C2). Demonstrate intelligent information systems capable of supporting joint/coalition C2 associated with a specific mission in a dynamically changing environment. Continue to develop tools to increase situational awareness and understanding of the air, space, and cyberspace domains through intelligent					

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 0602788F: *Dominant Information Technology*	PROJECT 625317: *Information Decision Making Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
information processing. Continue the application of system-of-systems and federation-of-systems engineering in the creation of joint/integrated C2 capabilities. Complete the exploration of the application of intelligent software agents as virtual battle staff members to enhance various C2 processes. Initiate investigation of intelligent software agents for autonomous air operations center (AOC)/platform operations. Continue the development of capability for a full-spectrum analysis for effects attainment at all levels of a campaign, linking leading indicators to desired and undesirable effects. Develop the capability to accomplish causal reasoning, linking effects to actions to desired end-state, and capable of reasoning through uncertainty and ambiguity. Continue research to achieve the capability to analyze multiple courses of action (COA) having cascading effects in near real-time. Develop the capability to mix kinetic and non-kinetic options, incrementally 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. Initiate investigation into wargaming technologies to support the rapid analysis of crisis-action plans or COA. Initiate in-house and university development of next generation planning, decision making, and COA tools supporting the commander's ability to exercise a wide range of command and execution options for AF forces. *FY 2011 Base Plans:* In FY 2011: Continue development of decision support sciences applications and advanced decision-making concepts for C2 activities focused on integrated C2. Continue demonstrating intelligent information systems capable of supporting joint/coalition C2 for various missions in a dynamically changing environment. Continue to develop tools to increase situational awareness and understanding of the air, space, and cyberspace domains through intelligent information processing. Continue the application of system-of-systems and federation-of-systems engineering in the creation of joint/integrated C2 capabilities emphasizing vertical and horizontal integration. Continue investigation of intelligent software agents for autonomous AOC/platform operations. Continue the development of capability for a full-spectrum analysis for effects attainment at all levels of a campaign, linking leading indicators to desired and undesirable effects. Continue to develop the capability to accomplish causal reasoning, linking effects to actions to desired end-state, and capable of reasoning through uncertainty					

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 0602788F: *Dominant Information Technology*	PROJECT 625317: *Information Decision Making Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
and ambiguity. Continue research to achieve the capability to analyze multiple COA having cascading effects in near real-time. Continue to develop and begin demonstrating capabilities to mix kinetic and non-kinetic options, continuously forecast the direct, indirect, and cascading effects of each COA, and play COAs forward in time to identify key plan dependencies, decision points, and the foreclosure of options. Continue investigating approaches to rapidly wargame crisis-action plans. Continue in-house and university development of next generation planning, decision making, and COA tools supporting the commander's ability to exercise a wide range of command and execution options for AF forces. Develop techniques for courses-of-action analysis and assessments following cyber attacks on AF systems allowing commanders the ability to dynamically reallocate resources based on attack severity. Develop technologies to be able to reconsitute mission data and reestablish trust levels of DoD systems in a timely manner after a comprehensive cyber attack. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
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: Not Applicable. *FY 2010 Plans:* In FY 2010: Continue to develop advanced interactive displays suitable for rapid deployment in harsh environments with C2 applications and command centers. Continue development of advanced techniques and AOC-based applications for information visualization for use in conjunction with multiple, heterogeneous data sets. Continue to develop technologies to improve the fidelity, accuracy, and interconnection of computer-based wargames used to prepare contingency plans and response strategies. Continue development of technologies for a holistic tool set that commanders can use to probe, study, analyze, visualize, reason, and predict activities in the battlespace. Continue	0.000	10.368	8.877	0.000	8.877

