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**Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force** **Date:** March 2023

<b>Appropriation/Budget Activity</b> 3620F: <i>Research, Development, Test &amp; Evaluation, Space Force I BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	280.023	360.286	206.196	0.000	206.196	157.742	159.394	160.521	164.238	Continuing	Continuing
621010: <i>Space Survivability &amp; Surveillance</i>	-	24.869	59.612	41.591	0.000	41.591	35.263	30.771	31.843	32.962	Continuing	Continuing
624846: <i>Spacecraft Payload Technologies</i>	-	16.012	61.582	71.286	0.000	71.286	20.138	20.834	21.256	22.080	Continuing	Continuing
624847: <i>Rocket Propulsion Technology</i>	-	21.180	16.966	14.483	0.000	14.483	15.654	16.001	16.329	16.917	Continuing	Continuing
624866: <i>Lasers &amp; Imaging Technology</i>	-	25.048	22.742	19.985	0.000	19.985	20.020	20.481	21.085	21.795	Continuing	Continuing
625018: <i>Spacecraft Protection Technology</i>	-	49.015	36.026	32.345	0.000	32.345	40.411	45.136	43.152	42.881	Continuing	Continuing
628809: <i>Spacecraft Vehicle Technologies</i>	-	143.899	163.358	26.506	0.000	26.506	26.256	26.171	26.856	27.603	Continuing	Continuing

**A. Mission Description and Budget Item Justification**

This program focuses on six major areas. First, the space survivability and surveillance area develops technologies to understand space weather and the geophysics environment for mitigation and exploitation of these effects to Department of Air Force systems. Second, the spacecraft payload technologies area improves satellite payload operations by developing advanced materials/components, networking, analysis tools, and subsystem capabilities. Third, the rocket propulsion technology area develops rocket propulsion technologies for space access, space maneuver, and the sustainment of strategic systems. Fourth, the lasers & imaging technology area conducts research supporting ground-based optical space situational awareness and ground-to-space laser-enabled communication. Fifth, the spacecraft protection area develops technologies for protecting United States space assets in potential hostile settings. The last major area, spacecraft vehicles, focuses on spacecraft platform and control technologies, operator effectiveness, and their interactions. Efforts in this program have been coordinated through the Department of Defense Science and Technology Executive Committee process to harmonize efforts and eliminate duplication.

This Program Element (PE) may include necessary civilian pay expenses required to manage, execute, and deliver science & technology capabilities. The use of such program funds would be in addition to civilian pay expenses budgeted in PE 1206616SF/Space Advanced Technology Development/Demo.

This program element may include necessary expenses to support the operation and maintenance of facilities to manage, execute, and deliver science and technology capabilities.

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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>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024 Base</b>	<b>FY 2024 OCO</b>	<b>FY 2024 Total</b>
Previous President's Budget	286.505	243.737	257.886	0.000	257.886
Current President's Budget	280.023	360.286	206.196	0.000	206.196
Total Adjustments	-6.482	116.549	-51.690	0.000	-51.690
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-32.706			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	140.900			
• Congressional Directed Transfers	0.000	8.355			
• Reprogrammings	4.866	0.000			
• SBIR/STTR Transfer	-4.316	0.000			
• Other Adjustments	-7.032	0.000	-51.690	0.000	-51.690

**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

**Project: 624847: Rocket Propulsion Technology**

Congressional Add: *Congressional Add: Program increase - non-toxic fuels*

Congressional Add: *Propulsion Technology*

Congressional Add: *Congressional Add: Program increase - adaptive medium-lift engine architecture*

Congressional Add Subtotals for Project: 624847

**Project: 625018: Spacecraft Protection Technology**

Congressional Add: *Congressional Add: Program increase - autonomy in space*

Congressional Add: *Congressional Add: Program increase - ground-based interferometry*

Congressional Add: *Congressional Add: Program increase - open architecture payloads*

Congressional Add: *Congressional Add: Program increase - architecture for space domain awareness beyond GEO*

Congressional Add: *Congressional Add: Program Increase - digital engineering and modeling for space domain awareness*

Congressional Add: *Congressional Add: Program Increase - lunar surface space domain awareness*

Congressional Add: *Congressional Add: Program Increase - SOSA-based spacecraft protection technology*

	<b>FY 2022</b>	<b>FY 2023</b>
	2.954	-
	-	5.000
	4.924	-
	7.878	5.000
	9.849	-
	5.909	2.000
	9.849	-
	15.168	-
	-	9.500
	-	4.000
	-	10.000

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<b>Exhibit R-2, RDT&amp;E Budget Item Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F: <i>Research, Development, Test &amp; Evaluation, Space Force I BA 2: Applied Research</i>	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>
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<b>Congressional Add Details (\$ in Millions, and Includes General Reductions)</b>	<b>FY 2022</b>	<b>FY 2023</b>
Congressional Add Subtotals for Project: 625018	40.775	25.500
<b>Project: 628809: <i>Spacecraft Vehicle Technologies</i></b>		
Congressional Add: <i>Congressional Add: Program increase - radiation hardened microprocessor</i>	8.766	-
Congressional Add: <i>Congressional Add: Program increase - lithium sulfur battery development</i>	3.939	-
Congressional Add: <i>Congressional Add: Program increase - thin-film photovoltaic energy</i>	2.954	3.000
Congressional Add: <i>Congressional Add: Program increase - multi-mission distributed antenna technology</i>	9.849	-
Congressional Add: <i>Congressional Add: Program increase - hybrid space architecture</i>	4.924	5.000
Congressional Add: <i>Congressional Add: Program increase - ultra-lightweight space solar arrays</i>	4.924	-
Congressional Add: <i>Congressional Add: Program increase - university consortia for space technology</i>	9.849	20.000
Congressional Add: <i>Congressional Add: Program increase - advanced multi-physics thermal management</i>	4.924	-
Congressional Add: <i>Congressional Add: Program increase - fundamental research</i>	14.774	-
Congressional Add: <i>Congressional Add: Program increase - space solar power inc demonstration</i>	2.856	-
Congressional Add: <i>Congressional Add: Program increase - aerospace films for increased operational range of reconnaissance</i>	-	6.000
Congressional Add: <i>Congressional Add: Program increase - 3D graphene lithium-sulfur batteries</i>	-	5.000
Congressional Add: <i>Congressional Add: Program increase - L-Band active phased array demonstration</i>	-	3.000
Congressional Add: <i>Congressional Add: Program increase - next generation multiband space array antenna</i>	-	10.000
Congressional Add: <i>Congressional Add: Program increase - advanced analog microelectronics</i>	-	3.000
Congressional Add: <i>Congressional Add: Program increase - spectrum superiority lab</i>	-	5.000
Congressional Add: <i>Congressional Add: Program increase - advanced space power systems</i>	-	9.400
Congressional Add: <i>Congressional Add: Program increase - cybersecurity for a hybrid space architecture</i>	-	15.000
Congressional Add: <i>Congressional Add: Program increase - flexible solar panels</i>	-	5.000
Congressional Add: <i>Congressional Add: Program increase - high efficiency lightweight RF amplifiers for LEO constellation</i>	-	5.000
Congressional Add: <i>Congressional Add: Program increase - moving target engagement solutions</i>	-	6.000
Congressional Add: <i>Congressional Add: Program increase - operational upper stage augmentation kit</i>	-	10.000
Congressional Add Subtotals for Project: 628809	67.759	110.400

