Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force											Date: April 2022	
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 1206761SF / *Protected Tactical Service (PTS)*							
COST ($ in Millions)	**Prior Years**	**FY 2021**	**FY 2022**	**FY 2023 Base**	**FY 2023 OCO**	**FY 2023 Total**	**FY 2024**	**FY 2025**	**FY 2026**	**FY 2027**	**Cost To Complete**	**Total Cost**
Total Program Element	-	193.291	229.329	294.828	0.000	294.828	360.442	348.957	345.692	465.268	Continuing	Continuing
643728: *Protected Tactical SATCOM*	-	193.291	229.329	294.828	0.000	294.828	360.442	348.957	345.692	465.268	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The global threat of electronic warfare attacks against space systems will expand in the coming years in both number and types of weapons. Threat development will very likely focus on jamming capabilities against dedicated military satellite communications. To address this critical threat, the Space Force is developing the Protected Anti-jam Tactical Satellite Communications (PATS) family-of-systems, Protected Tactical Satellite Communications (PTS) program to mitigate adversarial jamming effects. PTS provides worldwide and polar, beyond-line-of-sight, Anti-Jam (AJ), low- probability-of intercept communications in benign and highly-contested environments utilizing the Protected Tactical Waveform (PTW). PTS, with its on-board payload processing and antenna design, enables reliable tactical satellite communications within close proximities to adversarial jammers. The system also employs interfaces consistent with United States Space Force's on-going resilience initiatives; thereby enhancing mission assurance, resiliency, and interoperability.

The Space Force is utilizing FY 2016 National Defense Authorization Act, Middle Tier of Acquisition for Rapid Prototyping authority and Section 815, Other Transaction Authority (OTA), to achieve an affordable, rapid, operational capability for the tactical warfighter. This strategy employs spiral payload development to progressively and incrementally deploy prototypes with residual capabilities demonstrated in an operational environment. These spiral payload prototypes demonstrate innovative anti-jam technologies with modular and scalable payloads to meet validated military needs for protected tactical communications. This includes technical baseline development, systems engineering trade analyses, internal/external system integration and development, candidate system architecture evaluations, risk reduction demonstrations, prototyping concepts development, system testing, and enabling technologies maturation.

PTS includes a space segment, ground segment, and gateway segment. For the space segment, the Space Force strategy utilizes a payload-centric focus to enable an affordable, resilient space architecture. This enables hosting and rideshare opportunities with other US government, commercial, International Partner satellites or integration onto a commodity satellite bus. For the ground segment, PTS leverages the Enterprise Ground Service (EGS) for satellite command and control, and the Protected Tactical Enterprise Service (PTES) rapid prototyping activity for mission and key management planning. The PTS gateway segment enables tactical warfighters reach back to global DoD Information Network. The PTS user terminal segment, not included in this PTS acquisition, will be procured by the military services utilizing low-cost PTW modem upgrades enabled by the Air Force-Army Anti-Jam Modem (A3M) ACAT III program and the Navy Wideband Anti-Jam Modem System (WAMS) technology demonstration program.

Space acquisition must respond with speed and agility to emerging adversary threats. Space System Command (SSC) has transformed the organization and implementation of space acquisition to an enterprise approach, maximizing innovation and resiliency, leveraging international, commercial, and mission partnerships, and managing program/project priorities according to an integrated unclassified/classified enterprise space architecture. Expanding the appropriate acquisition

authorities and contract mechanisms to deliver capability sooner, SSC will strategically execute experimentation, prototyping, risk reduction, and other efforts to develop new or repurpose existing capabilities.

This program element may include necessary civilian pay expenses required to manage, execute, and deliver PTS weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 1206392SF and 1206398SF.

The total cost of the PTS program Middle Tier of Acquisition effort is $916M, including RDT&E and procurement of prototype units. PTS Rapid Prototype Middle Tier of Acquisition effort is fully funded across the Future Years Defense Program.

This effort is in Budget Activity 4, Advanced Component Development and Prototypes (ACD&P), because efforts are necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment.