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
development of capabilities to be more agile within a net centric enabled environment. Develop the ability for timely kinetic/non-kinetic 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. Continue the development and demonstration of decision workflow and workload management capabilities to manage the C2 constellation of resources focused on specific missions. *FY 2011 Base Plans:* In FY 2011: Complete development of advanced interactive displays suitable for rapid deployment in harsh environments with C2 applications and command centers. Complete development of advanced techniques and AOC-based applications for information visualization for use in conjunction with multiple, heterogeneous data sets. Complete development of technologies to improve the fidelity, accuracy, and interconnection of computer-based wargames used to prepare contingency plans and response strategies. Complete development of technologies for a holistic tool set that commanders can use to probe, study, analyze, visualize, reason, and predict activities in the battlespace. Continue development of capabilities to be more agile within a net centric enabled environment. Develop the ability for timely kinetic/non-kinetic option generation, selection, and coordination capabilities that account for uncertainty and missing and erroneous information, and support intuitive decision making processes between man and machine collaborating on complex, dynamic problems. Continue the development and demonstration of decision workflow and workload management capabilities to manage the command and control constellation of resources focused on specific missions. Develop the capability to process and rapidly disseminate information to the Expeditionary Aerospace Force. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Investigate, analyze, and develop technologies for planning, executing, and assessing seamless integrated C2 to achieve desired effects globally.	0.000	2.803	4.275	0.000	4.275

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 0602788F: *Dominant Information Technology*	PROJECT 625317: *Information Decision Making 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: Not Applicable. *FY 2010 Plans:* In FY 2010: Investigate processes and technologies and recommend solutions to enable the Air and Space Operations Center (AOC) to conduct kinetic/non-kinetic Monitor, Assess, Plan, and Execute (MAPE) while under degraded conditions due to cyber attacks. Design and develop an experimentation environment and conduct scenario-based integrated C2 studies. Develop and evaluate measures of effectiveness (MOEs) and measures of performance (MOPs) for key attributes associated with integrated C2. Investigate methods to seamlessly move between geospatial and non-geospatial data to enhance situational awareness and enable integrated decisions over the air, space, and cyber domains. Develop applications for visualizing and exploring remotely accessed heterogeneous data in to a common operating picture of the battlespace. Initiate an effort to develop an integrated task order synchronizing air, space, and cyberspace capabilities to achieve desired effect. *FY 2011 Base Plans:* In FY 2011: Complete the investigation of processes and technologies and recommend solutions to enable the AOC to conduct kinetic/non-kinetic MAPE procedures while under degraded conditions due to cyber attacks. Complete development of an experimentation environment and conduct scenario based integrated C2 studies. Complete development and evaluation of MOEs and MOPs for key attributes associated with integrated C2. Complete investigation of methods to seamlessly move between geospatial and non-geospatial data to enhance situational awareness and enable integrated decisions over the air, space, and cyberspace domains. Complete development of applications for visualizing and exploring remotely accessed heterogeneous data into a common operational picture of the battlespace. Complete development of an integrated task order capability synchronizing air, space, and cyberspace capabilities to achieve desired effect. Develop the capability to rapidly integrate and analyze C2 systems within a developmental environment. Develop technologies to provide dynamic					

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 0602788F: *Dominant Information Technology*	PROJECT 625317: *Information Decision Making Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
reconfigurable boundary conditions with the goal of forcing an adversary to continually re-plan their missions. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
Accomplishments/Planned Programs Subtotals	0.000	16.869	18.835	0.000	18.835

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 (14688):	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 0602788F: *Dominant Information Technology*	PROJECT 625318: *Operational Awareness 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
625318: *Operational Awareness Tech*	0.000	19.813	20.864	0.000	20.864	25.759	27.144	25.094	26.042	Continuing	Continuing

Note

Note: Prior to FY 2010, efforts in this PE were performed in PE 0602702F, Command, Control and Communications, Project 4594.

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 provides not only a network-centric, collaborative intelligence analysis capability that enables the fusion of multi-intelligence and sensor sources to provide timely situation awareness, understanding, and anticipation of the threats in the battle space, but also the advanced, novel exploitation technologies needed to intercept, collect, locate, and process both covert and overt raw data from intelligence and sensor sources. It leads the research, discovery, and development of technology that enables the fusion of multi-intelligence sources to provide accurate object tracking and ID, situational awareness, understanding, and anticipation of the threats in the battlespace (air, ground, space, and cyber). It also leads in the development of advanced exploitation technologies to maximize the intelligence gained from our adversaries in the areas of spectral detection and geolocation, signal recognition and analysis, and the data tagging, tracking, and tracing via the insertion of secure, imperceptible signal embedding for future fusion and understanding of the information.