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**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

	<b>FY 2022</b>	<b>FY 2023</b>
Congressional Add Totals for all Projects	116.412	140.900

**Change Summary Explanation**

FY24 PB to PB change of -51.690 result of:  
 257.886M - Baseline  
 +21.198M - Realignment  
 -72.888M - Database Error, realignment to BA06 1206601SF  
 206.196M - Final

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**Exhibit R-2A, RDT&E Project Justification:** PB 2024 Air Force **Date:** March 2023

Appropriation/Budget Activity 3620F / 2					R-1 Program Element (Number/Name) PE 1206601SF / <i>Space Technology</i>				Project (Number/Name) 621010 / <i>Space Survivability &amp; Surveillance</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
621010: <i>Space Survivability &amp; Surveillance</i>	-	24.869	59.612	41.591	0.000	41.591	35.263	30.771	31.843	32.962	Continuing	Continuing

**Note**

Decrease from FY 2023 to FY 2024 reflects realignment and consolidation of thrusts to other Budget Projects to better align with the Department of the Air Force (DAF) Operational Imperatives (OI) and the USSF Space System Command (SSC) Program Executive Office's (PEO) mission areas. Civilian Pay in this project was assigned an incorrect project code that aligned it in Budget Activity (BA) 06 (RDT&E Management Support), Project C6601Z. Funds will be transferred back to PE 1206616SF BA 02 in a follow-up technical adjustment request.

**A. Mission Description and Budget Item Justification**

This project develops technologies to understand and control the space environment for warfighter's future capabilities. The focus is on characterizing and forecasting the battlespace environment for more realistic space system design, modeling, and simulation, as well as the battlespace environment's effect on space systems' performance. This includes technologies to specify and forecast the space environment for planning operations, ensure uninterrupted system performance, optimize space-based surveillance operations, and provide capability to mitigate or exploit the space environment for both offensive and defensive operations.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	FY 2022	FY 2023	FY 2024
<p><b>Title:</b> Space Environment Research</p> <p><b>Description:</b> Develop techniques, forecasting tools, sensors, and technologies for specifying, monitoring, predicting, and controlling space environmental conditions hazardous to Department of Defense (DoD) operational space and radar systems.</p> <p><b>FY 2023 Plans:</b> Continue advancement of regional space environment specification and modeling to enable tactical applications. Complete development of next generation ionospheric observing systems. Continue development of controlled-radio frequency propagation effects across relevant frequency ranges for operations. Continue improvements in efficiency of plasma generation systems to enable practical applications. Complete plasma cloud formation models and evolution for engineered solutions. Complete next generation system for specifying and predicting space environment impacts on radio frequency services at relevant frequencies. Continue developing and enhancing space environment modelling capabilities to better enable accurate specification and forecasting of the state of the space environment, and the resulting impacts to DoD and national systems. Initiate advanced research into beyond-geosynchronous space environment impacts to national systems. Continue applied research of space environment interactions and effects for space situational awareness. Initiate transition of basic research in solar and space environment physics to applied research efforts.</p> <p><b>FY 2024 Plans:</b></p>	7.228	17.418	15.591

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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 621010 / <i>Space Survivability &amp; Surveillance</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>Increase support for North American Aerospace Defense Command (NORAD) Homeland Defense Modernization and Department of the Air Force (DAF) Arctic strategy. Develop and investigate representative and median regional space environment specifications intended for operational system simulation experiments. Extend and improve software radio techniques to monitoring and specifying space environment impacts. Utilize Artificial Intelligence (AI)/Machine Learning (ML) techniques. Improve efficiency of plasma generation systems. Support space experiments and demonstrations. Develop and enhance space environment modelling capabilities to better enable accurate specification and forecasting of the state of the space environment and the resulting impacts to Department of Defense and national systems. Extend advanced research into beyond-geosynchronous space environment impacts to national systems. Continue applied research of space environment interactions and effects for space situational awareness. Evaluate basic research in solar and space environment physics for transition to applied research efforts. Initiate exploratory work on space protection and exploitation technologies.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 1.827M due to a database error which realigned the civilian pay in this thrust to a BA 06 project. Funds will be transferred back in a follow-up technical adjustment request.</p>			
<p><b>Title:</b> Surveillance Technologies</p> <p><b>Description:</b> Develop advanced target detection techniques, spectral signature libraries, and decision aids for space-based sensors and surveillance systems.</p> <p><b>FY 2023 Plans:</b> Continue development of novel sensing technologies, including innovative data analytics and sensor concepts, to track targets that pose new challenges for missile warning systems and an expanded range of tactical threat warning systems. Continue development of automated data analytics for data processing on-board satellites, and cloud platforms, to meet tactical mission timelines. Continue study of tactical surveillance technologies for target detection by autonomous sensing grids operating across multiple-domains to meet the information timeliness, track custody and data access requirements necessary to detect, track and target emerging hypersonic missile threats.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust will be realigned to PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies, and consolidated under one thrust titled Missile Warning and Tactical Sensing to better align projects under mission areas focused on the DAF OIs and in line with the USSF SSC PEOs.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 10.053M due to realignment to a different Project. In FY 2024 this thrust will be realigned to PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies, and consolidated under one thrust titled Missile Warning and Tactical Sensing to better align projects under mission areas focused on the DAF OIs and in</p>	5.438	10.053	0.000

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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 621010 / <i>Space Survivability &amp; Surveillance</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
line with the USSF SSC PEOs. Therefore, an explanation of the change between Fiscal Years (FY) cannot be made in a relevant manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.				
<p><b>Title:</b> Alternative Navigation Technologies</p> <p><b>Description:</b> Develop new technologies based on cold atom physics and photonics that provide autonomous jam-proof precision inertial navigation to augment Global Positioning System (GPS) in case of GPS-denial. Develop atomic clocks and methods to disseminate time based on new technologies to replace legacy GPS atomic clocks and networks.</p> <p><b>FY 2023 Plans:</b> Continue testing of cold atom 3-axis accelerometers for improved Internal Navigation Systems in Global Position System-denied environments. Continue development of advanced photonic systems for high performance time transfer. Continue development of advanced components for quantum systems such as very low noise amplifiers, power efficient narrow-bandwidth lasers, and optical frequency comb technology. Continue development of quantum timing systems for advanced communication applications. Initiate preparation for second demonstration of 3-axis accelerometer outside of laboratory environment.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust will be realigned to PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies and consolidated under one thrust titled Space Communication/Positioning, Navigation, &amp; Timing (PNT) Technologies to better align projects focused on the DAF OIs and in line with the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 14.541M due to realignment to a different Project. In FY 2024 this thrust will be realigned to PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies and consolidated under one thrust titled Space Communication/Positioning, Navigation, &amp; Timing (PNT) Technologies to better align projects focused on the DAF OIs and in line with the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.</p>		12.203	14.541	0.000
<p><b>Title:</b> Strategic Radiation Hardened Electronics</p> <p><b>Description:</b> Design, develop, produce and qualify strategic radiation hardened (SRH) non-volatile memory (NVM) that does not exist today and is suitable to support DoD strategic missile, missile defense, and space system needs and to address a more diverse &amp; advanced nuclear threat.</p> <p><b>FY 2023 Plans:</b> Initiate identification of electrical and radiation performance requirements and specification development for strategic radiation hardened non-volatile memory. Initiate design, fabrication, test and evaluation of test articles to support technical development.</p>		0.000	17.600	26.000

