Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force											Date: April 2022	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602788F / *Dominant Information Sciences and Methods*							
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
Total Program Element	-	205.839	221.110	166.041	0.000	166.041	170.096	173.414	177.096	180.937	Continuing	Continuing
625315: *C4I Dominance Technology*	-	118.165	145.030	82.282	0.000	82.282	84.330	85.803	87.624	89.537	Continuing	Continuing
625319: *Cyberspace Dominance Technology*	-	71.636	52.234	59.282	0.000	59.282	60.769	62.074	63.390	64.760	Continuing	Continuing
62OMMS: *Research Site Support*	-	16.038	23.846	24.477	0.000	24.477	24.997	25.537	26.082	26.640	Continuing	Continuing

A. Mission Description and Budget Item Justification

This program develops enterprise-centric information technology for the Department of 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 C4I Dominance Technology project provides the technologies for (a) secure, self-configuring, self-healing, seamless networks; (b) timely delivery of information to tactical assets; (c) scaling, robustness, and collaboration features required of the Department of the Air Force net-centric information management environment; and (d) real-time effective portrayal of complex data sets. This project also provides 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; and the advanced, novel exploitation technologies needed to intercept, collect, locate, and process both covert and overt raw data from intelligence and sensor sources. The Cyberspace Dominance Technology project provides 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 also provides technology that ensures Department of Air Force ability to (a) access, maintain presence on, and deliver effects to adversary systems; (b) detect, defend, and respond to attacks on friendly computer systems and provide forensic analysis concerning those attack attempts; (c) bring game-changing computing power to the warfighter and disruptive computing power at the tactical edge and for federated grid services; and (d) provide cyber situational awareness to Department of the Air Force Commanders. The Research Site Support project provides the Rome Research Site infrastructure at Rome, New York and provides for the continued operations of all Rome Research Site properties, buildings, and services necessary for the research mission. Efforts in this program have been coordinated through the Department of Defense (DoD) Science and Technology (S&T) Executive Committee process to harmonize efforts and eliminate duplication.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver science and technology capabilities. The use of program funds in this PE would be in addition to the civilian pay expenses budgeted in program elements 0601102F, 0602102F, 0602201F, 0602202F, 0602203F, 0602204F, 0602602F, 0602605F, 0602788F, 1206601SF, and 0602298F.

Funds in this program element may be used to investigate specified technology advancements in air, space and/or cyber domains.

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force	Date: April 2022
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*

This program is in Budget Activity 2, Applied Research because this budget activity includes studies, investigations, and non-system specific technology efforts directed toward general military needs with a view toward developing and evaluating the feasibility and practicality of proposed solutions and determining their parameters.

B. Program Change Summary ($ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	215.275	169.110	0.000	0.000	0.000
Current President's Budget	205.839	221.110	166.041	0.000	166.041
Total Adjustments	-9.436	52.000	166.041	0.000	166.041
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	52.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-0.012	0.000			
• SBIR/STTR Transfer	-2.289	0.000			
• Other Adjustments	-7.135	0.000	166.041	0.000	166.041

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Project: 625315: *C4I Dominance Technology*		
Congressional Add: *Program Increase- Quantum Cryptography*	6.925	0.000
Congressional Add: *Program Increase- Quantum Network Testbed*	9.393	0.000
Congressional Add: *Program Increase- Quantum Information Science Innovation Center*	9.893	0.000
Congressional Add: *Program Increase - Quantum Network Testbed*	0.000	10.000
Congressional Add: *Program Increase - Photonic Quantum Computing*	0.000	25.000
Congressional Add: *Program Increase - Quantum Internet Battlefield*	0.000	7.000
Congressional Add: *Program Increase - Ion Trap Quantum Computing*	0.000	10.000
Congressional Add Subtotals for Project: 625315	26.211	52.000
Project: 625319: *Cyberspace Dominance Technology*		
Congressional Add: *Program Increase- Trusted UAS Traffic Management and c-SUAS Testbed*	9.893	0.000
Congressional Add Subtotals for Project: 625319	9.893	0.000
Congressional Add Totals for all Projects	36.104	52.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force	Date: April 2022
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*