B. Program Change Summary ($ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	200.178	243.285	0.000	0.000	0.000
Current President's Budget	193.291	229.329	294.828	0.000	294.828
Total Adjustments	-6.887	-13.956	294.828	0.000	294.828
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	0.000	-13.956			
• 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	-6.887	0.000			
• Other Adjustments	0.000	0.000	294.828	0.000	294.828

Change Summary Explanation

FY 2021: -$6.887M SBIR/STTR transfer.
FY 2022: -$13.956M Congressional Directed Reduction.
FY 2023: +$294.828M; The FY 2022 President's Budget submittal did not reflect FY 2023 through FY 2026 funding. Therefore, an explanation of the change between the two budget positions for FY 2023 cannot be made in a relevant manner.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
Title: Technical Baseline Management and System Integration	25.146	29.327	38.531
Description: Perform as Government system integrator function through acquiring, designing, testing, and integrating key prototype segments and interfaces. Mature technical baseline and interface requirements for the prototype system. Conduct			

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force	Date: April 2022
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 1206761SF *I Protected Tactical Service (PTS)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
architectural engineering and system level integration planning for the PTS space, ground, and gateway segments. Support, configure, and conduct integrated testing of the major PTS subsystems, segments, and end-to-end prototype system. Manage the PTS open system architecture, refine interface requirements, and validate concept of operations through integrated system performance demonstrations. ***FY 2022 Plans:*** Support prototype capability and interface maturity demonstrations of up to two flight prototype payloads. Iteratively incorporate critical lessons from demonstrations into maturation and refinement of the technical baseline and system architecture. Identify and mitigate program risks through the use of engineering trades, supported by the major design reviews and ongoing progress demonstrations. Continue managing key system interfaces for prototype Ground, Space, and Gateway Segments. Provide integration support for these components, along with the Space Hub End Cryptographic Unit (ECU) to the prototype payload contractors. Support PATS level integration and reduce risks to integrating with PTES and other partner programs. Conduct key interface tests between the PTS prototype and emulators/simulators to reduce risk prior to entering Build and Test phase of the payload. ***FY 2023 Plans:*** Continue prototype capability development and interface maturity demonstrations of two prototype payloads. Incorporate critical lessons from demonstrations into maturation and refinement of the technical baseline and system architecture. Engineering trades identified during ongoing progress demonstrations will continue to provide the necessary mitigation steps for program risks. Continue to manage key system interfaces for prototype Ground, Space, and Gateway Segments. Conduct Lead System integration for these components, along with the Space Hub End Cryptographic Unit (ECU) interfaces to the prototype payload contractors. Conduct key interface tests between the PTS prototype and emulators/simulators to reduce risk to PATS level integration with PTES and other partner programs. Continue testing, characterizing, and demonstrating anti-jam communication capabilities. Continue Ground CONOPS architecture development. Begin coordinating with national and international agencies for orbital slots and frequency allocation. Conduct launch planning and activities to include Space Vehicle and Launch Vehicle integration studies and coordination. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 increased due to the start of system level integration and testing, to include managing the system interfaces to the Ground, Space, and Gateway segments, and the start of launch planning.			
Title: Space Hub End Cryptographic Unit (ECU)	3.319	6.110	3.418
Description: Develop a single, National Security Agency (NSA) certified, space-flight qualified, production-ready Space Hub ECU for integration with the PTS payloads. Initiate execution of engineering and design work in advance of rapid prototype design and			

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force	Date: April 2022
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 1206761SF *I Protected Tactical Service (PTS)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
development to alleviate critical path risks to the launch of PTS payloads. Conduct requirements reviews, functional and design reviews, PTS interface development, Interface Control Document (ICD) coordination, and payload integration with PTS vendors. ***FY 2022 Plans:*** Complete development, and functional tests of Space Hub ECU. Obtain NSA certification. Conduct flight acceptance testing on production ready assemblies. Provide integration support to facilitate final flight delivery to enable payload build and test activities. ***FY 2023 Plans:*** Continue ECU build and final testing of production (flight ready) units to receive NSA certification and then deliver ECU to payload contractors for integration. Conduct quick reaction for ECU troubleshooting/deficiency resolution during payload integration. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 decreased due to the completion of the ECU build and test phase.			
Title: PTS Rapid Prototype Design and Development ***Description:*** Rapid prototyping of PTS space, ground, and gateway segments and key system components. Develop, demonstrate, test, and evaluate PTS hardware and software systems. Design and develop modular, scalable payloads to support hosted or free-flyer configurations. Demonstrate prototype payload performance on-orbit. Evaluate PTS concept of operations with user participation and enable potential residual operational capability. Mature and validate user requirements. Continue prototyping and risk reduction efforts. ***FY 2022 Plans:*** Complete the acquisition of vital prototype Ground and Gateway Segment equipment to enable testing and initial operations of prototype payloads. Continue development and design of Space Segment specific interfaces between the Ground and Gateway Segments of the PTS System. Continue developing, purchasing, and delivering government furnished software and hardware to allow ongoing demonstrations of prototype technology. Conduct Critical Design Review equivalent reviews and critical progress demonstrations to afford important feedback and maturation opportunities to the two remaining prototype contractors. Execute integration of bus and payloads to support capability demonstrations. Continue program office and other related support activities that may include, but are not limited to studies, technical analysis, prototyping, etc. ***FY 2023 Plans:*** Continue build, integration and testing for two competing prototype payloads. Complete prototype payload build, integration and testing. Continue build and integration of government furnished software and hardware. Continue development, build, integration and test/demonstrations of ground and gateway terminal with payload prototypes to reduce system level risk. Begin payload to space vehicle integration and testing. Conduct space vehicle to launch vehicle integration studies/coordination. Continue Engineering and Manufacturing Development (EMD) Phase acquisition planning. Receive approval of EMD Acquisition Strategy	164.826	179.146	231.369