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>Initiate space qualification of the strategic radiation hardened non-volatile memory family and supporting design support kit. Initiate efforts to ensure durability of a domestic source of readout integrated circuits and focal plane array technologies. Initiate efforts to enable maturation of large format high-dynamic range focal plane arrays.</p> <p><b><i>FY 2024 Plans:</i></b> Finalize concept design for SRH NVM to address the electrical and radiation performance requirements identified in FY 2023. Continue plan for fabrication, test and evaluation of test articles to mitigate emerging radiation effects in electronics. Initiate the technical development of the sub-scale test chip and continue efforts to develop a space qualification strategy. Continue efforts to ensure durability of a domestic source of readout integrated circuits (ROIC) and focal plane array (FPA) technologies. Continue efforts to enable maturation of large format high-dynamic range FPAs. Initiate feasibility assessment to port radiation hardened ROIC technology from current State-of-the-Art to a more advanced processing node.</p> <p><b><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i></b> FY 2024 increased compared to FY 2023 by 8.400M due to initiating efforts for the technical development of the sub-scale test chip and feasibility assessment of advanced ROIC technology.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	24.869	59.612	41.591

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

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<b>Appropriation/Budget Activity</b> 3620F / 2					<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>				<b>Project (Number/Name)</b> 624846 / <i>Spacecraft Payload Technologies</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
624846: <i>Spacecraft Payload Technologies</i>	-	16.012	61.582	71.286	0.000	71.286	20.138	20.834	21.256	22.080	Continuing	Continuing

**Note**

Increase from FY 2023 to FY 2024 reflects realignment and consolidation of thrusts from Project 621010/Space Survivability & Surveillance and Project 628809/Spacecraft Vehicle Technologies to better align with the DAF OIs and the USSF SSC PEO's mission areas. Civilian Pay in this project was assigned an incorrect project code that aligned it in Budget Activity (BA) 06 (RDT&E Management Support), Project C6601Z. Funds will be transferred back to PE 1206616SF BA 02 in a follow-up technical adjustment request.

**A. Mission Description and Budget Item Justification**

This project develops advanced technologies that enhance spacecraft payload operations by improving materials/component, networking, analysis tools, and subsystem capabilities. The project focuses on development of advanced space data generation and exploitation technologies, including infrared sensors; and development of high-fidelity space simulation models that support space-based surveillance and space asset protection research and development for the warfighter.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	FY 2022	FY 2023	FY 2024
<p><b>Title:</b> Space-Based Detector Technologies</p> <p><b>Description:</b> Develop advanced infrared device technologies that enable hardened space detector arrays with improved detection to perform acquisition, tracking, and discrimination of space objects and missile warning.</p> <p><b>FY 2023 Plans:</b> Complete design, development, and assessment of low-cost, high-volume infrared detectors and focal plane arrays for proliferated space architecture layers. Continue development of focal plane array optical data outputs for higher speed and data throughput and continue radiation tolerance characterization of photonic devices. Continue development and refinement of alternative infrared focal plane array materials and device architectures. Continue development and assessment of event based sensing concepts and hardware and initiate partnerships with other Government agencies to explore potential transition paths. Continue development of high dynamic range, laser hardened 8192 x 8192 pixels, 10 micron pixel pitch focal plane arrays to provide resilience against emerging threats.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust is consolidated under one thrust titled Missile Warning and Tactical Sensing to better align with the DAF OIs and the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 4.032M due to realignment and consolidation under a different Project. In FY 2024 this thrust is consolidated under one thrust titled Missile Warning and Tactical Sensing to better align with the DAF OIs and the</p>	5.006	4.032	0.000

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.</p> <p><b>Title:</b> Missile Warning and Tactical Sensing</p> <p><b>Description:</b> Develop advanced infrared device technologies that enable hardened space detector arrays with improved detection to perform acquisition, tracking, and discrimination of space objects and missile warning. Develop advanced target detection techniques, spectral signature libraries, and decision aids for space-based sensors and surveillance systems.</p> <p><b>FY 2023 Plans:</b> In FY 2024 the Surveillance Technology and Space-Based Detector Technology thrusts are consolidated under the new Missile Warning and Tactical Sensing thrust. The FY 2023 Plans for the Surveillance Technology thrust remain in PE 1206601SF/ Space Technology, Project 621010/Space Survivability &amp; Surveillance, and the Space-Based Detector Technology thrust in PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies.</p> <p><b>FY 2024 Plans:</b> Complete performance characterization of High Dynamic Range (HDR) resilient 10um pitch Focal Plane Array (FPA) series. Results will be rolled into full large format FPA build. Continue developing a more thorough understanding of noise sources in smaller Complementary Metal Oxide Semiconductor (CMOS) mixed signal nodes which are vital to success of HDR FPA program. Continue involvement in Event Based Sensor (EBS) development and assist in defining DoD and IC path forward. Evaluate the performance of test chips as they become available, as part of the AFRL collaboration with the Defense Advanced Research Projects Agency (DARPA). Continue the development of next generation infrared detector materials that have the potential of offering higher performance.</p> <p>Continue development of novel sensing concepts for space-based surveillance and detection of challenging, evolving strategic and tactical targets in contested environments. Initiate development and design of space-based sensors for resilient target custody by proliferated space architectures. Continue development of data analytics for edge processing, cloud solutions, and human-machine learning to shorten sensor-to-shooter timelines. Initiate development of trusted artificial intelligence and machine learning models for autonomous classification and moving target indication of ground vehicles, air platforms, and maritime vessels for battlefield operations. Initiate study of sensing systems optimized for space-based autonomous tasking and moving target indication from multiple target surveillance and tracking layers of a hybrid space architecture. Continue study and development of autonomous sensing strategies and technologies for multi-domain target acquisition and tracking by networked satellite constellations.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b></p>	-	0.000	8.076

