Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Air Force											Date: March 2024	
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 1206310SF / *Space Science and Technology Research and Development*							
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	431.411	472.493	425.166	0.000	425.166	477.878	428.174	281.289	428.318	Continuing	Continuing
634869: *Space Science and Technology Research and Development*	-	431.411	472.493	425.166	0.000	425.166	477.878	428.174	281.289	428.318	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Space Development Agency (SDA) is developing and demonstrating next generation space capabilities for the joint warfighter enabled by proliferation of satellites and a new acquisition model utilizing rapid spiral development. SDA is developing capabilities to address a wide range of Department of Defense (DoD) space needs as stated in the National Defense Strategy and DoD Space Vision, including low-latency tactical communication, beyond line of sight targeting, and advanced missile tracking. Specifically, SDA will demonstrate and field persistent, resilient capabilities needed to be responsive to emerging multi-domain threats against the U.S. national interest. SDA is responsible for the overall programmatic development and execution of a Proliferated Warfighter Space Architecture (PWSA). In coordination with other DoD Space stakeholders, SDA will drive the development of space capabilities to achieve the DoD Space Vision and reduce overlap and inefficiency. SDA will expand the DoD's space warfighting capability and foster growth in the U.S. space industrial base, by developing enhanced government-commercial relationships and international collaborations with key allies and partners.

While SDA is not responsible for building and fielding all capabilities within the PWSA, the Agency is responsible for orchestrating and architecting the PWSA and ensuring capability delivery to the warfighter following a spiral development approach. As part of the PWSA, SDA is building and fielding the Transport Layer, a proliferated constellation of satellites to provide low-latency, beyond line of sight (BLOS), high-volume data transport for the warfighter. This Transport Layer will provide the space-based connectivity backbone for Joint All-Domain Command and Control (JADC2).

The establishment of a proliferated data Transport Layer is essential to developing a new and responsive space architecture. SDA will integrate additional constellations with this Transport Layer to provide multiple warfighting capabilities, such as advanced missile warning, 24/7/365 custody of time critical targets, and alternative position, navigation and timing (APNT) capabilities in navigation warfare (NAVWAR) resilient environments.

This program element funds the research and development activity to deliver capabilities to U.S. joint warfighting forces in two-year tranches, which began in FY 2022, including performing trade studies, technical analyses, or modeling and simulation; identifying and maturing enabling technologies; defining and conducting risk reduction experiments and demonstrations, prototyping hardware or software systems; and exploring novel concepts for future warfighting capabilities.

This program element may include necessary civilian pay expenses and contractor support required to facilitate delivery of the PWSA capability.

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The total cost of the Tranche 1 (T1) Transport Layer Middle Tier of Acquisition effort is $2,977.300 million, including RDT&E and procurement of prototype units. The T1 Transport Layer RP program is fully funded across the Future Years Defense Program.

The total cost of the Tranche 2 (T1) Transport Layer Middle Tier of Acquisition effort is $5,250.700 million, including RDT&E and procurement of prototype units. The T2 Transport Layer RP program is fully funded across the Future Years Defense Program.

This program is in Budget Activity 3, Advanced Technology Development because this budget activity includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	447.472	472.493	489.580	0.000	489.580
Current President's Budget	431.411	472.493	425.166	0.000	425.166
Total Adjustments	-16.061	0.000	-64.414	0.000	-64.414
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	-16.061	0.000			
• Other Adjustments	0.000	0.000	-64.414	0.000	-64.414

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: 634869: *Space Science and Technology Research and Development*		
Congressional Add: *Defense of Low-Earth Orbit Satellites*	7.371	-
Congressional Add: *Defense-in-Depth for Spacecraft Cybersecurity*	4.817	-
Congressional Add Subtotals for Project: 634869	12.188	-
Congressional Add Totals for all Projects	12.188	-

Change Summary Explanation

The decrease in FY 2023 from the Previous President's Budget to the Current President's Budget is due to reallocations for SBIR/STTR projects.

The decrease from the FY 2024 amount to the FY 2025 amount is due to realignment for higher U.S. Space Force priorities.

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The decrease in FY 2025 from the Previous President's Budget to the Current President's Budget is due to realignment for higher U.S. Space Force priorities.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Space Development Agency R&E	419.223	472.493	425.166

Description: Research and development activities to support development, demonstration, and fielding of a resilient military sensing and data transport capability via a proliferated space architecture in Low Earth Orbit (LEO). The funds support the development of an increasingly broad set of technologies (including alternative navigation solutions, advanced missile tracking, multi-INT fusion algorithms, integrated battle management algorithms, and next generation tactical data links) that are critical to delivering a robust initial warfighting capability in the Proliferated Warfighter Space Architecture (PWSA).

FY 2024 Plans:

Tranche 0
- Continue to conduct post-Capstone demonstrations and experimentations with warfighters.
- Test and demonstrate more complex on-orbit Tracking data fusion algorithms within the Battle Management Command, Control, and Communications (BMC3) module.
- Continue to refine optical inter-satellite communication links from space-to-space, space-to-air, and space-to-ground.
- Continue tracking on-orbit operations background data collection and target of opportunity observation.
- Continue testing the developed algorithms for integrated BMC3 applications on-orbit.

Tranche 1
- Support risk reduction of Tranche 1 Transport Layer (T1TL) satellites, ground systems and integration.
- Conduct interoperability and compatibility testing for key T1TL interfaces including optical communications, space-to-ground radio frequency (RF), Link 16 and Networking and Encryption.
- Perform mission engineering support activities including Concept of Operations (CONOPS) and Concept of Employment (CONEMP) development, user segment integration, developmental and operational test planning and characterization and modeling of system performance.
- Begin development of user interface Interface Control Documents (ICDs).