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force	Date: April 2022
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 1206761SF *I Protected Tactical Service (PTS)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
and permission to release Request for Proposal. Rapidly respond to implement system resiliency and situational awareness necessary to operate in the contested space domain. Activities include, but are not limited to program office support, studies, technical analysis, experimentation, prototyping, etc. ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 increased to support final prototype payload build, integration and test activities for two payloads.			
Title: Protected Tactical Testbed ***Description:*** Protected Tactical Testbed provides a government gold standard of reference for risk reduction and experimentation on critical technology elements for the space payload, terminals and networking segments of the PATS system. It enables system integration capabilities with industry and FFRDC partners for interoperability testing and conducting experiments to mature the PATS operations, with a focus on the Protected Tactical Waveform (PTW). ***FY 2022 Plans:*** This is not a new start. This major thrust was transferred from PE1206431SF, Advanced EHF MILSATCOM (SPACE), in FY 2022. Testbed assets will continue to be used by both the government and contractor teams to support the PATS mission through vital system integration and demonstration events leading into their various major design reviews and essential risk reduction activities. Demonstrate interoperability between the Payload and the MMS, interoperability/interface and control of the Space Hub Integrated ECU Leading Edge Development (SHIELD) to the Payload, and compatibility with PATS user terminals. Perform eleven PTW Lead Service duties the Air Force is required to perform to ensure PTW will support the Department's Core Waveform program, to include verification of the PTW modem interoperability with the joint force. Utilize Joint SATCOM Engineering Center (JSEC) expertise to execute and enable critical testing activities for prototype payload contractors. Support the development and testing of the PTS Ground Entry Terminal Prototype (PGET-P). Support multi-service development of PATS user terminals (Army-Air force Anti-jam Modem and Navy WAMS) and final development stages of the PTES ground elements as they approach Mission Operational Test and Evaluation (MOT&E) and Initial Operational Capability (IOC). Continue use in outreach efforts to potential coalition partners and other emerging users, building upon demonstrations in FY 2020 and FY 2021 to demonstrate capability using their space, ground, and user terminal assets. ***FY 2023 Plans:*** Demonstrate interoperability between the Payload and the PTES Mission Management System, interoperability/interface and control of the ECU to the Payload, and compatibility with PATS user terminals. Conduct PTW Lead Service duties to demonstrate that PTW will support the department's Core Waveform program, to include verification of the PTW modem interoperability with the joint force. Joint SATCOM Engineering Center (JSEC) executes and enables critical testing activities for prototype payload contractors. Ensures the development process and impending product adhere to the tenets defined by the established requirements. Continue multi-service development of PATS user terminals (Army-Air force Anti-jam Modem and Navy WAMS) and	0.000	14.746	21.510

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force	Date: April 2022
Appropriation/Budget Activity 3620F: *Research, Development, Test & Evaluation, Space Force I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 1206761SF *I Protected Tactical Service (PTS)*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022	FY 2023
final development stages of the PTES delivery. Continue use in outreach efforts to potential coalition partners and other emerging users to demonstrate capability using their space, ground, and user terminal assets ***FY 2022 to FY 2023 Increase/Decrease Statement:*** FY 2023 increased to support requirements for system and payload integration testing as well as launch readiness.			
Accomplishments/Planned Programs Subtotals	193.291	229.329	294.828

