Exhibit R-2, RDT&E Budget Item Justification: PB 2014 Air Force											DATE: April 2013	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*					R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*							
COST ($ in Millions)	**All Prior Years**	**FY 2012**	**FY 2013#**	**FY 2014 Base**	**FY 2014 OCO ##**	**FY 2014 Total**	**FY 2015**	**FY 2016**	**FY 2017**	**FY 2018**	**Cost To Complete**	**Total Cost**
Total Program Element	-	139.980	104.362	138.161	-	138.161	147.826	150.057	151.068	153.931	Continuing	Continuing
625315: *Connectivity and Protection Tech*	-	64.025	40.834	57.471	-	57.471	63.486	64.805	62.705	61.619	Continuing	Continuing
625316: *Info Mgt and Computational Tech*	-	31.789	27.030	25.862	-	25.862	29.602	30.224	30.019	30.779	Continuing	Continuing
625317: *Information Decision Making Tech*	-	18.709	15.787	15.775	-	15.775	14.666	15.046	14.295	14.611	Continuing	Continuing
625318: *Operational Awareness Tech*	-	25.457	20.711	20.604	-	20.604	21.324	20.855	24.474	27.026	Continuing	Continuing
62OMMS: *Research Site Support*	-	0.000	0.000	18.449	-	18.449	18.748	19.127	19.575	19.896	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

The FY 2014 OCO Request will be submitted at a later date

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 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 deter any adversary from attacking computer systems while allowing access to, presence on, manipulation of, and operational effects on adversary computer systems. This project also develops the technology base for the next generation of ultra-wide-bandwidth, multi-channeled, air- and space-based communications networks. The Information Management and Computational Tech project provides advances in 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 Air Force systems. The Information Decision Making Tech project develops the technology 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 their capability to generate, process, manage, fuse, exploit, interpret, and disseminate timely and accurate information. This program has been coordinated through the the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication. 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 2014 Air Force	DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*

B. Program Change Summary ($ in Millions)	FY 2012	FY 2013	FY 2014 Base	FY 2014 OCO	FY 2014 Total
Previous President's Budget	127.855	104.362	115.129	-	115.129
Current President's Budget	139.980	104.362	138.161	-	138.161
Total Adjustments	12.125	0.000	23.032	-	23.032
• 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	13.385	0.000			
• SBIR/STTR Transfer	-1.260	0.000			
• Other Adjustments	0.000	0.000	23.032	-	23.032

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2012	FY 2013
Project: 625315: *Connectivity and Protection Tech*		
Congressional Add: *Cyber Security Research*	12.000	-
Congressional Add Subtotals for Project: 625315	12.000	0.000
Congressional Add Totals for all Projects	12.000	0.000

Change Summary Explanation

In FY 2014, increase is due to Project 62OMMS, Research Site Support being included due to additional civilian end strength, and realignment of research site support efforts to this PE.

Received realignment of Congressional Add from PE 0601103F University Research Initiative; Reprogrammed for specific projects in accordance with Section 219 of the Duncan Hunter National Defense Authorization Act for Fiscal Year (FY) 2009, as amended by Section 2801 of the National Defense Authorization Act for FY 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force			DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625315: *Connectivity and Protection Tech*	

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO ##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
625315: *Connectivity and Protection Tech*	-	64.025	40.834	57.471	-	57.471	63.486	64.805	62.705	61.619	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

