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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 1206431F / <i>Advanced EHF MILSATCOM (SPACE)</i>
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COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
Total Program Element	0.000	139.927	117.290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	257.217
657104: <i>MILSATCOM Space Modernization Initiative (SMI)</i>	0.000	139.927	117.290	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	257.217
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	

Program MDAP/MAIS Code: 261

A. Mission Description and Budget Item Justification

In FY 2021, PE 1206431F, Advanced EHF MILSATCOM (Space) efforts were transferred to Appropriation 3620, Research, Development, Test & Evaluation, Space Force, PE 1206431SF, Advanced EHF MILSATCOM (Space) from Appropriation 3600, Budget Activity 05 due to the creation of a new Appropriation for Space Force.

The Air Force ability to deliver global satellite communications (SATCOM) is unprecedented, and the joint warfighter relies on this capability at all levels and across the range of military operations. SATCOM provides survivable communications for Presidential support and nuclear command and control, and affords national and military leaders a means to maintain strategic situational awareness and convey their intent to the Joint Force Commander (JFC). In order for the United States to maintain its asymmetric advantage of global space-based communications, the SATCOM enterprise must be prepared to "fight SATCOM" as a single enterprise through a Contested, Degraded and Operationally-limited (CDO) environment, prevent or withstand loss, and continue to deliver effects to warfighters.

The Space Modernization Initiative (SMI) strategy is to evolve current and future SATCOM systems to meet the needs of an integrated "Fighting SATCOM" Enterprise, sustain the existing AEHF system capability, develop a more affordable and resilient SATCOM enterprise capable of meeting near term and emerging requirements, demonstrate technologies and Concepts of Operations (CONOPS) that lead to a future Protected Anti-Jam Tactical SATCOM (PATs) capability that provides tactical level Military SATCOM (MILSATCOM) users protected, anti-jam satellite communications while operating in a contested environment, and develop an integrated (Commercial SATCOM (COMSATCOM and MILSATCOM) "Fighting SATCOM" Enterprise. PATs will provide tactical users significantly higher data rates than AEHF and a security architecture that enables forward deployed users to have protected satellite communications in scenarios where AEHF terminals cannot be deployed.

Under this construct the SMI will: 1) Continue the Capabilities Insertion Program (CIP) to enhance the current AEHF constellation and Protected Communications performance, and improve system operational resiliency, 2) Invest in technologies and demonstrations (e.g. Protected Tactical Service Field Demonstration (PTSFD)) that enable the future Protected Tactical Enterprise Service (PTES) and SATCOM programs by continued development of the Protected Tactical Testbed, and demonstrating resilient and affordable wideband protected technologies and CONOPS, 3) Demonstrate and develop a roadmap to evolve the current stove piped MILSATCOM Command and Control (C2) management system into an integrated "Fighting SATCOM" Enterprise, 4) Develop and demonstrate flexible terminal interface technologies with Services and SATCOM Terminal providers, and 5) Develop and demonstrate an improved integration of ground gateways and data networking with the space segment with the goal of providing seamless end to end SATCOM service for the warfighters in a CDO environment.

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Space acquisition must respond with speed and agility to emerging adversary threats. Space & Missile Systems Center (SMC) is transforming 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, SMC will strategically execute experimentation, prototyping, risk reduction, and other efforts to develop new or repurpose capabilities.

This program is in Budget Activity 5, System Development and Demonstration (SDD) because it has passed Milestone B approval and is conducting engineering and manufacturing development tasks aimed at meeting validated requirements prior to full rate production.

B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	144.753	117.290	113.469	0.000	113.469
Current President's Budget	139.927	117.290	0.000	0.000	0.000
Total Adjustments	-4.826	0.000	-113.469	0.000	-113.469
• 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	-4.826	0.000			
• Other Adjustments	0.000	0.000	-113.469	0.000	-113.469

Change Summary Explanation

FY2021: Funds were transferred from RDT&E, Air Force to RDT&E, Space Force.

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
Title: Capabilities Insertion Program (CIP)	88.183	89.915	0.000
Description: Develop software that will increase the current AEHF constellation and Protected Communications capabilities, broaden overall user base, and accommodate a larger user population through improved resource utilization efficiencies. Develop modifications that will improve the Protected mission operational resiliency. Develop software to increase current AEHF terminal data rates with adaptive coding algorithms. Invest in technology demonstrations that improve the operational mission resiliency and effectiveness for all protected capabilities, which include, but are not limited to; Rapid Adaptive Planning and Situational Awareness for the Warfighter (RAPSAW), Mission Planning Element (MPE) 8.4, Cyber Defense-in-depth, etc.			
FY 2020 Plans:			