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

E. Acquisition Strategy

The PTS team utilizes the FY 2016 National Defense Authorization Act Middle Tier Acquisition guidance for Rapid Prototyping/Rapid Fielding and Section 815 OTA guidance in developing the acquisition strategy. This strategy places an emphasis on the rapid prototyping, production, and incremental iteration of PTS capability. This strategy takes the form of a series of successively honed and tailored spirals, focusing on payload development and hosting opportunities and incorporating lessons learned from Milstar, Enhanced Polar System (EPS), EPS-Recapitalization, Advanced Extremely High Frequency, PTES, and commercial SATCOM practices.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3620F / 4	**R-1 Program Element (Number/Name)** PE 1206761SF / *Protected Tactical Service (PTS)*	**Project (Number/Name)** 643728 / *Protected Tactical SATCOM*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Protected Tactical SATCOM Rapid Prototyping	C/FFP	Boeing & Northrop Grumman : Various	-	158.347	Jan 2021	172.495	Nov 2021	223.338	Nov 2022	-		223.338	Continuing	Continuing	-
Space Hub End Cryptographic Unit (ECU)	C/CPIF	L3Harris East : Camden, NJ	-	3.319	Jan 2021	6.111	Jan 2022	3.417	Jan 2023	-		3.417	Continuing	Continuing	-
Protected Tactical Testbed	Various	Various : Various	-	-		14.745	Dec 2021	21.510	Dec 2022	-		21.510	Continuing	Continuing	-
Technical Mission Analysis	MIPR	Aerospace : El Segundo, CA	-	9.102	Nov 2020	10.334	Nov 2021	12.428	Nov 2022	-		12.428	Continuing	Continuing	-
Enterprise SE&I	Various	Various : Various	-	16.149	Jan 2021	17.793	Jan 2022	24.904	Jan 2023	-		24.904	Continuing	Continuing	-
		Subtotal	-	186.917		221.478		285.597		-		285.597	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2021 Cost	FY 2021 Award Date	FY 2022 Cost	FY 2022 Award Date	FY 2023 Base Cost	FY 2023 Base Award Date	FY 2023 OCO Cost	FY 2023 OCO Award Date	FY 2023 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FFRDC	MIPR	Aerospace : El Segundo, CA	-	1.068	Nov 2020	1.090	Nov 2021	1.334	Nov 2022	-		1.334	Continuing	Continuing	-
A&AS	Various	Various : Various	-	5.300	Nov 2020	6.661	Nov 2021	7.397	Nov 2022	-		7.397	Continuing	Continuing	-
Other Support	Various	Various : Various	-	0.006	Nov 2020	0.100	Nov 2021	0.500	Nov 2022	-		0.500	Continuing	Continuing	-
		Subtotal	-	6.374		7.851		9.231		-		9.231	Continuing	Continuing	N/A

	Prior Years	FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	193.291		229.329		294.828		-		294.828	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3620F / 4	**R-1 Program Element (Number/Name)** PE 1206761SF / *Protected Tactical Service (PTS)*	**Project (Number/Name)** 643728 / *Protected Tactical SATCOM*