Change Summary Explanation

Decrease in FY 2021 reflects reprogramming to support Research and Development Projects, 10 U.S.C. Section 2363, an amendment to PL 110-417, 10 U.S.C. Section 2358 and 10 U.S.C. 2805(d)(1)(B)

The FY 2022 President's Budget submittal did not reflect FY 2023 through FY 2026 funding. Therefore, an explanation of the change between the two budget positions for FY 2023 cannot be made in a relevant manner.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force			Date: April 2022
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / *Dominant Information Sciences and Methods*	Project (Number/Name) 625315 / *C4I Dominance Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
625315: *C4I Dominance Technology*	-	118.165	145.030	82.282	0.000	82.282	84.330	85.803	87.624	89.537	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Department of the Air Force requires advanced technologies which support the Department of the Air Force five core missions and enable the Department of the Air Force to achieve Global Vigilance, Global Reach, and Global Power in support of national security objectives. The technologies developed under this project enable the National Defense Strategy and Department of the Air Force future operating concepts which require operational agility (the ability to rapidly generate—and shift among—multiple solutions for a given challenge), creating combinations of air, space, and cyberspace capabilities to achieve desired effects in the battlespace.

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 and dynamic policy-based network management capabilities; and modular, programmable, low-cost software radios. In addition, it develops both the technology base for ultra-wide bandwidth and multi-channeled communications networks (both air and space based) on and between platforms.

This project provides the technologies which enable 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 Department of the Air Force net-centric information management environment.

This project advances 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. This project provides technologies for anticipatory decision support; course of action development, planning, scheduling, and assessment; and the real-time effective portrayal of complex data sets.

This project improves and automates 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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Assured Communications & Networks	24.992	25.462	18.925
Description: Develop communications, networking, and signal processing technologies with improved survivability and capacity to provide secure, adaptive, covert, anti-jam, and assured global battlespace connectivity tailored to anti-access and area-denial			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625315 / *C4I Dominance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
environments and contested operations. Includes the research and development to advance existing nuclear capable forces to ensure command, control, and connectivity for the President without constraints. ***FY 2022 Plans:*** Continue the research and development of technologies for robust, adaptive, and mission aware airborne networks. Maintain the research and development of large-scale hardware-in-the-loop verification of developed directional networking protocols. Advance the research and development of propagation models. Initiate the development of a network stack suitable for high-bandwidth terahertz links. Launch the development, verification, and validation of advanced, airborne high-frequency antenna/ionospheric structure. Initiate the development, verification, and test of advanced waveforms. Establish the development, verification, and test of software-defined radio prototypes. Continue development of enhanced assurance and filtration offloading. Extend the development of advanced, airborne high-frequency antenna/ionospheric structures. Continue to develop, verify, and validate software-defined radio prototypes. ***FY 2023 Plans:*** Continue the research and development of technologies for robust, adaptive, and mission aware airborne networks. Continue the research and development of large-scale hardware-in-the-loop verification of developed directional networking protocols. Decrease the research and development of propagation models. Decrease the development of a network stack suitable for high-bandwidth terahertz links. Decrease the development, verification, and validation of advanced, airborne high-frequency antenna/ionospheric structure. Decrease the development of an airborne mesh networking capability that utilizes adaptive and responsive antennas for a dynamic and reliable high capacity mesh network suitable for communications in contested environments. Continue the development, verification, and test of advanced waveforms. Continue the development, verification, and test of software-defined radio prototypes. Continue development of enhanced assurance and filtration offloading. Continue to develop, verify, and validate software-defined radio prototypes. Develop capabilities that incorporated communications network connectivity into information extraction tools. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 decreased compared to FY 2022 by $6.537 million due to higher Department priorities.			
Title: Data to Decisions ***Description:*** Investigate and develop technologies for decision quality information dissemination services via publish, subscribe, and query across the Global Information Grid to enterprise and tactical assets and coalition partners. ***FY 2022 Plans:*** Continue the research and development of data analytics and strategic indications and warnings technologies (including large data alignment, indexing and search on textual data, large-scale and disparate data sources, both structured and unstructured	14.210	15.199	14.186