The FY 2014 OCO Request will be submitted at a later date

A. Mission Description and Budget Item Justification

The Air Force requires technologies that enable assured, worldwide communications among all elements of the force. These communication technologies will provide en-route and deployed reachback communications for distributed collaborative military operations. 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. In addition, the Air Force requires technologies to deliver a full range of options in cyberspace on 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: access, maintain presence on, and deliver effects to adversary systems; detect, defend, and respond to attacks on friendly computer systems as well as provide forensic analysis concerning those attack attempts; and provide cyber situational awareness to Air Force commanders.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Title: Advanced Connectivity Technologies	11.147	9.927	24.137
Description: Develop improved, survivable, higher bandwidth communications, networking, and signal processing technologies to provide secure, adaptive, covert, anti-jam, and assured global battlespace connectivity tailored to anti-access and area denial environments and contested operations.			
FY 2012 Accomplishments: Conducted in-house and university development of next generation advanced networking technologies for distributed military operations in an airborne environment. Developed secure video distribution over tactical internets on demand, and designed optimized, distributed, cross-layer protocol stacks for cognitive radio ad hoc networks with decentralized control. Investigated spatial multiplex multiple-input and multiple-output (MIMO) techniques to increase channel capacity, and developed a cognitive cooperation protocol for wireless networks. Completed development of capability for increased V/W bandwidth communication and characterization to a variety of airborne platforms with varying data rates. Completed investigation of mission essential			

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625315: *Connectivity and Protection Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
functions, including mini-CDL, assessing threat tolerance in contested environments, and developing mitigation strategies to alleviate risk due to cyber vulnerabilities. ***FY 2013 Plans:*** Continue development of next generation advanced networking technologies for distributed military operations in an airborne environment. Continue both development of secure video distribution over tactical internets on demand and design of distributed, cross-layer protocols for cognitive radio ad hoc networks with decentralized control. Complete investigation of spatial multiplex MIMO techniques to increase channel capacity and the development of a cognitive cooperation protocol for wireless networks. ***FY 2014 Plans:*** Continue development of next generation advanced networking technologies for distributed military operations in an airborne environment. Continue both development of secure video distribution over tactical internets on demand and design of distributed, cross-layer protocols for cognitive radio ad hoc networks with decentralized control. Initiate the development of a modular airborne network bridge for the creation of an air-air/air-ground secure tactical intranet. Initiate the development of wideband, long-range, rapidly deployable aerial backbone network for command, control, intelligence, surveillance, and reconnissaince (C2ISR) dissemination. Initiate research in support of the development of a protected, wide-band satellite communication architecture.			
Title: Cyber Defense Technologies ***Description:*** 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 2012 Accomplishments:*** Developed technology to assure operations of our networked forces (a trusted execution environment) in high threat, contested cyber environments by demonstrating a trusted cyber delivery vehicle/platform to support nearly all types cyber operations. Completed development of technologies to support the ability to avoid cyber attacks by increasing redundancy, diversity, and agility in Air Force networks to disrupt adversary attack planning by pursuing defensive cyber maneuver and agility, polymorphic code development, and concealment and obfuscation of our networks. ***FY 2013 Plans:*** Continue development of technology to assure operations of our networked forces (a trusted execution environment) in high threat, contested cyber environments by demonstrating a trusted cyber delivery vehicle/platform to support nearly all types cyber operations. ***FY 2014 Plans:*** Continue development of technology to assure operations of our networked forces (a trusted execution environment) in high threat, contested cyber environments by demonstrating a trusted cyber delivery vehicle/platform to support nearly all types of	8.600	14.131	21.212