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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>FY 2024 increased compared to FY 2023 by 8.076M due to realignment and consolidation of thrusts from different Projects. In FY 2024 the Surveillance Technology and Space-Based Detector Technology thrusts are consolidated under the new Missile Warning and Tactical Sensing thrust. The FY 2023 Plans for the Surveillance Technology thrust remain in PE 1206601SF/Space Technology, Project 621010/Space Survivability &amp; Surveillance, and the Space-Based Detector Technology thrust in PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in a new start. FY to FY funding change explanations will be reflected in this new thrust beginning in FY 2025.</p>				
<p><b>Title:</b> Space Electronics Research</p> <p><b>Description:</b> Develop technologies for space-based payload components such as radiation-hardened electronic devices, microelectro-mechanical system devices, and advanced electronics packaging.</p> <p><b>FY 2023 Plans:</b> Continue leadership role in Deputy Assistant Secretary of Defense Systems Engineering trusted and assured microelectronics strategy efforts to develop trusted manufacturing techniques that reduce risk to National Security Space systems. Continue adapting bench-marking capabilities on new electronics using the latest spacecraft algorithms and transitioning bench-marking capabilities and results to the acquisition community to enable data-informed payload architecture design decisions. Initiate prototype memory manufacturing, testing and design improvements. Complete research and development of ultra-low power and neuromorphic/cortical processing architectures and advanced transistor research to enable game-changing capabilities in future National Security Space systems. Continue research and development of high-performance processing for small satellites to enable revolutionary on-orbit edge processing, autonomy, data fusion, and machine learning.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust is realigned to PE 1206601SF/Space Technology, Project 628809/Spacecraft Vehicle Technologies and consolidated under one thrust, titled Spacecraft Component Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 5.683M due to realignment and consolidation to a different Project. In FY 2024 this thrust is realigned to PE 1206601SF/Space Technology, Project 628809/Spacecraft Vehicle Technologies and consolidated under one thrust, titled Spacecraft Component Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.</p>		0.000	5.683	0.000
<p><b>Title:</b> Modeling and Simulation Tools for Space Applications</p>		1.545	3.752	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force		<b>Date:</b> March 2023
<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 624846 / <i>Spacecraft Payload Technologies</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p><b>Description:</b> Provide modeling, simulation, and analysis for technology evolution in space-based terrestrial surveillance systems, precision navigation and timing, space situational awareness, satellite communications, space environment monitoring, and space control payloads.</p> <p><b>FY 2023 Plans:</b> Continue mission-level military utility analyses of technology and associated architectures and employment concepts across multi-domain mission areas. Continue refining guidelines and checkpoints for concept maturation evaluations in context of emerging space technologies. Continue to evolve processes for applying model-based systems engineering into technology decision-making and flight experiment design.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust is transferred to Program Element 1206616SF/Space Advanced Technology Development/Demo, Project 633834/Integrated Space Technology Demonstrations, to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 3.752M due to realignment to a different Program Element. In FY 2024 this thrust is transferred to Program Element 1206616SF/Space Advanced Technology Development/Demo, Project 633834/Integrated Space Technology Demonstrations, to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. his realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.</p>			
<p><b>Title:</b> Alternative Positioning, Navigation, and Timing Technology</p> <p><b>Description:</b> Identify and develop technologies that enable new, or enhance existing, United States positioning, navigation, and timing satellite capabilities by increasing resiliency and availability of accuracy, and/or increasing the affordability of providing current capabilities. Develop technologies to meet identified Air Force Space Command/Space and Missile Systems Center positioning, navigation, and timing space payload technology needs.</p> <p><b>FY 2023 Plans:</b> Initiate flight experiments to examine the interaction of signals between the space, ground, and user equipment segments in contested environments and exercise potential CONOPs. Continue development of technologies for multi-layer space-based positioning, navigation, and timing architecture in order to improve resiliency of the space architecture, affordability, and reduce burden on the user. Continue development of physics level modeling and simulations of next generation space architecture and the impact of developing technologies. Continue laboratory and field testing capabilities of new signals and architecture concepts.</p> <p><b>FY 2024 Plans:</b></p>	9.461	7.315	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 624846 / <i>Spacecraft Payload Technologies</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
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In FY 2024 this thrust is consolidated under one thrust titled Space Communication/PNT Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas.

***FY 2023 to FY 2024 Increase/Decrease Statement:***

FY 2024 decreased compared to FY 2023 by 7.315M due to consolidation to a new thrust. In FY 2024 this thrust is transferred to Program Element 1206616SF/Space Advanced Technology Development/Demo, Project 633834/Integrated Space Technology Demonstrations, to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. his realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.

<b><i>Title:</i></b> Space Communication/ Positioning, Navigation & Timing Technologies	-	0.000	13.210
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***Description:*** Identify and develop technologies that enable new, or enhance existing, United States communication, positioning, navigation, and timing satellite capabilities. Technology solutions should improve performance, increase robustness and/or resilience, and/or increase the affordability of providing current capabilities. Develop technologies to meet identified US Space Command/Space Systems Command communication, positioning, navigation, and timing space payload technology needs. Develop new technologies based on cold atom physics and photonics that provide autonomous jam-proof precision inertial navigation to augment Global Positioning System in case of Global Positioning System-denial. Develop atomic clocks and methods to disseminate time based on new technologies to replace legacy Global Positioning System atomic clocks and networks

***FY 2023 Plans:***

In FY 2024 the Alternative Navigation Technologies thrust, the Space Communication Technologies thrust, and the Alternative Positioning, Navigation, and Timing Technology thrust are consolidated under the new Space Communication/PNT thrust. The FY 2023 Plans for the Alternative Navigation Technologies thrust remain in PE 1206601SF/Space Technology, Project 621010/Space Survivability & Surveillance, the Space Communication Technologies thrust in PE 1206601SF/Space Technology, Project 628809/Spacecraft Vehicle Technologies, and the Alternative Positioning, Navigation, and Timing Technology thrust in PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies.

***FY 2024 Plans:***

Continue scientific research and technology development for space communications exploring W/V-band spectrum options. Continue to support field demonstrations and on-orbit experiments to examine the interaction of communication, position, navigation and timing signals between the multi-layer, multi-function architectures in contested environments and exercise potential Concept of Operations (CONOPs). Continue development of the enabling technologies to increase Timing precision, enable transition to proliferated low earth orbit constellation, and provide increased options for the user. Continue to support Quantum Rim of the Pacific (RIMPAC) exercise and other opportunities to accelerate the fielding of Quantum-based technologies. Continue laboratory development of Quantum-based technologies and component miniaturization efforts.

***FY 2023 to FY 2024 Increase/Decrease Statement:***

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 624846 / <i>Spacecraft Payload Technologies</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2022	FY 2023	FY 2024
<p>FY 2024 increased compared to FY 2023 by 13.210M due to realignment and consolidation of thrusts from different Projects. In FY 2024 the Alternative Navigation Technologies thrust, the Space Communication Technologies thrust, and the Alternative Positioning, Navigation, and Timing Technology thrust are consolidated under the new Space Communication/PNT thrust. The FY 2023 Plans for the Alternative Navigation Technologies thrust remain in PE 1206601SF/Space Technology, Project 621010/Space Survivability &amp; Surveillance, the Space Communication Technologies thrust in PE 1206601SF/Space Technology, Project 628809/Spacecraft Vehicle Technologies, and the Alternative Positioning, Navigation, and Timing Technology thrust in PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in a new start. FY to FY funding change explanations will be reflected in this new thrust beginning in FY 2025.</p> <p><b>Title:</b> Resilient Satellite Navigation</p> <p><b>Description:</b> *Formerly Resilient Positioning, Navigation, and Timing Solutions</p> <p>Advance and evaluate technologies contributing diversity to satellite positioning, navigation and timing (PNT) information delivery, creating models of performance, scalability and resiliency needed to anchor USSF's Space Warfighting Analysis Center (SWAC) Force Design analytics. Pursue signals and user equipment concepts targeting low size, weight and power (SWAP) users. Promote and characterize commercial PNT capabilities potentially suitable for DoD use. Conduct laboratory and on-orbit experimentation to capture representative integrated system performance and feed back key parameters to SWAC analyses and forward into future requirements definition.</p> <p><b>FY 2023 Plans:</b> Initiate development of technologies for frequency and waveform agility that can use alternate signal sources for positioning, navigation, and timing solutions in jammed environments. Initiate development of technologies for path diversity and alternate signal processing with the ability to provide solutions to modifiable software defined user equipment.</p> <p><b>FY 2024 Plans:</b> Complete development of reprogrammable user equipment silicon. Continue signals and hardware/software-in-the-loop (HIL/SIL) development toward on-orbit demonstration of reprogrammable PNT signal broadcast to low-SWAP user equipment to assess resiliency, performance and scalability. Conduct modeling and simulation of planned field experiments utilizing testbed assets to predict end-to-end PNT performance in contested electromagnetic environment. Feed initial findings back to inform SWAC Force Design model.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 increased compared to FY 2023 by 9.200M due to increased modeling &amp; simulation and conducting field experiments to inform SWAC Force Design.</p>	0.000	40.800	50.000
<b>Accomplishments/Planned Programs Subtotals</b>	16.012	61.582	71.286