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625315 / *C4I Dominance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
data, and employment of various ontologies and machine learning techniques). Maintain the development of a user customizable entity, event, and relation text extraction capability with automatic performance estimates of the user-customized extractors on new documents and mission areas. Initiate research and development of a Request for Information (RFI) dialog system that can help answer Requests for Information (RFI) for single service applications across 10 essential Intelligence enterprise identified RFIs. Develop a Multi-Int Intelligence, Surveillance, and Reconnaissance ontology connecting Air Force analytics, Application Programming Interfaces, and services. Research and develop an initial integrated threat detection system based on vetted events from PAI fused and corroborated with ISR sources. Continue the research and development of autonomous, heterogeneous, distributed multi-sensor management and upstream data fusion for improved target detection, tracking and classification. Sustain the development of counter Small Unmanned Air systems (C-SUAS) detection and identification, via acoustics, and algorithm work.			
FY 2023 Plans: Continue the research and development of data analytics and strategic indications and warnings technologies (including large data alignment, indexing and search on textual data, large-scale and disparate data sources, both structured and unstructured data, and employment of various ontologies and machine learning techniques). Decrease the development of Conversational Artificial Intelligence (CAI) capabilities to deliver conversational agents capable of answering complex analytical questions. Decrease the development of a user customizable entity, event, and relation text extraction capability with automatic performance estimates of the user-customized extractors on new documents and mission areas. Decrease research and development of a Request for Information (RFI) dialog system that can help answer Requests for Information (RFI) for single service applications across 10 essential Intelligence enterprise identified RFIs. Continue the development of a Multi-Int Intelligence, Surveillance, and Reconnaissance ontology connecting Air Force analytics, Application Programming Interfaces, and services. Continue research and development of an integrated threat detection system based on vetted events from PAI fused and corroborated with ISR sources. Continue the research and development of autonomous, heterogeneous, distributed multi-sensor management and upstream data fusion for improved target detection, tracking and classification. Decrease the development of counter Small Unmanned Air systems (C-SUAS) detection and identification, via acoustics, and algorithm work. Initiate the development of new methods that exploit traditional and non-traditional data to categorize and predict engagement scenarios of coordinated, non-cooperative targets, and that assess the threats based on situation-driven adversary capabilities. Continue to develop capabilities to automate emitter corridor extraction and mode tagging to deploy capabilities onboard the collection platform. Initiate research to add new data sources to identify signatures corresponding to different categories of multi-satellite actions. Research methods that allow for change detection and pattern recognition. Initiate research to seek correlations between non-traditional data source signatures and multi-satellite actions.			
FY 2022 to FY 2023 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625315 / *C4I Dominance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
FY 2023 decreased compared to FY 2022 by $1.013 million due to higher Department priorities.			
Title: Processing Technologies ***Description:*** Develop automatic and dynamically reconfigurable, scalable, affordable distributed peta-flop processing technologies for real-time global information systems. Starting in FY 2021, the remaining non-cyber work that was performed under Project 625319, Cyberspace Dominance Technology, in the Processing Technologies effort within this PE will now be performed within this effort. ***FY 2022 Plans:*** Advance the application of novel neuromorphic systems for robust machine learning. Continue to advance research and development of the neuromorphic processor and validate capabilities for dynamic learning on mobile and power-constrained platforms. Initiate the development of a prototype integrated with existing embedded high performance computing systems. Commence the development and delivery of a Neuromorphic High-Performance-Computing (Brain-in-the-Box). ***FY 2023 Plans:*** Continue to advance the application of novel neuromorphic systems for robust machine learning. Continue to advance research and development of the neuromorphic processor and validate capabilities for dynamic learning on mobile and power-constrained platforms. Decrease the development of a prototype integrated with existing embedded high performance computing systems. Continue the development and delivery of a Neuromorphic High-Performance-Computing (Brain-in-the-Box). ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 decreased compared to FY 2022 by $0.202 million. Justification for the decrease is described in the plans above.	6.481	7.463	7.261
Title: Multi-Domain Command & Control (MDC2) ***Description:*** Develop advanced monitoring, planning, and assessment technologies enabling aerospace commanders to develop effects-based campaigns. Investigate, analyze, and develop technologies for planning, execution, and automatic rapid reconfiguration of distributed intelligent and integrated command and control information systems to achieve the commander's intent throughout varying crisis levels. ***FY 2022 Plans:*** Continue research for applying machine learning techniques to enhance and optimize space operations. Advance research and development to refine the mathematical framework and provide a method for evaluating and presenting multi-domain courses of action to maximize operational effects for decisive advantage. Maintain the development of tools, technology, and a framework	18.782	19.731	17.892