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625315: *Connectivity and Protection Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
cyber operations. Complete development of advanced data assurance and threat mitigation technologies. Initiate development of technologies to support cyber missions' ability to keep pace with rapidly changing next-generation communications networks/ devices and deliver a full range of cyber effects.			
Title: Cyber Offense Technologies	19.309	9.877	11.347
Description: Develop offensive cyber operations technologies to access, maintain presence on, and deliver effects to adversary systems. ***FY 2012 Accomplishments:*** Developed information system access methods and propagation techniques. Developed stealth and persistence technologies and initiated investigation into anti-reverse engineering methods. Developed the capability to exfiltrate information from adversary information systems, developed methods for increased cyber situational awareness and understanding of the battlefield, and developed methods for covert data exchange. Developed technology to deliver D5 (decieve,degrade, deny, disrupt, destroy) effects in concert with cyber platforms. Initiated development of a publish/subscribe architecture for exchange and exfiltration of information while operating within adversary information systems. ***FY 2013 Plans:*** Complete development of information system access methods and development of propagation techniques. Continue development of stealth and persistence technologies. Continue investigation into anti-reverse engineering methods. Continue development of methods for increased cyber situational awareness and understanding of the battlefield, and continue the development of methods for covert data exchange. Complete development of technology to deliver D5 effects in concert with cyber platforms. Continue development of a publish/subscribe architecture for exchange and exfiltration of information while operating within adversary information systems. ***FY 2014 Plans:*** Continue development of stealth and persistence technologies. Continue investigation into anti-reverse engineering methods. Continue development of methods for increased cyber situational awareness and understanding of the battlefield, and continue the development of methods for covert data exchange. Continue development of a publish/subscribe architecture for exchange of information. Initiate the development of a common operating platform for Air Force operational cyber missions.			
Title: Survivability Technologies	5.876	6.899	0.775
Description: Develop methods and technologies for controlled operation of information systems during attacks and fault conditions, minimizing vulnerabilities of cyber attacks, and guaranteeing the accuracy and correctness of data and codes. ***FY 2012 Accomplishments:***			

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625315: *Connectivity and Protection Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Completed development of methods for disruption of malware and covert channels in data transmissions without having to detect whether malware or covert channels exist in the transmission. Initiated development of defensive cyber technologies to increase system survivability while under a cyber attack. Completed development of a resilient and self-regenerating information enterprise and developed automatic machine regeneration of software to recover with immunity from cyber attack. Conducted challenge problem in-house and university research investigations for development of cyber domain capabilities supporting Air Force information systems, including research in assured cyber operations in complex networks. Completed investigation of information assurance tenents in infrastructure as a service cloud environments, concentrating on ensuring secure processing, data storage and communication in a cloud. Developed defensive techniques for wireless, mobile, and embedded systems with vulnerability analysis and threat identification for emerging commercial wireless standards. ***FY 2013 Plans:*** Continue development of defensive cyber technologies to increase system survivability while under a cyber attack. Continue challenge problem in-house and university research investigations for development of cyber domain capabilities supporting Air Force information systems including research in assured cyber operations in complex networks. Continue investigation into secure processing by using hardware techniques and logic reconfiguration to drastically reduce major vulnerabilities. ***FY 2014 Plans:*** Complete development of defensive cyber technologies to increase system survivability while under a cyber attack. Complete challenge problem in-house and university research investigations for development of cyber domain capabilities supporting Air Force information systems including research in assured cyber operations in complex networks. Complete investigation into secure processing by using hardware techniques and logic reconfiguration to drastically reduce major vulnerabilities.			
Title: Next Generation Communications ***Description:*** Develop and assess wideband network technologies for application in the air and space environment, including existing and emerging modulation schemes and protocols and consisting of high capacity radio frequency (RF) and optical technologies, for next generation platform communications. ***FY 2012 Accomplishments:*** Initiated development of an all-optical communications system for airborne and satellite platforms, that can distribute very high rate digital data and RF signals in high shock, vibration, and radiation environments. Initiated development of next generation of high capacity data links supporting transmission requirements of airborne and spaceborne sensors. Conducted ground tests of RF waveform generation to demonstrate high capacity persistent sensor data transmission. ***FY 2013 Plans:***	7.093	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625315: *Connectivity and Protection Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
N/A. Effort terminated due to higher Department of Defense priorities. ***FY 2014 Plans:*** N/A			
Accomplishments/Planned Programs Subtotals	52.025	40.834	57.471

	FY 2012	FY 2013
Congressional Add: Cyber Security Research	12.000	-
FY 2012 Accomplishments: Conducted Congressionally directed cyber security research program.		
Congressional Adds Subtotals	12.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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 2014 Air Force			DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625316: *Info Mgt and Computational Tech*	

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO ##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
625316: *Info Mgt and Computational Tech*	-	31.789	27.030	25.862	-	25.862	29.602	30.224	30.019	30.779	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