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**Exhibit R-2A, RDT&E Project Justification:** PB 2024 Air Force **Date:** March 2023

<b>Appropriation/Budget Activity</b>	<b>R-1 Program Element (Number/Name)</b>	<b>Project (Number/Name)</b>
3620F / 2	PE 1206601SF / <i>Space Technology</i>	624846 / <i>Spacecraft Payload Technologies</i>

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force										<b>Date:</b> March 2023		
<b>Appropriation/Budget Activity</b> 3620F / 2					<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>				<b>Project (Number/Name)</b> 624847 / <i>Rocket Propulsion Technology</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024 Base</b>	<b>FY 2024 OCO</b>	<b>FY 2024 Total</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
624847: <i>Rocket Propulsion Technology</i>	-	21.180	16.966	14.483	0.000	14.483	15.654	16.001	16.329	16.917	Continuing	Continuing

**A. Mission Description and Budget Item Justification**

This project develops rocket propulsion technologies for space access and space maneuver. Analytical and experimental areas of emphasis are propellants, propellant management, combustion, rocket material applications, and innovative space propulsion concepts. Technologies of interest will improve reliability, performance, survivability, affordability, and environmental compatibility of these systems. Develop technologies to reduce the weight and cost of components using new materials and improved designs and manufacturing techniques. All efforts in this project contribute to the sustainment of the space and rocket propulsion industry, providing rocket propulsion technology for the entire Department of Defense (DoD). Technologies under this project enable capabilities of interest to both DoD and National Aeronautics and Space Administration (NASA). Tasks include: modeling and simulation; proof of concept tests of critical components; advanced component development; and ground-based tests. All thrusts are reviewed by a DoD level steering committee yearly for relevance to DoD missions, and the associated support costs.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<b>Title:</b> Liquid Engine Combustion Technologies	6.261	5.059	6.123
<b>Description:</b> Develop advanced liquid engine combustion technology for improved performance, while preserving chamber lifetime and reliability needs for engine uses in heavy lift space vehicles.			
<b>FY 2023 Plans:</b> Complete installation of new test facility that will fill the current capability gap and allow for fast, low-cost testing of multi-injector designs and stability strategies at conditions relevant to the demands of both Department of Defense and industry for next-generation engines (including use of liquid oxygen and higher pressures and thrust). Continue the employment of new fuel and material operating limitations, manufacturing processes, and launch goals in cycle analysis to identify trade space for future engines. Continue to develop and evaluate advanced material solutions for high temperature components in rocket propulsion. Continue development and payoff determination of rotating detonation rocket engine technologies.			
<b>FY 2024 Plans:</b> Continue the employment of new fuel and material operating limitations, manufacturing processes, and launch goals in cycle analysis to identify trade space for future engines. Continue to develop and evaluate advanced material solutions for high temperature components in rocket propulsion. Continue development and payoff determination of rotating detonation rocket engine technologies. Initiate technologies and material studies supporting rapid launch capabilities emphasizing digital design capabilities.			
<b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY2024 increased compared to FY2023 by \$1.065 million. Funding increase due to initiation of the digital design capabilities work.			
<b>Title:</b> Advanced Liquid Engine Technologies	2.771	2.718	3.290

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force		<b>Date:</b> March 2023		
<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 624847 / <i>Rocket Propulsion Technology</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p><b>Description:</b> Develop advanced liquid engine technologies for improved performance, while increasing life and reliability needs for engine uses in expendable and reusable launch vehicles.</p> <p><b>FY 2023 Plans:</b> Continue sub-scale risk mitigation and technology maturation activities to incorporate into next generation engine concepts. Continue modular component integration and interaction research activities supporting next generation engine concepts.</p> <p><b>FY 2024 Plans:</b> Continue sub-scale risk mitigation and technology maturation activities to incorporate into next generation engine concepts. Continue modular component integration and interaction research activities supporting next generation engine concepts and operational capabilities. Initiate technologies and processes supporting modeling and analysis for rapid launch capabilities.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY2024 increased compared to FY2023 by \$0.572 million. Funding increase due to increased fuel supply costs for testing.</p>				
<p><b>Title:</b> On-Orbit Propulsion Technologies</p> <p><b>Description:</b> Develop solar electric, chemical, and advanced propulsion technologies for station-keeping, repositioning, and orbit transfer for satellites and satellite constellations.</p> <p><b>FY 2023 Plans:</b> Continue advanced chemical propellants development focusing on flight-weight systems to assist in transition to industry partners. Continue to support the maturation of advanced diagnostics for both chemical and electric propulsion thruster plumes with potential for integrated state-of-health application. Continue to expand the validation and verification programs (both experimental and flight) to quantify accuracy of modeling and simulation tools developed to support thruster-spacecraft integration. Continue transition and support of thruster/plume modeling framework to spacecraft industry to propulsion community. Continue expanding exploration of advanced integrated electric propulsion and chemical thruster concepts and assess new spacecraft propulsion requirements.</p> <p><b>FY 2024 Plans:</b> Continue advanced chemical propellants development focusing on flight-weight systems to assist in transition to industry partners. Continue to support the maturation of advanced diagnostics for both chemical and electric propulsion thruster plumes with potential for integrated state-of-health application. Continue to expand the validation and verification programs (both experimental and flight) to quantify accuracy of modeling and simulation tools developed to support thruster-spacecraft integration. Continue transition and support of thruster/plume modeling framework to spacecraft industry to propulsion community. Continue expanding</p>		4.270	4.189	5.070

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 624847 / <i>Rocket Propulsion Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2022	FY 2023	FY 2024
exploration of advanced integrated electric propulsion and chemical thruster concepts and assess new spacecraft propulsion requirements.			
<b><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i></b> FY2024 increased compared to FY2023 by \$0.881 million. Funding increase due to increased cost of fuels and raw materials.			
<b>Accomplishments/Planned Programs Subtotals</b>	13.302	11.966	14.483

	FY 2022	FY 2023
<b><i>Congressional Add:</i></b> Congressional Add: Program increase - non-toxic fuels <b><i>FY 2022 Accomplishments:</i></b> Conduct Congressionally directed effort.	2.954	-
<b><i>Congressional Add:</i></b> Propulsion Technology <b><i>FY 2023 Plans:</i></b> Conduct Congressionally directed efforts.	-	5.000
<b><i>Congressional Add:</i></b> Congressional Add: Program increase - adaptive medium-lift engine architecture <b><i>FY 2022 Accomplishments:</i></b> Conduct Congressionally directed effort.	4.924	-
<b>Congressional Adds Subtotals</b>	7.878	5.000

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

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**Exhibit R-2A, RDT&E Project Justification:** PB 2024 Air Force **Date:** March 2023

<b>Appropriation/Budget Activity</b> 3620F / 2					<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>				<b>Project (Number/Name)</b> 624866 / <i>Lasers &amp; Imaging Technology</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
624866: <i>Lasers &amp; Imaging Technology</i>	-	25.048	22.742	19.985	0.000	19.985	20.020	20.481	21.085	21.795	Continuing	Continuing