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625315 / *C4I Dominance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
for execution management of operational center process workflows and applications. Sustain the research and development of a novel composable planning paradigm to overcome the serial and time-intensive nature of existing planning techniques. ***FY 2023 Plans:*** Decrease research for applying machine learning techniques to enhance and optimize multi domain operations (including space). Increase research and development to refine the mathematical framework and provide a method for evaluating and presenting multi-domain courses of action to maximize operational effects for decisive advantage. Decrease the development of tools, technology, and a framework for execution management of operational center process workflows and applications. Sustain the research and development of a novel composable planning paradigm to overcome the serial and time-intensive nature of existing planning techniques. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 decreased compared to FY 2022 by $1.839 million due to higher Department priorities.			
Title: Artificial Intelligence/Autonomy/Machine Learning ***Description:*** Perform research and development (R&D) to harness the speed and scale of computers and machines to address problems of complexity. ***FY 2022 Plans:*** Advance the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments. Maintain the research to understand operational needs of machine learning algorithms and systems with the multi-domain command and control connect. Continue to research the application of Interactive Learning techniques to the auto-planning problem and develop an IL based planning capability to augment existing auto-planning tools. Sustain the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments. ***FY 2023 Plans:*** Advance the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments. Maintain the research to understand operational needs of machine learning algorithms and systems with the multi-domain command and control connect. Decrease research into the application of Interactive Learning techniques to the auto-planning problem and development of an IL based planning capability to augment existing auto-planning tools. Decrease the research and development of machine learning approaches for supporting and performing operations in complex adversarial environments. ***FY 2022 to FY 2023 Increase/Decrease Statement:***	15.700	16.699	15.580

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625315 / *C4I Dominance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
FY 2023 decreased compared to FY 2022 by $1.119 million due to higher Department priorities.			
Title: Nuclear C3 Modernization ***Description:*** Perform research and development (R&D) to advance existing nuclear capable forces to ensure command, control, and connectivity for the President without constraints. ***FY 2022 Plans:*** Starting in FY 2022, this work will be performed in PE 0602788F, Dominant Information Sciences and Methods, Project 625315, C4I Dominance Technology, Assured Communications & Networks effort. ***FY 2023 Plans:*** Starting in FY 2022, this work will be performed in PE 0602788F, Dominant Information Sciences and Methods, Project 625315, C4I Dominance Technology, Assured Communications & Networks effort.	4.099	0.000	0.000
Title: Quantum Information Science ***Description:*** Perform research and development (R&D) that will utilize quantum physics for the storage, transmission, manipulation, computing, or measurement of information in ways that offer advantages to classical capabilities. ***FY 2022 Plans:*** Continue research and development in the area of supreme and quantum computing information sciences. Maintain development of further reducing SWaP of network node demonstrations. Initiate demonstration of quantum information processing on a single chip by using developed quantum photonics processor with photon sources. ***FY 2023 Plans:*** Continue research and development in the area of supreme and quantum computing information sciences. Advance development of further reducing SWaP of network node demonstrations. Continue demonstration of quantum information processing on a single chip by using developed quantum photonics processor with photon sources. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 decreased compared to FY 2022 by $0.038 million. Justification for the decrease is described in the plans above.	7.690	8.476	8.438
Title: Future AF Capabilities Applied Research ***Description:*** Investigate, design, and develop science and technologies supporting future Department of the Air Force capabilities to provide compelling advantage to the warfighter. To the greatest extent practical, research efforts will utilize modeling and simulation and cross-discipline systems integration (For example: air and space vehicles, avionics, propulsion, materials, human	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
performance, cybersecurity, command, control, communications, computer and intelligence, sensors, electronic warfare, and conventional/unconventional weapons). The National Defense Strategy and the Department of the Air Force Science and Technology 2030 Strategy will inform investments over the FYDP. ***FY 2022 Plans:*** Not applicable. ***FY 2023 Plans:*** Not applicable			
Accomplishments/Planned Programs Subtotals	91.954	93.030	82.282