The FY 2014 OCO Request will be submitted at a later date

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: computer architectures with greater capacity and sophistication for addressing constrained, dynamic mission objectives; "game-changing" computing power to the warfighter; disruptive computing power at the tactical edge and for federated grid services; and 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 Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Title: Dissemination Technologies	6.357	6.476	6.484
Description: Investigate and develop technologies for decision quality information dissemination services via publish, subscribe, and query across the Global Information Grid (GIG) to enterprise and tactical assets and coalition partners.			
FY 2012 Accomplishments: Developed 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. Completed research of service oriented architecture (SOA) based architectures and services for tactical and enterprise environments that are secure, survivable, and resilient to cyber attack and failures.			
FY 2013 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625316: *Info Mgt and Computational Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Continue development of tools and safeguards required to quickly and reliably transfer information from a higher classification security-domain to a lower classification security-domain, as well as to coalition partners. Initiate research into mission responsive data systems by mapping mission requirements to information flows. ***FY 2014 Plans:*** Demonstrate a multi-faceted approach to design, develop, and demonstrate a wide range of capabilities intended to protect information services and make them resilient to adverse conditions including cyber attack. Continue research into scalable mission responsive data systems by mapping mission requirements to information flows. Continue development and design of cloud-based information management services for provisioning sufficient computational power for high demand semantic processing of large data sets within mission timeline constraints. Initiate development of responsive autonomous control for tactical sensor control.			
Title: Processing Technologies ***Description:*** Develop automatic and dynamically reconfigurable, affordable, scalable, distributed petaflop processing technologies for real-time global information systems. ***FY 2012 Accomplishments:*** Developed next generation advanced computing techniques, enabling superior information processing for Air Force warfighters through in-house and university research. Completed study of reconfigurable electronics to enable intelligent Air Force systems to perform autonomous operations. Developed tools to analyze codes and dynamic execution profiles and extract threads suitable for multi-core computation. Completed development of advanced processing capabilities to enable the collection and processing of information as close to the sensor as feasible. Developed embedded processing for on-demand and multi-core petaflops computing. Conducted study of quantum cores as the foundational building blocks for a multi-core quantum processor. ***FY 2013 Plans:*** Continue development of next generation advanced computing techniques, enabling superior information processing for Air Force warfighters through in-house and university research. Complete development of tools to analyze codes and dynamic execution profiles and extract threads suitable for multi-core computation. Continue development of petaflops embedded processing on-demand and multi-core computing by demonstrating increased control of power of fabricated prototype. Complete study of quantum cores as the foundational building blocks for a multi-core quantum processor. ***FY 2014 Plans:*** Continue development of next generation advanced computing techniques, enabling superior information processing for Air Force warfighters through in-house research. Continue development of petaflops embedded processing on-demand and multi-core computing by demonstrating increased control of power of fabricated prototype. Demonstrate a context and content-aware trusted	14.146	11.155	10.354