Tranche 2
- Continue design of Tranche 2 Transport Layer (T2TL) Alpha system and mission - further proliferation of Link 16 capabilities.
- Continue design of T2TL-Beta system and mission - initial global proliferation of tactical satellite communications (TACSATCOM) and Integrated Broadcast Service - Low Earth Orbit (IBS-L) capability.
- Begin design of T2TL-Gamma system and mission - further proliferation of advanced capabilities and fire control.
- Extend PWSA Ground Segment architecture design to support integration of Tranche 2 system elements and missions.

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Proliferated Warfighter Space Architecture (PWSA) Future Programs (PFP) - Construct ground segment network including a Demonstration Operations Center (DOC). - Initiate PFP Ground Segment Integration (PGI) effort to provide a common, enduring ground infrastructure and resources to minimize cost and complexity for PFP space vehicle demonstration and experimentation programs (beginning with FOO Fighter and T2DES). NExT - Complete the Critical Design Review for the NExT space systems. - Accept delivery of key long-lead system components in preparation for payload to space vehicle integration. - Implement critical encryption architecture upgrades to support partner payloads operating at multiple classification levels. - Complete system cybersecurity milestones. TxDES - Work with DARPA to transfer Blackjack technology into the T1DES program. - Continue design and analysis effort for an additional tactical data link, waveform, and/or alternative position, navigation and timing (APNT) signal planned for demonstration in T2 (i.e., T2 Demonstration and Experimentation System (T2DES)) and proliferation beginning with Proliferated Warfighter Space Architecture (PWSA) Tranche 3 (T3). ***FY 2025 Plans:*** Tranche 0 - Continue to conduct post-Capstone demonstrations and experimentations with warfighters. - Continue tracking on-orbit operations background data collection and target of opportunity observation. - Continue testing the developed algorithms for integrated Battle Management Command, Control and Communications (BMC3) applications on-orbit. Tranche 1 - Support risk reduction of T1 Transport satellites, ground systems, and integration. - Continue interoperability and compatibility testing for key T1 interfaces including optical communications, space-to-ground RF, Link 16 and Networking and Encryption. - Continue mission engineering support activities including Concept of Operations (CONOPS) and Concept of Employment (CONEMP) development, user segment integration, developmental and operational test planning, and characterization and modeling of system performance. - Continue development of user interface Interface Control Documents (ICDs).			

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Tranche 2 - Complete T2TL-Alpha system and mission design. - Complete T2TL-Beta system and mission design. - Complete T2TL-Gamma system and mission design. - Complete PWSA Ground Segment architecture design. Tranche 3 - Finalize Minimum Viable Capability (MVC) design requirements with warfighting community. - Initiate T3 acquisition and source selection processes leading to space vehicle vendor procurement instruments. PFP - Complete facility and network design for the DOC to support demonstrations. - Continue PFP Ground Segment Integration (PGI) effort to provide a common, enduring ground infrastructure and resources to minimize cost and complexity for PFP space vehicle demonstration and experimentation programs (beginning with FOO Fighter and T2DES). NExT - Construct NExT ground segment with network interfaces. - Accept delivery of NExT partner payloads for flight integration. - Integrate partner payloads to host NExT space vehicles. - Complete NExT Assembly, Integration, and Test (AI&T) activities, including ground segment verification. - Begin launch of NExT space vehicles. - Assess system cybersecurity. TxDES - Complete assembly, integration and test of T1DES space vehicles and finalize demonstration plans. - Finalize development of additional tactical data link, waveform, and/or APNT signal planned for demonstration in T2 (i.e., T2DES) and proliferation beginning with PWSA T3. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The decrease from the FY 2024 amount to the FY 2025 amount is due to realignment for higher U.S. Space Force priorities.			
Accomplishments/Planned Programs Subtotals	419.223	472.493	425.166

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	FY 2023	FY 2024
Congressional Add: Defense of Low-Earth Orbit Satellites ***FY 2023 Accomplishments:*** Applied fast prototyping techniques to develop machine learning algorithms for advanced monitoring capabilities. The development process used data from orbiting satellites and a command and control (C2) center. The proposed system aims to improve the interface between humans and machines to boost situational awareness in space systems. Its primary goal is establishing and sustaining trust between humans and space systems by calibrating their interactions, particularly about essential spacecraft systems, constellations, and C2 operations. Additionally, it will offer rapid machine-based support in formulating tactics, methods, and procedures (TTPs) to restore the integrity of the space system following its degradation and the identification or suspicion of a breach. Performance testing and assessment will be conducted at different stages of the system's development.	7.371	-
Congressional Add: Defense-in-Depth for Spacecraft Cybersecurity ***FY 2023 Accomplishments:*** Researched, designed, tested, and deployed cyber defense-in-depth techniques and algorithms for proliferated low earth orbit (LEO) class space vehicles. This lays the foundation for SDA's PWSA architecture against cyber and intrusion exploitation.	4.817	-
Congressional Adds Subtotals	12.188	-

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

E. Acquisition Strategy

Partners for these activities include DoD research centers, small businesses, large defense contractors, commercial space providers, Federally Funded Research and Development Centers, University Affiliated Research Centers, Missile Defense Agency (MDA), Space Systems Command (SSC), Space Operations Command (SpOC), Space Training and Readiness Command (STARCOM), and Defense Advanced Research Projects Agency (DARPA). SDA is also a potential transition partner for technology developers seeking to conduct on-orbit experimentation and prototyping.