**A. Mission Description and Budget Item Justification**

This project conducts research advancing ground-based optical space domain awareness, techniques to counter laser threats to space craft, and laser applications towards ground-to-space communication.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	FY 2022	FY 2023	FY 2024
<p><b>Title:</b> Electro-Optic Space Domain Awareness and Satellite Security</p> <p><b>Description:</b> Develop advanced, long-range, electro-optical technologies that enable ground-based optical Space Domain Awareness (SDA) and quantum-based optical communications. Develop and use technologies to quantitatively assess the vulnerability of blue satellite systems and components to lasers and other directed energy sources. Operate the Starfire Optical Range (SOR) to conduct research meeting internal and customer requirements.</p> <p><b>FY 2023 Plans:</b> Continue research and development of laser-enabled space domain awareness (SDA) focused on full-dark imaging using laser illumination. Continue to mature component technologies for 24/7 real-time optical and infrared imaging of near-earth and geosynchronous objects enabling characterization on tactical timelines. Continue investigation through measurement, modeling, and simulation of the susceptibility of satellite components to laser and other directed energy threats to inform practical designs for protective equipment and for employing protection methods on tactically-rapid timelines. Continue to mature daylight detection of satellites allowing custody through daytime hours when satellites cannot normally be detected by ground-based optical systems. Continue development of laser-enabled options for both ranging to and imaging of geosynchronous satellites from apertures smaller than 3 meters. Continue development of long-range secure optical network technology leveraging quantum science, especially for free space lasercomm channels during daylight. Continue project to apply machine-learning to automatically identify geosynchronous orbit objects more accurately and rapidly than current "hard-wired" algorithms. Conduct research into maintaining custody of space craft in 3-body-gravitational pseudo-orbits, such as in cis-lunar space and Earth-Sun equilibrium zones. Continue to maintain the Starfire Optical Range (SOR) facilities and experimental equipment in a mission-ready state for both R&amp;D and for use by Space Operations Command DEL2/Det2.</p> <p><b>FY 2024 Plans:</b> Demonstrate and transition to SPOC and SSC laser-enabled space domain awareness (SDA) focused on full-dark imaging using laser illumination. Continue to mature component technologies for 24/7 real-time optical and infrared imaging of near-earth and geosynchronous objects enabling characterization on tactical timelines. Continue investigation through measurement, modeling, and simulation of the susceptibility of satellite components to laser and other directed energy threats to inform practical designs for</p>	25.048	22.742	19.985

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 624866 / <i>Lasers &amp; Imaging Technology</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>protective equipment and for employing protection methods on tactically-rapid timelines. Continue to mature daylight detection of satellites allowing custody through daytime hours when satellites cannot normally be detected by ground-based optical systems. Continue development of laser-enabled options for both ranging to and imaging of geosynchronous satellites from apertures smaller than 3 meters. Continue development of long-range secure optical network technology leveraging quantum science, especially for free space lasercomm channels during daylight. Continue projects to apply machine-learning to automatically identify non-spatially resolved space objects and their components more accurately and rapidly than current "hard-wired" algorithms. Conduct research into maintaining custody of space craft in 3-body-gravitational pseudo-orbits, such as in cis-lunar space and Earth-Sun equilibrium zones. Upgrade the Starfire Optical Range (SOR) facilities to provide infrastructure resilience to enable operations by Space Operations Command DEL2/Det2. Continue to sustain SOR experimental equipment in a mission-ready state for both R&amp;D and for use by Space Operations Command DEL2/Det2.</p> <p><b><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i></b>  FY24 decreased from FY23 by \$2.757M due to tech adjustment of funds from PE 060205F Project 625173 to PE 1206601SF Project 624866 in FY23.</p>			
<b>Accomplishments/Planned Programs Subtotals</b>	25.048	22.742	19.985

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force										<b>Date:</b> March 2023		
<b>Appropriation/Budget Activity</b> 3620F / 2					<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>				<b>Project (Number/Name)</b> 625018 / <i>Spacecraft Protection Technology</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024 Base</b>	<b>FY 2024 OCO</b>	<b>FY 2024 Total</b>	<b>FY 2025</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
625018: <i>Spacecraft Protection Technology</i>	-	49.015	36.026	32.345	0.000	32.345	40.411	45.136	43.152	42.881	Continuing	Continuing

**Note**

The Major Thrust in this project was updated from Threat Warning Research to Space Control to better identify the breadth of research in this mission area. Consequently, the Mission Description was also updated.

**A. Mission Description and Budget Item Justification**

This project develops the technologies to perform faster, well-informed decision making for space operations, enhanced mission assurance of critical space services, and integrate space with joint operational picture for protecting United States space assets, in potentially hostile environments, to assure continued space system operation. The project provides transitionable technology and knowledge to enable speed-of-light protection, many-on-many engagement and defense, and new orbit regimes despite growing threat impunity.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<b>Title:</b> Space Control	8.240	10.526	20.345
<b>Description:</b> *Formerly Threat Warning Research			
Provide timely, well-informed decisions enabled by space situational awareness in the cislunar environment, analytic tools powered by modern techniques and practices, trusted autonomy in both ground and on-orbit systems, and an underlying resilience to cyber and electronic warfare threats.			
<b>FY 2023 Plans:</b> Continue to develop techniques to detect, track, identify, and characterize satellites using multi-phenomenology techniques with particular focus on space situational awareness in the cislunar environment; investigate potential flight experiments that will demonstrate utility of cislunar situational awareness for deterring threats from deep space. Continue development of on-orbit threat warning sensing and assessment with emphasis on spectrum awareness and inherent, on-board satellite sensors. Continue research on cyber hardening of space assets with laboratory testbeds and solidify a pipeline for continuously transitioning cyber hardening techniques to on-orbit experiments. Continue experimentation and exercises with Department of Defense ground architectures, operations centers, and commercial and international partners, with an emphasis on employing agile space operations software development techniques. Continue engagements with commercial space data providers for testing new enabling technologies on commercial satellites. Continue to develop on-board autonomous satellite technologies and plan for next generation flight experiments.			
<b>FY 2024 Plans:</b>			

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force		<b>Date:</b> March 2023
<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 625018 / <i>Spacecraft Protection Technology</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>Continue to develop techniques to detect, identify, track, characterize, and catalog satellites using multi-phenomenology techniques with particular focus on space situational awareness in the cislunar environment; provide technical expertise towards flight experiments that will demonstrate utility of cislunar situational awareness for establishing and transferring custody, tracking, and deterring threats from deep space. Continue studies to inform potential upgrades to operational tools used in space situational awareness. Continue development of on-orbit threat warning sensing and assessment with emphasis on spectrum awareness and inherent, on-board satellite sensors. Continue research on cyber vulnerability and cyber hardening methods of space assets with laboratory testbeds; developing standards and techniques. Continue collaboration and demonstration of cyber hardening techniques aboard on-orbit experiments through established transitional pipeline of flight experiments; growing pipeline for future demonstrations. Continue to develop on-board autonomous satellite technologies, emphasizing operational resilience for tactical action, awareness across operator, ground and space interfaces, enabling tactical awareness for distributed system elements, defining success criteria for many-to-many engagements; plan for next generation flight experiments. Continue experimentation and exercises with DoD ground architectures, operations centers, commercial and international partners.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 increased compared to FY 2023 by 9.819M to realign funds to this thrust for increased emphasis in space situational awareness specifically in the cislunar environment.</p>			
<p><b>Title:</b> University Consortium for Space Research</p> <p><b>Description:</b> Expand the University Consortium for Space Research to address research needs unique to the USSF. Create Technology Institutes at universities focused on developing and delivering technology for critical USSF missions. Support development of the future space workforce. Build capacity for space research within higher education institutions.</p> <p><b>FY 2023 Plans:</b> Not Applicable</p> <p><b>FY 2024 Plans:</b> Expand the number of Technology Institutes, provide programming that builds capacity for space research in higher education including a focus on minority serving institutions.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 increased compared to FY 2023 by 12.000M due to the expansion of the University Consortium for Space, previously initiated through Congressional Budget Adds in FY 2022 and FY 2023 in PE 1206601SF/Space Technology, Project 628809/Spacecraft Vehicle Technologies.</p>	-	0.000	12.000
<b>Accomplishments/Planned Programs Subtotals</b>	8.240	10.526	32.345