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625316: *Info Mgt and Computational Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
router and a secure processor with hardware roots of trust. Demonstrate affordable, high performance, interactive and massively parallel computing architectures for intelligent and timely decision making for increased warfighter awareness.			
Title: Cross Domain Technologies ***Description:*** Develop secure cross domain discovery services for access to services outside of existing domain. Develop the tools to allow collaboration of workflows required by the Air Force net-centric information management environment. ***FY 2012 Accomplishments:*** Initiated development of an automated security annotation framework that provides safeguarding mechanisms for the AF enterprise. Completed an open architecture for the efficient integration of sensors, algorithms, and computing and communications hardware to support real-time tactical information collection, exploitation, and command and control. Completed development of advanced technologies to effectively manage large data storage warehouses within agile enterprise environments by developing quality of service enabled information management services coupled to network routing and management for tactical edge IP-based networks. Developed 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. Continue to develop information management capabilities in support of force protection. ***FY 2013 Plans:*** Continue development of an automated security annotation framework that provides safeguarding mechanisms for the Air Force enterprise. Continue development of novel information management techniques as applied to all security-domains through in-house and university research leading to enhanced information flow across the net-centric assets of the GIG. ***FY 2014 Plans:*** Continue development of an automated security annotation framework that provides safeguarding mechanisms for the Air Force enterprise. Continue development of novel information management techniques as applied to all security-domains through in-house and university research leading to enhanced information flow across the net-centric assets of the GIG. Enable Voice-Over-IP (VOIP) and video tele-confrence (VTC) content filters for allowing real time domain voice and video communications across coalition partners. By 2015 incrementally deliver a suite of new US/coalition collaboration services producing four new cross-domain capabilities (voice/video; full motion video streaming; automated content inspection; and global trusted remote management). Initiate development and demonstration of multi-level security trust, speed, & cost advancements for Global Network Operations Access/Connectivity.	4.485	4.543	4.690
Title: Advanced Architectural Technologies ***Description:*** Develop the architectural mechanisms that form the basis for predictable software and high assurance systems. ***FY 2012 Accomplishments:***	6.801	4.856	4.334

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625316: *Info Mgt and Computational Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Initiated development of architectures for a compact large array of many node clusters with very low power demand for intelligent systems. Completed development of trusted, automated cyber defense capability to reduce response time down to milli-seconds vice hours. Developed a co-design of a multi-core Tagged Secure Processor, a Zero-Kernel Operating System, and Application Development Environment inherently resistant to malicious software and inherently compliant with Multiple Independent Levels of Security (MILS) systems. Designed a hybrid complementary metal oxide semiconductor (CMOS)/memristor logic unit that is compact and efficient for encryption algorithm implementation. Developed tools, techniques, standards, and technologies required to build highly complex software-intensive systems including correct concurrent code for trusted embedded multi-core systems. ***FY 2013 Plans:*** Complete development of a trusted, automated cyber defense capability to reduce response time down to milliseconds vice hours. Continue the development of the tools, techniques, standards, and technologies required to build highly complex software-intensive systems. Complete development of a co-design of a multi-core Tagged Secure Processor, a Zero-Kernel Operating System, and Application Development Environment inherently resistant to malicious software and inherently compliant with MILS systems. Complete design of a hybrid CMOS/memristor logic unit that is compact and efficient for encryption algorithm implementation. ***FY 2014 Plans:*** Continue the development of the tools, techniques, standards, and technologies required to build highly complex software-intensive systems. Continue research to reduce power draw of embedded systems to enable sufficient performance to achieve autonomy and/or more on board processing. Complete design of foundations for trustworthy computing systems.			
Accomplishments/Planned Programs Subtotals	31.789	27.030	25.862

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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 2014 Air Force			DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625317: *Information Decision Making Tech*	

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO ##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
625317: *Information Decision Making Tech*	-	18.709	15.787	15.775	-	15.775	14.666	15.046	14.295	14.611	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