	FY 2021	FY 2022
Congressional Add: Program Increase- Quantum Cryptography ***FY 2021 Accomplishments:*** Conduct congressionally directed efforts. ***FY 2022 Plans:*** Not applicable.	6.925	0.000
Congressional Add: Program Increase- Quantum Network Testbed ***FY 2021 Accomplishments:*** Conduct congressionally directed efforts. ***FY 2022 Plans:*** Not applicable.	9.393	0.000
Congressional Add: Program Increase- Quantum Information Science Innovation Center ***FY 2021 Accomplishments:*** Conduct congressionally directed efforts. ***FY 2022 Plans:*** Not applicable.	9.893	0.000
Congressional Add: Program Increase - Quantum Network Testbed ***FY 2021 Accomplishments:*** Not applicable. ***FY 2022 Plans:*** Conduct congressionally directed efforts.	0.000	10.000
Congressional Add: Program Increase - Photonic Quantum Computing	0.000	25.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625315 / *C4I Dominance Technology*

	FY 2021	FY 2022
FY 2021 Accomplishments: Not applicable. ***FY 2022 Plans:*** Conduct congressionally directed efforts.		
Congressional Add: Program Increase - Quantum Internet Battlefield ***FY 2021 Accomplishments:*** Not applicable. ***FY 2022 Plans:*** Conduct congressionally directed efforts.	0.000	7.000
Congressional Add: Program Increase - Ion Trap Quantum Computing ***FY 2021 Accomplishments:*** Not applicable. ***FY 2022 Plans:*** Conduct congressionally directed efforts.	0.000	10.000
Congressional Adds Subtotals	26.211	52.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force			Date: April 2022
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / *Dominant Information Sciences and Methods*	Project (Number/Name) 625319 / *Cyberspace Dominance Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
625319: *Cyberspace Dominance Technology*	-	71.636	52.234	59.282	0.000	59.282	60.769	62.074	63.390	64.760	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Department of 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. The Department of the Air Force requires the development of superior, intelligent, on-demand computing to enable information superiority to include advances in secure information sharing across domains and boundaries as well as technologies that successfully deter any adversary from attacking computer systems anytime, anywhere by ensuring the Department of 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 and provide forensic analysis concerning those attack attempts; and provide cyber situational awareness to Department of the Air Force Commanders. In addition, the Department of the Air Force requires technology development that produces computing 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 Department of the Air Force. It includes technologies in computational sciences and engineering, computer architectures and software intensive systems.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Cyber Defense Technologies	20.358	32.225	29.279
Description: Develop cyber defense and supporting technologies to detect, defend, and respond to attacks on computer systems as well as provide forensic concerning attacks. ***FY 2022 Plans:*** Continue research in the area of autonomous integrated cyber operations. Advance applied research in the area of biologically resilient cyber technologies. Extend research into mission-specific block-chain capabilities, and the alignment of cyber resilient services and dynamic management tailored towards unmanned aerial systems. Maintain the development of radical architectural and infrastructural changes from computational diversity, to deliver a quantifiable improvement to cybersecurity. Continue to sustain research and validation of a cyber-hardened (robust, secure) processor for embedded weapon systems. Continue to maintain applied research to create trusted and resilient embedded systems that are capable of identifying, localizing, and automatically repairing previously unknown and/or unintended vulnerabilities. Sustain development of software using evolutionary approaches to make embedded systems tolerant to unexpected and unforeseen situations. Continue to investigate research concepts and capabilities for cyber survivability techniques and algorithms for counter-unmanned aerial systems. Extend development of a counter-unmanned aerial systems open architecture to enable interoperability. Maintain evolution of autonomous machine learning functions. Continue the validation and demonstration of automated workflows into defensive cyber operations systems. Sustain development of a model-assisted concolic firmware exploration and threat models based on device			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625319 / *Cyberspace Dominance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
behavior. Conduct large scale device analysis and demonstration on AF-relevant system. Create a capability to model, intercept, and synchronize the state of all embedded devices connected on a single bus. ***FY 2023 Plans:*** Continue research in the area of autonomous integrated cyber operations. Decrease applied research in the area of biologically resilient cyber technologies. Continue research into mission-specific block-chain capabilities, and the alignment of cyber resilient services and dynamic management tailored towards unmanned aerial systems. Maintain the development of radical architectural and infrastructural changes from computational diversity, to deliver a quantifiable improvement to cybersecurity. Decrease research and validation of a cyber-hardened (robust, secure) processor for embedded weapon systems. Decrease applied research to create trusted and resilient embedded systems that are capable of identifying, localizing, and automatically repairing previously unknown and/or unintended vulnerabilities. Sustain development of software using evolutionary approaches to make embedded systems tolerant to unexpected and unforeseen situations. Decrease research effort to discover concepts and capabilities for cyber survivability techniques and algorithms for counter-unmanned aerial systems. Decrease development of a counter-unmanned aerial systems open architecture to enable interoperability. Maintain evolution of autonomous machine learning functions. Decrease the validation and demonstration of automated workflows into defensive cyber operations systems. Sustain development of a model-assisted concolic firmware exploration and threat models based on device behavior. Conduct large scale device analysis and demonstration on AF-relevant system. Create a capability to model, intercept, and synchronize the state of all embedded devices connected on a single bus. Develop a physics-based and topologically-based model of an intra-connected and inter-connected electric power grid and communications network. Research and develop the design, implementation, and evaluation of a proof-of-concept prototype to enable secure and efficient outsourcing of relational queries and Machine Learning training. Research the inference to untrusted clouds with cost-based optimization options, under Multiparty Computation (MPC) protocols with different threat models, guarantees, and physical deployments (i.e., Local Area Network, Wide Area Networks, Blockchain, or mixed) settings. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 decreased compared to FY 2022 by $2.946 million due to higher Department priorities.			
Title: Cyber Offense Technologies	19.012	20.009	30.003
Description: Develop offensive cyber operations technologies to access, maintain presence on, and deliver effects to adversary systems. ***FY 2022 Plans:*** Sustain research and development of new, leading-edge technologies that are game changing and employ dominant power for cyber offensive operations. Continue to increase research and development in capabilities for multi-function, non-kinetic cyber effects against adversarial systems. Continue to demonstrate ground-based and airborne delivery of disrupt, deny, degrade,			