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p>Continue Advanced AEHF Capabilities Augmentation development, eXtreme Data Rate (XDR) Transition Development and Endurance Mission Re-plan to provide crypto and survivability improvements. Maintain user communication when fixed site support is unavailable, adds capability for planning downlink resources and other improvements. Complete Operational Resiliency (OR2/2B) Phase 1 4Q FY 2020. Begin OR2/2B Phase 2 (i.e., Engineering analysis and Flight software) contract award. Begin capability improvements to the AEHF system with awarding MPE 8.4; improving the wideband EHF beyond line of sight terminal (WEB-T) functionality and crypto redesign, while also closing the final six remaining CAT IU deficiency report (DR) IOC liens. Begin RAPSAW; a resiliency effort that decreases the mission planning timelines, de-conflicts communication planning for the operators, and provides enhanced situational awareness of payload and terminal resources. Invest in technology demonstrations that improve the operational mission resiliency and effectiveness for all protected capabilities. Begin development of watcher spacecraft based anomaly detection efforts. Other activities may include, but are not limited to W/V Frequency utility, combat cloud, crosslinks, etc. Continue program office and other related support activities that may include, but are not limited to studies, technical analysis, prototyping, etc.</p> <p>FY 2021 Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: N/A</p>				
<p>Title: Protected Tactical Testbed</p> <p>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. Supports the hardware development of the hub component for the PTES ground system and any necessary test capabilities to support either the over-the-air (OTA) or laboratory demonstrations for the PTSFD. 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).</p> <p>FY 2020 Plans: Complete the first phase of over the air testing with the Hub and Wideband Global SATCOM (WGS) as well as Commercial satellite assets. Complete compatibility testing between the ground testbed and Terminal Modem (TM) Line Replaceable Unit (LRU). Complete Hub capability to PTES and Protected Tactical SATCOM (PTS) risk reduction events.</p> <p>FY 2021 Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement:</p>		13.441	9.450	0.000

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
N/A				
<p>Title: Protected Tactical Waveform (PTW) Modem Development and Demonstrations</p> <p>Description: Develop, demonstrate, test and evaluate PTW modems and components capable of being integrated into existing Army, Air Force, and Navy tactical satellite communication terminals spanning ground, aerial, and naval environments such as the Army's Satellite Transportable Terminal (STT), the Air Force's Ground Multiband Terminal (GMT), airborne terminals, and the Navy Multiband Terminal (NMT). This includes associated End Cryptographic Unit (ECU) development, testing, National Security Agency (NSA) certification, and integration with PTW modems. Conduct trade space and requirements definition with the military Services and terminal program offices to support future PTW-related capabilities. Identify potential assets such as ground hubs and information assurance components that can be further developed by future PTW-related programs. Explore opportunities and releasability of PTW-related technologies to International Partners. PTSFD is a technology demonstration that will develop and demonstrate prototype TM LRUs utilizing PTW over wideband space/ground systems. PTSFD includes an option to demonstrate over a commercial SATCOM system and design and build the MMS simulator. The PTSFD will demonstrate an Anti-Jam (AJ) and Low Probability of Intercept (LPI)/Low Probability of Detection (LPD) communications capability that can be provided to tactical users in all Services through fielded terminals, existing wideband MILSATCOM assets, and potential COMSATCOM assets.</p> <p>FY 2020 Plans: Complete PTSFD Modem Certification testing with Army Strategic Command (ARSTRAT). Complete PTSFD Payload Hardware Equipment Chain (PHEC) testing to verify compatibility using a WGS emulation on the ground prior to the WGS and Commercial satellite demo. Complete OTA technology demonstrations over WGS and commercial satellites for PTSFD and conduct the second Systems Integration Laboratory (SIL) test.</p> <p>FY 2021 Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: N/A</p>		38.303	4.925	0.000
<p>Title: Army-Air Force Anti-Jam Modem (A3M)</p> <p>Description: The A3M will develop PTW modems that meet all environmental, integration, and mission requirements for STT and GMT tactical users. A3M development includes fabrication of pre-production modems, development of operator training materials, fielding, and sustainment planning.</p> <p>FY 2020 Plans:</p>		0.000	13.000	0.000

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
A3M is not a New Start as it was previously included in the "Protected Tactical Waveform (PTW) Modem Development and Demonstrations" major thrust and funded in FY 2020 plans. FY 2021 Plans: N/A FY 2020 to FY 2021 Increase/Decrease Statement: N/A			
Accomplishments/Planned Programs Subtotals	139.927	117.290	0.000

D. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u> <u>Base</u>	<u>FY 2021</u> <u>OCO</u>	<u>FY 2021</u> <u>Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
• SPAF 01 ADV555: <i>Advanced EHF</i>	28.329	21.894	-	-	-	-	-	-	-	0.000	50.223