The FY 2014 OCO Request will be submitted at a later date

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. Technology development in this project includes 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 Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Title: Campaign Planning Technologies	8.348	8.108	8.051
Description: Develop next generation monitoring, planning, and assessment technologies enabling aerospace commanders to develop effects-based campaigns. ***FY 2012 Accomplishments:*** Initiated development of a hybrid wargaming concept of decision theory and game theory to provide safeguarded courses of action (COA) in adversarial environments with varying degrees of partial information. Completed development and demonstrated 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. Investigated full-spectrum, quantitative analysis techniques that aid operational assessor's ability to link actions to effects to desired objectives. Developed and demonstrated decision workflow and workload management capabilities to analyze and prioritize courses of action for space control missions and space situational awareness. ***FY 2013 Plans:*** Continue development of decision theory and initiate the development of a capability for autonomous adaptive re-planning in a real-time simulation environment using a case-based planning system. Continue investigation of full-spectrum, quantitative analysis techniques that aid operational assessor?s ability to link actions to effects to desired objectives. Initiate development of robust autonomous control algorithms for heterogeneous and distributed assets capable of learning in dynamic environments. ***FY 2014 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625317: *Information Decision Making Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Continue development of decision theory and continue the development of a capability for autonomous adaptive re-planning in a real-time simulation environment using a case-based planning system. Continue investigation of full-spectrum, quantitative analysis techniques that aid operational assessor's ability to link actions to effects to desired objectives. Continue development of robust autonomous control algorithms for heterogeneous and distributed assets capable of learning in dynamic environments.			
Title: Command and Control System Technologies ***Description:*** Investigate, analyze, and develop technologies for planning, execution, and automatic rapid reconfiguration of distributed intelligent and integrated command and control (C2) information systems to achieve the commander's intent throughout varying crisis levels. ***FY 2012 Accomplishments:*** Developed capabilities to be more agile within a net centric enabled environment by developing models of cyber network attacks to enable better operation of cyber assets with air and space assets. Completed development of a cooperative multi-agent system to maximize sensor task completions and provide an adaptive and flexible solution to deal with the dynamics of new asset task allocations. Conducted 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 2013 Plans:*** Complete development of capabilities to be more agile within a net-centric enabled environment by developing models of cyber network attacks to enable better operation of cyber assets with air and space assets. 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 Air Force forces. Continue development of techniques for visualizing cyber situational awareness, appropriately selecting cyber assets to achieve desired effects and assuring Operations Center functionality while under cyber attack. ***FY 2014 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 Air Force forces. Continue development of techniques for visualizing cyber situational awareness, appropriately selecting cyber assets to achieve desired effects and assuring Operations Center functionality while under cyber attack. Initiate research and development of algorithms for obtaining a comprehensive situational awareness and timely execution assessment to achieve desired effects.	10.361	7.679	7.724
Accomplishments/Planned Programs Subtotals	18.709	15.787	15.775

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625317: *Information Decision Making Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

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 2014 Air Force			DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625318: *Operational Awareness Tech*	

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO ##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
625318: *Operational Awareness Tech*	-	25.457	20.711	20.604	-	20.604	21.324	20.855	24.474	27.026	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

The FY 2014 OCO Request will be submitted at a later date

A. Mission Description and Budget Item Justification

The Air Force requires technologies that improve and automate the 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 situational awareness, understanding, and anticipation of the threats in the battlespace, 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 identification (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 Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Title: Multi-Source Fusion Technologies	14.201	10.188	11.286
Description: Develop higher-level fusion and the enabling text information/knowledge base technologies to achieve situational awareness and understanding at all command levels for dynamic planning, assessment, and execution processes. ***FY 2012 Accomplishments:*** Developed 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. Initiated development of techniques for performing indications and warnings, pattern recognition, and information fusion for information exploitation. Developed techniques and algorithms to improve analysis of multi-sensor data for mining data across multi-INT repositories for behavioral patterns to identify terrorist networks, track movement, and process moving-target indication data from airborne sensors, and automatically classify airborne targets, including RPA. Completed design and demonstration of an automated feature aided tracking and pattern recognition capability for onboard processing of high-resolution, wide-area video staring sensor with cueing from lower bandwidth sensors. Conducted in-house and university research dealing with level 1 - 4 fusion using multi-source intelligence and sensor feeds to advance the Air Force capability to anticipate the variety of threats from the ground, air, and cyber domains. Completed development of techniques for analyzing and assessing activities to support situation assessment. Initiated developing software to aid the analyst in determining the entity's behavior, including direction, speed, maneuvers, and operation of equipment. Completed development of automated generation			

