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

Appropriation/Budget Activity 3620F: <i>Research, Development, Test & Evaluation, Space Force I BA 3: Advanced Technology Development (ATD)</i>	R-1 Program Element (Number/Name) PE 1206310SF / <i>Space Science and Technology Research and Development</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	-	0.000	447.472	472.493	0.000	472.493	489.580	493.127	509.703	525.104	Continuing	Continuing
634869: <i>Space Science and Technology Research and Development</i>	-	0.000	447.472	472.493	0.000	472.493	489.580	493.127	509.703	525.104	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	12	-	12	-	-	-	-		

Note

This program element includes funds for the Tranche 1 Transport Layer program, which is a Middle Tier of Acquisition effort. The total cost of the Tranche 1 Transport Layer Middle Tier of Acquisition effort is \$3,199.000 million. The Tranche 1 Transport Layer program is fully funded across the Future Years Defense Program.

FY 2024 RDT&E funding for PE 1206310SF, Program 634869 is in compliance with budgeted end items per the approved test strategy and FY 2023 Omnibus, Sec. 8059.

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. 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 (PNT) capabilities in navigation warfare (NAVWAR) resilient environments.

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This program element funds the research and development activity to deliver capabilities to U.S. joint warfighting forces in two-year tranches, beginning 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 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 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	460.820	690.386	0.000	690.386
Current President's Budget	0.000	447.472	472.493	0.000	472.493
Total Adjustments	0.000	-13.348	-217.893	0.000	-217.893
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-26.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	12.652			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	-217.893	0.000	-217.893

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

Project: 634869: *Space Science and Technology Research and Development*

Congressional Add: *Defense of Low-Earth Orbit Satellites*

Congressional Add: *Defense-in-Depth for Spacecraft Cybersecurity*

Congressional Add Subtotals for Project: 634869

Congressional Add Totals for all Projects

	FY 2022	FY 2023
	0.000	7.652
	0.000	5.000
	0.000	12.652
	0.000	12.652

Change Summary Explanation

In FY 2022 and prior, funds for this effort were in Appropriation 0400, RDT&E BA 03, PE 126310SDA.

FY 2023 Congressional marks resulted in a net reduction of \$13.348 million. Project 634869 (Space Science and Technology Research and Development) was decreased by \$26.000 million for follow-on Tranches. Project 634869 was increased by \$7.652 million to support defense of low-earth orbit satellites and increased by \$5.000 million to develop defense-in-depth for spacecraft cybersecurity.

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FY 2024 decreases due to a budget realignment to RDT&E, PE 1206410SF, for continued development of the Tranche 1 and Tranche 2 Transport Layers.

C. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024
<p>Title: Space Development Agency R&E</p> <p>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).</p> <p>FY 2023 Plans:</p> <p>Tranche 0</p> <ul style="list-style-type: none"> - Demonstrate optical inter-satellite communication links from space-to-space, space-to-air, and space- to-ground. - Conduct tracking on-orbit operations demonstration. - Begin testing the developed algorithms for integrated battle management command, control, and communications (BMC3) applications on-orbit. - Demonstrate Link-16 connectivity from space vehicle to terrestrial users. - Complete satellites launches and conduct capstone demonstration. <p>Tranche 1</p> <ul style="list-style-type: none"> - Complete the design and Critical Design Reviews of the Tranche 1 (T1) Transport Layer space vehicles. - Complete the TACSATCOM radio frequency payload design and Critical Design Reviews for the T1 Demonstration and Experimentation Systems (T1DES) space vehicles. - Begin designing the software and hardware for the battle management command, control, and communications (BMC3) Applications Factory and Applications. - Complete Transport segment space vehicle system design. - Complete ground operations and network integration interoperability testing. - Conduct early initial launch vehicle studies. - Design the T1 network mission management systems hardware and software. - Design the BMC3 software architecture. <p>Tranche 2</p> <ul style="list-style-type: none"> - Finalize Minimum Viable Capability design requirements with warfighting community. - Initiate Tranche 2 (T2) acquisition and source selection processes leading to space vehicle vendor procurement instruments. 	0.000	434.820	472.493