Remarks

E. Acquisition Strategy
 A3M is an ACAT III program. A3M leverages the PTSFD technology maturation resulting in a low risk development effort delivering pre-production modems with 100% production ready components. This will include certified ECUs for full scope operational and cyber testing, operator and maintainer training materials, and all required intellectual property rights, provisioning documentation, and training materials to enable swift terminal modification for operational use and sustainment. The development phase will deliver pre-production PTW capable modems ready for "build to print" production. Blended developmental and operational testing is expected to include full environmental, blue, and red team testing prior to the production decision.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force												Date: February 2020			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
3600 / 5				PE 1206431F / Advanced EHF MILSATCOM (SPACE)				657104 / MILSATCOM Space Modernization Initiative (SMI)							
Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	C/CPAF	Not specified. : TBD	0.000	-		-		-		-		-	0.000	0.000	-
Capabilities Insertion Program (CIP)	SS/CPIF	Lockheed Martin : Sunnyvale, CA	0.000	83.940	Jun 2019	72.766	Oct 2019	-		-		-	0.000	156.706	-
W/V Frequency utilization demonstration	MIPR	AFRL : Various	0.000	-		8.600	Nov 2019	-		-		-	0.000	8.600	-
Protected Tactical Service Field Demonstration (PTSFD)	Various	Various : Various	0.000	15.253	Oct 2018	4.395	Oct 2019	-		-		-	0.000	19.648	-
PTSFD (Modem) Contractor 1	C/CPIF	L3 : Camden, NJ	0.000	8.315	Dec 2018	1.621	Nov 2019	-		-		-	0.000	9.936	-
PTSFD (Modem) Contractor 2	C/CPIF	VIASAT : Carlsbad, CA	0.000	3.031	Dec 2018	1.509	Nov 2019	-		-		-	0.000	4.540	-
PTSFD (Modem) Contractor 3	C/CPIF	Raytheon : Marlborough, MA	0.000	8.010	Dec 2018	1.695	Nov 2019	-		-		-	0.000	9.705	-
PTSFD (Mission Management System simulator)	MIPR	Aerospace : El Segundo, CA	0.000	1.408	Nov 2018	-		-		-		-	0.000	1.408	-
Protected Tactical Testbed	Various	Various : Various	0.000	6.701	Dec 2018	9.450	Dec 2019	-		-		-	0.000	16.151	-
A3M PTW Modem Development	C/TBD	TBD : TBD	0.000	-		13.000	Jan 2020	-		-		-	0.000	13.000	-
Fighting SATCOM Enterprise	TBD	Not specified. : TBD	0.000	-		-		-		-		-	0.000	0.000	-
Technical Mission Analysis	MIPR	Aerospace : El Segundo, CA	0.000	3.622	Nov 2018	-		-		-		-	0.000	3.622	-
Enterprise SE&I	C/CPAF	Linguest : Los Angeles, CA	0.000	6.740	Jun 2019	-		-		-		-	0.000	6.740	-
Subtotal			0.000	137.020		113.036		-		-		-	0.000	250.056	N/A

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Air Force		Date: February 2020
Appropriation/Budget Activity 3600 / 5	R-1 Program Element (Number/Name) PE 1206431F / <i>Advanced EHF MILSATCOM (SPACE)</i>	Project (Number/Name) 657104 / <i>MILSATCOM Space Modernization Initiative (SMI)</i>

	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	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
MILSATCOM Space Modernization Initiative																												
CIP: MPE 8.3 Endurance Mission Replan (EMR)																												
CIP: MPE 8.4 Design Release																												
CIP: Operational Resiliency - Phase 1																												
CIP: Operational Resiliency - Phase 2																												
W/V Frequency Utilization demonstration																												
Protected Tactical Testbed: Support End to End OTA Demonstration (TM LRU, MMS, PHEC)																												
A3M PTW Modem RFP, Source Selection/ Contract Award																												
A3M PTW Modem SFRR, PDR, CDR																												

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Air Force		Date: February 2020
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>MILSATCOM Space Modernization Initiative</i>				
CIP: MPE 8.3 Endurance Mission Replan (EMR)	1	2019	3	2020
CIP: MPE 8.4 Design Release	2	2020	4	2020
CIP: Operational Resiliency - Phase 1	1	2019	4	2020
CIP: Operational Resiliency - Phase 2	2	2020	4	2020
W/V Frequency Utilization demonstration	2	2020	4	2020
Protected Tactical Testbed: Support End to End OTA Demonstration (TM LRU, MMS, PHEC)	2	2019	4	2020
A3M PTW Modem RFP, Source Selection/Contract Award	4	2019	3	2020
A3M PTW Modem SFRR, PDR, CDR	4	2020	4	2020