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625318: *Operational Awareness Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
of ontology from free-text or heterogeneous data sources, and automated task suggestion in response to requests for intelligence information and assessments. ***FY 2013 Plans:*** Complete 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. Continue development of techniques for performing indications and warnings, pattern recognition, and information fusion for information exploitation. Complete development of techniques and algorithms to improve analysis of multi-sensor data for mining data across multi-INT repositories for behavioral patterns to identify terrorist networks and track movement and that process moving-target indication data from airborne sensors, and automatically classify airborne targets, including RPA. Continue in-house and university research dealing with level 1 - 4 fusion using multi-source intelligence and sensor feeds to advance the Air Force capability to anticipate the variety of threats from the ground, air, and cyber domains. Continue developing software to aid the analyst in determining the entity's behavior, including direction, speed, maneuvers, and operation of equipment. ***FY 2014 Plans:*** Continue development of techniques for performing indications and warnings, pattern recognition, and information fusion for information exploitation. Continue in-house and university research dealing with level 1-4 fusion using multi-source intelligence and sensor feeds to advance the Air Force capability to anticipate the variety of threats from the ground, air, and cyber domains. Continue developing software to aid the analyst in determining the entity's behavior, including direction, speed, maneuvers, and operation of equipment. Continue research into machine learning to improve Planning and Direction, Collection, Processing and Exploitation, Analysis and Production, and Dissemination (PCPAD). Develop text analysis capabilities enabling analysts to efficiently: extract/consolidate info from massive amounts of textual data; ID enemy entity-relation networks from that info, and develop/ maintain an understanding of the networks over time. Develop Activity-Based Intelligence capabilities capable of characterizing and locating activities and transactions.			
Title: Exploitation Technologies	8.249	9.574	6.176
Description: Develop digital information exploitation technologies for electronic communications and special signals intelligence, imagery, and measurement signatures to increase accuracy, correlation, and timeliness of the information. ***FY 2012 Accomplishments:*** Completed the development and evaluation of watermarking techniques, focusing on streaming media. Completed investigation of combined temporal, spatial, and frequency techniques to provide a multi-domain approach for information provenance, pedigree, and assurance. Developed, tested, and evaluated real-time, tactical information exploitation software using laboratory tools and operational data. Developed a wide variety of exploitation methods to enhance signals situational awareness. Conducted in-house and university research in advanced exploitation techniques that maximize the Air Force ability to gather, process, and			

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625318: *Operational Awareness Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
display information from multi-INT sources identifying threats to warfighters across the physical and cyber domains. Completed the development of optimizing exploitation across sensors to enhance multi-INT fusion. ***FY 2013 Plans:*** Complete the development, test, and evaluation of real-time, tactical information exploitation software using laboratory tools and operational data. Continue development of a wide variety of exploitation methods to enhance signals situational awareness. Continue in-house and university research in advanced exploitation techniques that maximize the Air Force's ability to gather, process, and display information from multi-INT sources identifying threats to warfighters across the physical and cyber domains. ***FY 2014 Plans:*** Continue development of a wide variety of exploitation methods to enhance signals situational awareness. Continue in-house and university research in advanced exploitation techniques that maximize the Air Force's ability to gather, process, fuse, and display information from multi-intelligence sources identifying threats to warfighters across the physical and cyber domains.			
Title: Next Generation Command Technologies ***Description:*** Develop modeling and simulation technologies for the next generation of planning, assessment, and execution environments. ***FY 2012 Accomplishments:*** Developed tools for the analyst to identify the optimum set of leverage points to meet commander's objectives. Identified the degree to which the adversary can achieve hypothesized COAs based on predicted goals. Developed an integrated set of possible combinations of adversary COAs and adversarial intentions based on the adversary's abilities and capabilities to perform activities associated with various domains. ***FY 2013 Plans:*** Complete development of tools for the analyst to identify the optimum set of leverage points to meet commander's objectives. Complete the identification of degree to which the adversary can achieve hypothesized COAs based on predicted goals. Complete development of an integrated set of possible combinations of adversary COAs and adversarial intentions based on the adversary's abilities and capabilities to perform activities associated with various domains. ***FY 2014 Plans:*** Initiate research into advanced analytical capabilities that integrate kinetic and non-kinetic options with world knowledge to determine the effects those options will have on the environment, adversary and the general populace. Increase targeting capabilities to include the full range of options available to increase the depth and breadth of the analysis and reduce the overall time to perform analyses and generate targeting options.	3.007	0.949	3.142
Accomplishments/Planned Programs Subtotals	25.457	20.711	20.604