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 625319 / *Cyberspace Dominance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
destroy, or deceive effects that are both cyber and physical/kinetic. Maintain the advancement of research in systems to perform blind data discovery associated with the Internet of Things. Advance the identification of items of interest associated with the Internet of Things. Extend research for specific items of interest within the Internet of Things. Complete the Mission tool framework and automated vulnerability discovery framework. ***FY 2023 Plans:*** Increase research and development of new, leading-edge technologies that are game changing and employ dominant power for cyber offensive operations and information warfare to change the future fight. Increase research and development in capabilities for multi-function, non-kinetic cyber effects against adversarial systems. Continue to demonstrate ground-based and airborne delivery of disrupt, deny, degrade, destroy, or deceive effects that are both cyber and physical/kinetic. Increase the advancement of research in systems to perform blind data discovery associated with the Internet of Things. Increase research and development for the identification of items of interest associated with the Internet of Things. Increase research for specific items of interest within the Internet of Things. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 increased compared to FY 2022 by $9.994 million due to implementation of AF S&T 2030 for Speed and Reach of Disruption & Lethality for cyber offensive and information warfare kinetic cyber effects against adversarial systems, performing blind data discovery associated with the Internet of Things (IoT), identification of items of interest associated with the IoT, and increase in research for specific items of interest within the IoT.			
Title: Advanced Architectural Technologies ***Description:*** Develop the architectural mechanisms that form the basis for predictable software and high assurance systems. ***FY 2022 Plans:*** Starting in FY 2022, this work will be performed within this PE, under Project 625319, Cyberspace Dominance Technology, in the Cyber Defense Technologies effort. ***FY 2023 Plans:*** Not applicable	8.624	0.000	0.000
Title: Processing Technologies ***Description:*** Develop automatic and dynamically reconfigurable, scalable, affordable distributed peta-flop processing technologies for real-time global information systems. ***FY 2022 Plans:***	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force		Date: April 2022
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Not applicable ***FY 2023 Plans:*** Not applicable			
Title: Survivability Technologies ***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 2022 Plans:*** Starting in FY 2022, this work will be performed within this PE, under Project 625319, Cyberspace Dominance Technology, in the Cyber Defense Technologies effort. ***FY 2023 Plans:*** Not applicable	3.989	0.000	0.000
Title: Cross-Domain Technologies ***Description:*** Develop secure cross-domain discovery services for access to services outside the existing domain. Develop the tools to allow collaboration of workflows required by the Air Force net-centric information management system. ***FY 2022 Plans:*** Much of the technology covered under this effort has matured to the level of advanced technology. Starting in FY 2022, the remaining work will be performed within this PE, under Project 625315, C4I Dominance Technologies, in the Assured Communications & Networks effort. ***FY 2023 Plans:*** Not applicable	6.012	0.000	0.000
Title: Cyber Technologies for Spectrum Warfare ***Description:*** Develop technologies combining electronic warfare, signals intelligence, communications, and cyber technologies that provide synergistic access, exploitation and effects across air and cyber domains in congested and contested environments. ***FY 2022 Plans:*** Starting in FY 2022, this work will be performed within this PE, under Project 625319, Cyberspace Dominance Technology, in the Cyber Offense Technologies effort. ***FY 2023 Plans:***	3.748	0.000	0.000