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 environment.	0.000	5.991	4.938	0.000	4.938
FY 2009 Accomplishments: In FY 2009: Not Applicable.					
FY 2010 Plans: In FY 2010: Extend and mature models to reflect real Multi-INT data effects. Demonstrate capability on real data sets. Complete Hybrid Multi-INT association algorithms based on contextual knowledge/					

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 0602788F: *Dominant Information Technology*	PROJECT 625318: *Operational Awareness Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
advanced reasoning. Explore tracking techniques in combination with Multi-INT feature data to improve the probability of correct association and extend track lifetimes for moving targets. Continue to investigate impacts of resource management. Examine and demonstrate distributed multi-platform fusion utilizing resource allocation, mission planning, and cueing. Develop the capability to utilize detected movement information and social network analysis to define and exploit the structure and behavior of the enemy. *FY 2011 Base Plans:* In FY 2011: Complete techniques and strategies for confusion event prediction and mitigation. Demonstrate the ability to track targets, exploiting feature data, for an average of greater than 1 hour in moderate traffic density. Begin development and implementation of techniques to increase the scalability of tracking algorithms from 10's to 1000's of ground targets in a large rural-urban environment. Investigate ways of partitioning the area of interest (AOI) based on the multi-layered sensing architecture vision. Initiate development of techniques to improve analysis of multi-sensor data for mining data across multi-INT repositories for behavioral patterns to identify terrorist networks and track movement. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop higher-level fusion and the enabling information/knowledge base technologies to achieve situational awareness and understanding at all command levels. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Complete development of automated reasoning techniques for assessing current situations using adversarial capabilities. Initiate development of techniques for analyzing and	0.000	1.510	3.614	0.000	3.614

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
assessing activities to support situation assessment. Initiate in-house and university research dealing with level 1 - 4 fusion using multi-source intelligence and sensor feeds to advance the AF capability to anticipate the variety of threats from the ground, air, and cyber domains. *FY 2011 Base Plans:* In FY 2011: Continue development of techniques for analyzing and assessing activities to support situation assessment. Continue in-house and university research dealing with level 1 - 4 fusion using multi-source intelligence and sensor feeds to advance the AF capability to anticipate the variety of threats from the ground, air, and cyber domains. Develop technologies for pre-positioning of cyber defensive capabilities including cyber intelligence collection and analysis to enable AF's ability to fight through future cyber attacks on AF systems. Develop capability to incorporate mission context data and information to enhance cyber situational awareness. Develop technologies to improve cyber agility by linking intelligence and cyber information operations. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					
MAJOR THRUST: Develop digital information exploitation technologies for electronic communications and special signals intelligence, imagery, and measurement signatures. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Continue the development and evaluation of watermarking techniques, extending to include streaming data. Extend multimedia data technologies for additional applications, with a focus on net-centric technology applications. Focus on information provenance. Analyze and develop audio processing technologies in the area of vocal tract modification. Develop foundations, technology, and algorithms to enable improvements to intelligence, surveillance, and reconnaissance (ISR) missions.	0.000	3.625	6.599	0.000	6.599