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 625318: *Operational Awareness Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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 2014 Air Force			DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 62OMMS: *Research Site Support*	

COST ($ in Millions)	All Prior Years	FY 2012	FY 2013#	FY 2014 Base	FY 2014 OCO ##	FY 2014 Total	FY 2015	FY 2016	FY 2017	FY 2018	Cost To Complete	Total Cost
62OMMS: *Research Site Support*	-	0.000	0.000	18.449	-	18.449	18.748	19.127	19.575	19.896	Continuing	Continuing

FY 2013 Program is from the FY 2013 President's Budget, submitted February 2012

The FY 2014 OCO Request will be submitted at a later date

A. Mission Description and Budget Item Justification

The Air Force Research Laboratory Information Directorate leads the discovery, development and implementation of information science and technology to drive transformation within the Air Force and across the DoD. The focus of the work is to provide the warfighter with the required technology-based capabilities to defend the Nation by unleashing the power of innovative information science and technology to anticipate, find, fix, track, target, engage, and assess anything, anytime, anywhere. Since the site is a single-purpose location not located on a military installation, the Information Directorate has unique requirements for supporting its S&T mission. As the host unit, the directorate is responsible to provide the Rome Research Site infrastructure at Rome, NY and provide for the continued operations of all Rome Research Site properties, buildings, and services necessary for the research mission. Operations include: logistics and communication services, utilities, maintenance of facilities and structures, safety and security of the workforce and visiting researchers, and ensures compliance with the laws, regulations and directives that pertain to site operations. These services are host unit responsibilities and are necessary to provide a safe and effective environment for the Research Site's workforce and mission.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
Title: Rome Research Infrastructure	0.000	0.000	18.449
Description: Provide the necessary services and support including, but not limited to: fire inspections, refuse collection, water, electricity, steam, heat, custodial, and grounds maintenance services to the Research Site. Provide the necessary support for the maintenance and repair of Research Site facilities (buildings and other structures), vehicle and equipment lease and security/ safety inspections and services as necessary for compliance and safety/security of personnel and research assets. Provide the Research Site with long haul communications (NETWORX (CONUS)), trunk connectivity and wireless communications.			
FY 2012 Accomplishments: N/A			
FY 2013 Plans: N/A			
FY 2014 Plans: Provide civilian payroll and non-pay costs for installation operations in support of the Rome Research Site property and all on-site personnel. Provide facilities, facility operations, facility sustainment, support equipment, contracts and associated costs			

Exhibit R-2A, RDT&E Project Justification: PB 2014 Air Force		DATE: April 2013
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 2: *Applied Research*	R-1 ITEM NOMENCLATURE PE 0602788F: *Dominant Information Sciences and Methods*	PROJECT 62OMMS: *Research Site Support*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2012	FY 2013	FY 2014
to plan, manage and execute the following functions: fire prevention, disaster preparedness, plant operation and purchase of commodity, refuse collection, pavement clearance of snow and ice, grounds maintenance including landscaping, real property special inspections, pest control and custodial services. Provide Real Property Management & Engineering Services, including: (1) Facility Management and Administration and (2) Installation Engineering Services. Facility Management includes public works management costs, contract management, material procurement, facility data management, furnishings management costs, and real estate management. Installation Engineering Services includes annual inspection of facilities, master planning, overhead of planning and design, overhead of construction management, and non-Sustainment and Restoration Modernization (SRM) service calls. Provide basic installation communication services, including long haul trunk and telecommunications services. Provide site vehicle lease under GSA for logistics, security, and mission support.			
Accomplishments/Planned Programs Subtotals	0.000	0.000	18.449

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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.