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Not applicable			
Accomplishments/Planned Programs Subtotals	61.743	52.234	59.282

	FY 2021	FY 2022
Congressional Add: Program Increase- Trusted UAS Traffic Management and c-SUAS Testbed ***FY 2021 Accomplishments:*** Conduct congressionally directed efforts. ***FY 2022 Plans:*** Not applicable.	9.893	0.000
Congressional Adds Subtotals	9.893	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2023 Air Force			Date: April 2022
Appropriation/Budget Activity 3600 / 2	R-1 Program Element (Number/Name) PE 0602788F / *Dominant Information Sciences and Methods*	Project (Number/Name) 62OMMS / *Research Site Support*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
62OMMS: *Research Site Support*	-	16.038	23.846	24.477	0.000	24.477	24.997	25.537	26.082	26.640	Continuing	Continuing

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 Department of the Air Force and across the Department of Defense. 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 which is not located on a military installation, the Information Directorate has unique requirements for supporting its science and technology mission. As the host unit, the directorate is responsible to provide the Rome Research Site infrastructure at Rome, New York 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 2021	FY 2022	FY 2023
Title: Rome Research Infrastructure	16.038	23.846	24.477
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 (using the Government Services Administration set of Networx contracts for Continental United States), trunk connectivity and wireless communications.			
FY 2022 Plans: Continue to provide civilian payroll and non-pay costs for installation operations in support of the Rome Research Site property and all onsite personnel. Continue to provide facilities, facility operations, facility sustainment, support equipment, contracts, and associated costs 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. Continue to provide Real Property Management and 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 Site Recovery			

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Appropriation/Budget Activity 3600 / 2	**R-1 Program Element (Number/Name)** PE 0602788F / *Dominant Information Sciences and Methods*	**Project (Number/Name)** 62OMMS / *Research Site Support*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Management service calls. Continue to provide basic installation communication services, including long haul trunk and telecommunications services. Continue to provide site vehicle lease for logistics, security, and mission support under the Government Services Administration. ***FY 2023 Plans:*** Continue to provide civilian payroll and non-pay costs for installation operations in support of the Rome Research Site property and all onsite personnel. Continue to provide facilities, facility operations, facility sustainment, support equipment, contracts, and associated costs 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. Continue to provide Real Property Management and 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 Site Recovery Management service calls. Continue to provide basic installation communication services, including long haul trunk and telecommunications services. Continue to provide site vehicle lease for logistics, security, and mission support under the Government Services Administration. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 increased compared to FY 2022 by $0.631 million. Justification for the increase is described in the plans above.			
Accomplishments/Planned Programs Subtotals	16.038	23.846	24.477

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Not applicable