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 625018 / <i>Spacecraft Protection Technology</i>
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	FY 2022	FY 2023
<b>Congressional Add:</b> Congressional Add: Program increase - autonomy in space <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	9.849	-
<b>Congressional Add:</b> Congressional Add: Program increase - ground-based interferometry <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort. <b>FY 2023 Plans:</b> Conduct Congressionally directed effort.	5.909	2.000
<b>Congressional Add:</b> Congressional Add: Program increase - open architecture payloads <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	9.849	-
<b>Congressional Add:</b> Congressional Add: Program increase - architecture for space domain awareness beyond GEO <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	15.168	-
<b>Congressional Add:</b> Congressional Add: Program Increase - digital engineering and modeling for space domain awareness <b>FY 2023 Plans:</b> Conduct Congressionally directed effort.	-	9.500
<b>Congressional Add:</b> Congressional Add: Program Increase - lunar surface space domain awareness <b>FY 2023 Plans:</b> Conduct Congressionally directed effort.	-	4.000
<b>Congressional Add:</b> Congressional Add: Program Increase - SOSA-based spacecraft protection technology <b>FY 2023 Plans:</b> Conduct Congressionally directed effort.	-	10.000
<b>Congressional Adds Subtotals</b>	40.775	25.500

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A

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**Exhibit R-2A, RDT&E Project Justification:** PB 2024 Air Force **Date:** March 2023

<b>Appropriation/Budget Activity</b> 3620F / 2					<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>				<b>Project (Number/Name)</b> 628809 / <i>Spacecraft Vehicle Technologies</i>			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
628809: <i>Spacecraft Vehicle Technologies</i>	-	143.899	163.358	26.506	0.000	26.506	26.256	26.171	26.856	27.603	Continuing	Continuing

**Note**

Funding and thrust changes from FY 2023 to FY 2024 reflect realignment and consolidation of thrusts in PE 1206601SF/Space Technology from Project 624846/Spacecraft Payload Technologies. The overall decrease is due to significant Congressional Adds in FY 2023 and a database error pertaining to Civilian Pay in FY 2024. Civilian Pay was assigned an incorrect project code aligning it in Budget Activity (BA) 06 (RDT&E Management Support), Project C6601Z. Funds will be transferred back to PE 1206616SF BA 02 in a follow-up technical adjustment request.

**A. Mission Description and Budget Item Justification**

This project is a pervasive portfolio pursuing a broad range of emerging technologies targeted for application and insertion in the future national space architecture. The project focuses on spacecraft components including, structures, power, thermal management, electronics, and robotics/logistics modules. Leap-ahead capability is provided utilizing in-house expertise and laboratories, and by leveraging the creativity and innovation of the Nation's industry, universities, and national laboratories to conduct applied research. The project maintains core competencies in astrodynamics, controls, electronics, materials, power, structures, and thermal, and provides foundational technologies supporting all space mission areas.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	FY 2022	FY 2023	FY 2024
<p><b>Title:</b> Space Power/Thermal Research</p> <p><b>Description:</b> Develop technologies for advanced space platform subsystems such as compact, high efficiency solar power cells and arrays, and innovative power generation concepts.</p> <p><b>FY 2023 Plans:</b> Continue development of high power arrays and storage capability for small satellites including solar array structures scalable to all missions with specific power greater than 100 watts per kilogram. Continue development of power system protection capabilities to sense and warn of directed energy threats for proliferated low Earth orbit constellations and next generation US Space Force satellite buses. Continue exploration of alternative power generation sources, such as nuclear to characterize the limitations and challenges underpinning operating space systems in non-traditional orbital regimes. Continue research to enable high-pulsed power systems including generation, storage, and heat rejection technologies for small satellites.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust will be consolidated under one thrust titled Spacecraft Component Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b></p>	8.118	10.376	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force		<b>Date:</b> March 2023		
<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 628809 / <i>Spacecraft Vehicle Technologies</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>FY 2024 decreased compared to FY 2023 by 10.376M due to consolidation into another Thrust. In FY 2024 this thrust will be consolidated under one thrust titled Spacecraft Component Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.</p>				
<p><b>Title:</b> Space Structures and Controls Research</p> <p><b>Description:</b> Develop revolutionary and enabling technologies, including lighter weight, lower cost, high performance structures for space platforms; guidance, navigation, and controls hardware and software for next generation of space superiority systems.</p> <p><b>FY 2023 Plans:</b> Continue research in autonomous spacecraft flight software including verification and validation and techniques for high-fidelity simulations. Complete transition efforts in agile manufacturing, additive manufacturing, and high-performance phased arrays and antennas. Continue research to enable space logistics concepts including autonomous rendezvous, proximity operations, and docking; refueling and module upgrade; and on-orbit assembly. Continue research to develop guidance and navigation algorithms for cislunar space including novel orbits. Continue research efforts in high-performance, resilient small satellite technologies and development efforts in deployable structures, metrology, power and thermal management for tactical intelligence, surveillance, and reconnaissance missions in contested environments.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust with associated funding is consolidated under one thrust titled Spacecraft Component Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 19.280M due to consolidation into another Thrust. In FY 2024 this thrust will be consolidated under one thrust titled Spacecraft Component Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.</p>		16.388	19.280	0.000
<p><b>Title:</b> Spacecraft Component Technologies</p> <p><b>Description:</b> Develop technology and research initiatives executed through continuous cycles of development, maturation, and assessment of component technologies. Develop revolutionary and enabling technologies including: lighter weight, lower cost, high-performance structures and thermal systems for space platforms; compact, high-efficiency solar power cells and arrays, and innovative power-generation concepts; radiation-hardened electronic devices; microelectro-mechanical system devices; advanced</p>		0.000	0.000	26.506