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
<p>- Explore alternate tactical data links, waveforms, and/or APNT signals to demonstrate in T2 Demonstration and Experimentation Systems (T2DES).</p> <p>NExT</p> <p>- Complete the interface control documents of the space vehicles for the NExT Program and design the space vehicles.</p> <p>- Formalize agreements with partnering organizations.</p> <p>FY 2024 Plans:</p> <p>Tranche 0</p> <p>- Continue to conduct post-Capstone demonstrations and experimentations with warfighters.</p> <p>- Test and demonstrate more complex on-orbit data fusion algorithms with tracking algorithms for BMC3 applications on-orbit.</p> <p>- Continue to refine optical inter-satellite communication links from space-to-space, space-to-air, and space-to-ground.</p> <p>- Continue tracking on-orbit operations background data collection and target of opportunity observation.</p> <p>- Continue testing the developed algorithms for integrated BMC3 applications on-orbit.</p> <p>Tranche 1</p> <p>- Support on-orbit risk reduction of T1 Transport satellites.</p> <p>- Complete the Critical Design Review for the BMC3 Applications Factory.</p> <p>- Begin implementing T1 BMC3 Applications.</p> <p>- Coordinate a series of launches and demonstrate space vehicle interoperability and tactical data communications.</p> <p>- Design a BMC3 Application Factory software and hardware design.</p> <p>Tranche 2</p> <p>- Continue Transport space vehicle system design for Link-16 and proliferate TACSATCOM capability as demonstrated via T1DES.</p> <p>- Continue design and analysis effort for an additional tactical data link, waveform, and/or APNT signal planned for demonstration in T2 (i.e., T2DES) and proliferation beginning with Proliferated Warfighter Space Architecture (PWSA) Tranche 3.</p> <p>NExT</p> <p>- Complete the Critical Design Review for the Partner Payload Program space vehicles.</p> <p>- Begin payload to space vehicle integration in preparation for launch.</p> <p>- Complete NExT space vehicle system design.</p> <p>- Begin establishing ground network systems for operations and integration with payloads.</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement:</p>			

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024
The increase from the FY 2023 amount to the FY 2024 amount coincides with the increased risk reduction and technology maturation efforts that are stand-alone and happening concurrently with T1 and T2 activities. It also reflects an increase in the developmental work for the T2 effort and NExT activities.			
Accomplishments/Planned Programs Subtotals	0.000	434.820	472.493

	FY 2022	FY 2023
Congressional Add: Defense of Low-Earth Orbit Satellites <i>FY 2022 Accomplishments:</i> N/A <i>FY 2023 Plans:</i> Rapidly prototype, evaluate, and iterate on a product that provides human operators with an enhanced human-machine interface intended to bolster space system situational awareness and maintain/restore reliance via human-space system trust calibration on critical spacecraft systems, constellations, and command and control (C2). Provide machine-speed assistance in developing tactics, techniques, and procedures (TTPs) to return the space system to a trustworthy state once a system is degraded and/or a compromise is suspected/detected.	0.000	7.652
Congressional Add: Defense-in-Depth for Spacecraft Cybersecurity <i>FY 2022 Accomplishments:</i> N/A <i>FY 2023 Plans:</i> Research, design, test, and deploy cyber defense-in-depth techniques and algorithms for proliferated LEO class space vehicles. This will lay the foundation for SDA's PWSA architecture against cyber and intrusion exploitation.	0.000	5.000
Congressional Adds Subtotals	0.000	12.652

D. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u> <u>Base</u>	<u>FY 2024</u> <u>OCO</u>	<u>FY 2024</u> <u>Total</u>	<u>FY 2025</u>	<u>FY 2026</u>	<u>FY 2027</u>	<u>FY 2028</u>	<u>Cost To Complete</u> Continuing	<u>Total Cost</u> Continuing
• RDTE 03 1206310SDA: <i>Space Development Agency R&E</i>	166.615	-	-	-	-	-	-	-	-	-	

Remarks
For FY 2022 and prior, this work is performed in Appropriation 0400, BA 3, PE 1206310SDA, Space Science and Technology Research and Development, Project 012, Space Development Agency R&E.

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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), 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.