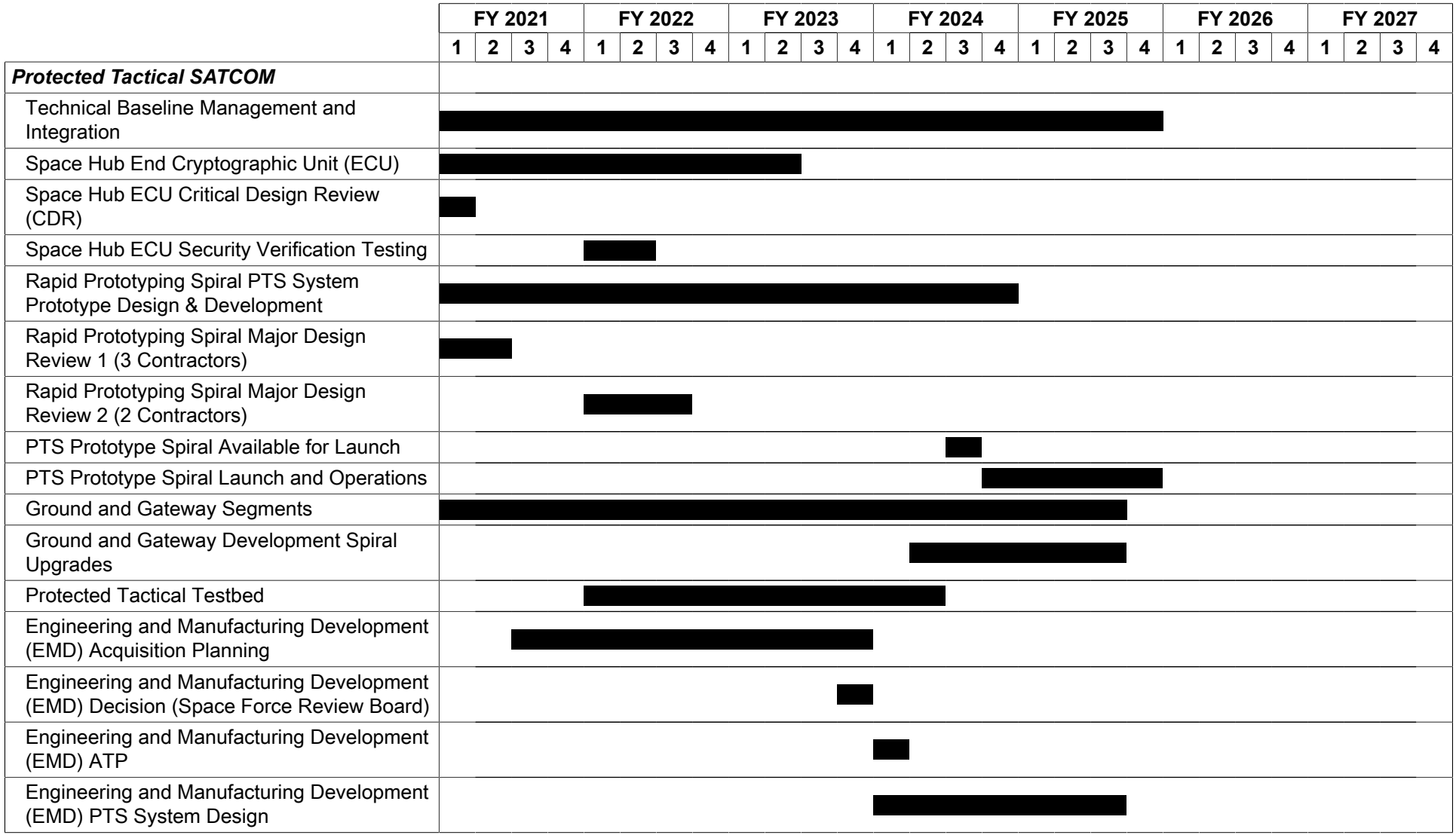

Exhibit R-4, RDT&E Schedule Profile: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3620F / 4	**R-1 Program Element (Number/Name)** PE 1206761SF / *Protected Tactical Service (PTS)*	**Project (Number/Name)** 643728 / *Protected Tactical SATCOM*

	FY 2021				FY 2022				FY 2023				FY 2024				FY 2025				FY 2026				FY 2027			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Engineering and Manufacturing Development (EMD) Build and Test																												

Exhibit R-4A, RDT&E Schedule Details: PB 2023 Air Force		Date: April 2022
Appropriation/Budget Activity 3620F / 4	**R-1 Program Element (Number/Name)** PE 1206761SF / *Protected Tactical Service (PTS)*	**Project (Number/Name)** 643728 / *Protected Tactical SATCOM*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Protected Tactical SATCOM				
Technical Baseline Management and Integration	1	2021	4	2025
Space Hub End Cryptographic Unit (ECU)	1	2021	2	2023
Space Hub ECU Critical Design Review (CDR)	1	2021	1	2021
Space Hub ECU Security Verification Testing	1	2022	2	2022
Rapid Prototyping Spiral PTS System Prototype Design & Development	1	2021	4	2024
Rapid Prototyping Spiral Major Design Review 1 (3 Contractors)	1	2021	2	2021
Rapid Prototyping Spiral Major Design Review 2 (2 Contractors)	1	2022	3	2022
PTS Prototype Spiral Available for Launch	3	2024	3	2024
PTS Prototype Spiral Launch and Operations	4	2024	4	2025
Ground and Gateway Segments	1	2021	3	2025
Ground and Gateway Development Spiral Upgrades	2	2024	3	2025
Protected Tactical Testbed	1	2022	2	2024
Engineering and Manufacturing Development (EMD) Acquisition Planning	3	2021	4	2023
Engineering and Manufacturing Development (EMD) Decision (Space Force Review Board)	4	2023	4	2023
Engineering and Manufacturing Development (EMD) ATP	1	2024	1	2024
Engineering and Manufacturing Development (EMD) PTS System Design	1	2024	3	2025
Engineering and Manufacturing Development (EMD) Build and Test	3	2025	4	2027