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Further provide laboratory functionality to develop real time, tactical information exploitation software for test and evaluation using operational data. Initiate the development and evaluation of algorithms to identify and classify an application layer (request/reply) messaging protocol (termed MODBUS) that provides client/server communication between devices connected on different types of buses or networks, for supervisory control and data acquisition (SCADA) systems, including field and protocol specific characteristics. Extend and incorporate these characteristics into lab-generated test sets. Initiate in-house and university research in advanced exploitation techniques that maximize the AF ability to gather, process, and display information from multi-INT sources identifying threats to warfighters across the physical and cyber domains. *FY 2011 Base Plans:* In FY 2011: Continue the development and evaluation of watermarking techniques for multimedia, beginning extensions to non-multimedia data and executable code. Continue to focus on application within network and ISR-centric scenarios. Continue work toward the integration of provenance information, and investigate usage of intrinsic watermarks for these purposes. Identify potential methods for verification and absolute measures of effectiveness. Continue the development, test, and evaluation of real time, tactical information exploitation software using laboratory tools and operational data. Develop a wide variety of exploitation methods to enhance signals situational awareness. Complete SCADA protocols, integrate all algorithms, demonstrate and test a prototype analysis suite as an extensible proof-of-concept. Verify and validate algorithm performance against simulated real-world data. Prepare for spiral development, including complete documentation of findings and recommendations. Continue in-house and university research in advanced exploitation techniques that maximize the AF ability to gather, process, and display information from multi-INT sources identifying threats to warfighters across the physical and cyber domains. Initiate the development of optimizing exploitation across sensors to enhance multi-intelligence fusion. Develop a wide variety of exploitation methods to enhance signals situational awareness.					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Air Force		DATE: February 2010
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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: N/A					
MAJOR THRUST: Research and evaluate capabilities for reasoning and learning, text understanding, link and group discovery, and advanced analysis for situational awareness and understanding. *FY 2009 Accomplishments:* In FY 2009: Not Applicable. *FY 2010 Plans:* In FY 2010: Develop and complete a framework for document level discourse analysis and inference based on information extracted from the text and ontological world knowledge. Develop and complete techniques for analysis of audio sources as well as alternate sources by applying social network analysis metrics to determine high value targets. Initiate research on dynamic networks over time for simultaneous analysis of large volumes of streaming data with archived relational information. *FY 2011 Base Plans:* In FY 2011: Initiate development automated generation of ontology from free-text or heterogeneous data sources, in particular the learning of linkages or relationships between concepts and instances necessary for advanced reasoning. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A	0.000	2.041	1.834	0.000	1.834
MAJOR THRUST: Develop modeling and simulation technologies for the next generation of planning, assessment, and execution environments. *FY 2009 Accomplishments:* In FY 2009: Not Applicable.	0.000	6.646	3.879	0.000	3.879

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 0602788F: *Dominant Information Technology*	PROJECT 625318: *Operational Awareness 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: Complete 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. Initiate development to model and explore policy actions and reactions taken by the different modeled entities activities. Initiate development of the nation state model (to include both the physical and social subsystems). Provide initial capability for the decision maker to understand varying degree of effects, their interactions and interdependencies caused by "blue's" potential actions. Initiate verification and validation for integration of the various frameworks. Investigate development of techniques that are capable of developing/managing sets of adversary futures. Complete investigation of ability to forecast potential adversaries and events based on indications of known evidence and projected known and/or anticipated threat(s). Initiate development of an integrated set of possible combinations of adversary COAs based on the adversary's abilities and capabilities to perform activities associated with various domains. *FY 2011 Base Plans:* In FY 2011: Complete development of the "core" nation state model (to include both the physical and social subsystems). Complete development to model and explore policy actions and reactions taken by the different modeled entities activities. Initiate development of tools for the analyst to identify the optimum set of leverage points to meet commander's objectives. Initiate the identification of degree to which the adversary can achieve hypothesized eCOAs based on predicted goals. Complete verification and validation for integration of the various frameworks. Continue development of an integrated set of possible combinations of adversary COAs based on the adversary's abilities and capabilities to perform activities associated with various domains. Develop capability to rapidly identify adversarial intentions in order to develop counter COA. *FY 2011 OCO Plans:* In FY 2011 OCO: N/A					

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 0602788F: *Dominant Information Technology*	PROJECT 625318: *Operational Awareness Tech*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Accomplishments/Planned Programs Subtotals	0.000	19.813	20.864	0.000	20.864

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 (14881): *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.