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force		<b>Date:</b> March 2023		
<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 628809 / <i>Spacecraft Vehicle Technologies</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>electronics packaging; guidance, navigation, and controls hardware and software; refueling and logistics module upgrade; on-orbit assembly; and high degree of freedom robotics.</p> <p><b>FY 2023 Plans:</b> In FY 2024 the Space Electronics Research, Space Power/Thermal Research, and Space Structures and Controls Research thrusts were consolidated under the new Spacecraft Component Technologies thrust. The FY 2023 plans for the Space Electronics thrust remain in PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies, and the Space Power/Thermal and Space Structures and Controls remain in PE 1206601SF/Space Technology, Project 628809/Spacecraft Payload Technologies.</p> <p><b>FY 2024 Plans:</b> Continue development of high power arrays and storage capability for small satellites including solar array structures scalable to all missions with specific power greater than 100 Watts per kilogram. Transition compact telescoping array to industry and initiate new efforts pushing toward landmark 40% efficiency solar cells. Transition initial development of directed energy protection capabilities for proliferated low Earth orbit constellations and next generation US Space Force satellite buses. Complete exploration of alternative power generation sources, such as nuclear to characterize the limitations and challenges underpinning operating space systems in non-traditional orbital regimes. Initiate technology development required for alternative power generation sources and next-generation US Space Force satellite buses. Transition research to enable high-pulsed power systems including generation, storage, and heat rejection technologies for small satellites. Continue research efforts in high-performance, resilient small satellite technologies and development efforts in deployable structures, metrology, power and thermal management for tactical intelligence, surveillance, and reconnaissance missions in contested environments.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 increased compared to FY 2023 by 25.506M due to realignment and consolidation of thrusts from different Projects. In FY 2024 the Space Electronics Research, Space Power/Thermal Research, and Space Structures and Controls Research thrusts were consolidated under the new Spacecraft Component Technologies thrust. The FY 2023 plans for the Space Electronics thrust remain in PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies, and the Space Power/Thermal and Space Structures and Controls remain in PE 1206601SF/Space Technology, Project 628809/Spacecraft Payload Technologies. Therefore, an explanation of the change between FYs cannot be made in a relevant manner. This realignment did not result in a new start. FY to FY funding change explanations will be reflected in this new thrust beginning in FY 2025.</p>				
<b>Title:</b> Space Experiments		34.545	8.890	0.000
<b>Description:</b> Develop flight experiments to improve the capabilities of existing operational space systems and to enable new transformational space capabilities.				
<b>FY 2023 Plans:</b>				

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force		<b>Date:</b> March 2023		
<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 628809 / <i>Spacecraft Vehicle Technologies</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2022</b>	<b>FY 2023</b>	<b>FY 2024</b>
<p>Continue design and build of satellite experiments demonstrating small satellite systems/sub-systems to prove performance, military utility, and enabling capabilities in autonomy, cyber resiliency and integration of commercial and government space networks for command and control (C2) of a hybrid space architecture.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust is transferred to Program Element 1206616SF/Space Advanced Technology Development/Demo, Project 633834/Integrated Space Technology Demonstrations and consolidated into the Integrated Satellite Demonstrations thrust to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 8.890M due to realignment and consolidation to a different Project. In FY 2024 this thrust is transferred to Program Element 1206616SF/Space Advanced Technology Development/Demo, Project 633834/Integrated Space Technology Demonstrations and consolidated into the Integrated Satellite Demonstrations thrust to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FY's cannot be made in a relevant manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.</p>				
<p><b>Title:</b> Space Communication Technologies</p> <p><b>Description:</b> Develop technologies for next-generation space communications terminals and equipment and methods/techniques to enable future space system operational command and control concepts.</p> <p><b>FY 2023 Plans:</b> Continue scientific research and technology development for space communications with focus on W/V-band spectrum options, laser communications, and adaptive technologies. Complete demonstration of multi-wavelength optical router. Initiate development of reconfigurable laser communication technology. Initiate demonstration of technology for positioning, navigation, and timing over laser communication links.</p> <p><b>FY 2024 Plans:</b> In FY 2024 this thrust is realigned to PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies, and consolidated under one thrust titled Space Communication/Positioning, Navigation, &amp; Timing Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas.</p> <p><b>FY 2023 to FY 2024 Increase/Decrease Statement:</b> FY 2024 decreased compared to FY 2023 by 14.412M due to realignment and consolidation to a different Project. In FY 2024 this thrust is realigned to PE 1206601SF/Space Technology, Project 624846/Spacecraft Payload Technologies, and consolidated under one thrust titled Space Communication/Positioning, Navigation, &amp; Timing Technologies to better align efforts with the DAF OIs and the USSF SSC PEO's mission areas. Therefore, an explanation of the change between FYs cannot be made in a relevant</p>		17.089	14.412	0.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 628809 / <i>Spacecraft Vehicle Technologies</i>
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<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2022	FY 2023	FY 2024
manner. This realignment did not result in any discontinuation of effort. FY to FY funding change explanations will be reflected in the new thrust beginning in FY 2025.			

<b>Accomplishments/Planned Programs Subtotals</b>	76.140	52.958	26.506
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	FY 2022	FY 2023
<b>Congressional Add:</b> Congressional Add: Program increase - radiation hardened microprocessor <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	8.766	-
<b>Congressional Add:</b> Congressional Add: Program increase - lithium sulfur battery development <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	3.939	-
<b>Congressional Add:</b> Congressional Add: Program increase - thin-film photovoltaic energy <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort. <b>FY 2023 Plans:</b> Conduct Congressionally directed effort.	2.954	3.000
<b>Congressional Add:</b> Congressional Add: Program increase - multi-mission distributed antenna technology <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	9.849	-
<b>Congressional Add:</b> Congressional Add: Program increase - hybrid space architecture <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort. <b>FY 2023 Plans:</b> Conduct Congressionally directed effort.	4.924	5.000
<b>Congressional Add:</b> Congressional Add: Program increase - ultra-lightweight space solar arrays <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	4.924	-
<b>Congressional Add:</b> Congressional Add: Program increase - university consortia for space technology <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort. <b>FY 2023 Plans:</b> Conduct Congressionally directed effort.	9.849	20.000
<b>Congressional Add:</b> Congressional Add: Program increase - advanced multi-physics thermal management <b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.	4.924	-
<b>Congressional Add:</b> Congressional Add: Program increase - fundamental research	14.774	-

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Air Force		Date: March 2023	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)	Project (Number/Name)	
3620F / 2	PE 1206601SF / <i>Space Technology</i>	628809 / <i>Spacecraft Vehicle Technologies</i>	
		<b>FY 2022</b>	<b>FY 2023</b>
<b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - space solar power inc demonstration		2.856	-
<b>FY 2022 Accomplishments:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - aerospace films for increased operational range of reconnaissance		-	6.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - 3D graphene lithium-sulfur batteries		-	5.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - L-Band active phased array demonstration		-	3.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - next generation multiband space array antenna		-	10.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - advanced analog microelectronics		-	3.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - spectrum superiority lab		-	5.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - advanced space power systems		-	9.400
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - cybersecurity for a hybrid space architecture		-	15.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - flexible solar panels		-	5.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - high efficiency lightweight RF amplifiers for LEO constellation		-	5.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.			
<b>Congressional Add:</b> Congressional Add: Program increase - moving target engagement solutions		-	6.000

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2024 Air Force	<b>Date:</b> March 2023
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<b>Appropriation/Budget Activity</b> 3620F / 2	<b>R-1 Program Element (Number/Name)</b> PE 1206601SF / <i>Space Technology</i>	<b>Project (Number/Name)</b> 628809 / <i>Spacecraft Vehicle Technologies</i>
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	FY 2022	FY 2023
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.		
<b>Congressional Add:</b> Congressional Add: Program increase - operational upper stage augmentation kit	-	10.000
<b>FY 2023 Plans:</b> Conduct Congressionally directed effort.		
<b>Congressional Adds Subtotals</b>	67.759	110.400

**C. Other Program Funding Summary (\$ in Millions)**

N/A

**Remarks**

**D. Acquisition Strategy**

N/A