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

Appropriation/Budget Activity 3620F: <i>Research, Development, Test & Evaluation, Space Force I BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 1206432SF / <i>Polar 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	0.000	0.000	190.235	0.000	190.235	129.455	35.539	10.069	0.000	10.342	375.640
654215: <i>EPS Recap</i>	0.000	0.000	0.000	190.235	0.000	190.235	129.455	35.539	10.069	0.000	10.342	375.640
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	-

Program MDAP/MAIS Code: 121

A. Mission Description and Budget Item Justification

In FY 2021, PE 1206432F, Polar MILSATCOM (SPACE) efforts were transferred to Appropriation 3620, Research, Development, Test & Evaluation, Space Force, PE 1206432SF, Polar MILSATCOM (SPACE) from Appropriation 3600, Budget Activity 05 due to the creation of a new Appropriation for Space Force.

This program element acquires the Polar MILSATCOM system that provides protected communications (anti-jam and low probability of intercept and detection) for users in the North Polar Region.

In FY 2006, the DoD began funding EPS. The host spacecraft and the polar communications packages took advantage of the Advanced Extremely High Frequency (AEHF) technology including the eXtended Data Rate (XDR) waveform. The EPS Capability Development Document (CDD), approved by the Joint Requirements Oversight Council in September 2006, is based on a two-package, hosted XDR program with operational availability in CY 2015 and CY 2017. EPS is comprised of four segments: Payload, Ground Control, Gateway, and Terminal (acquired by each Service's Terminal Program Office). Milestone B review was completed April 2, 2014.

In FY 2019, the USAF and Norwegian Ministry of Defense signed the Arctic Memorandum of Agreement, which enforces the international collaboration with Norway to host two EPS-Recapitalization (EPS-R) payloads on Space Norway-procured spacecraft. Beginning FY 2020, the EPS-R effort transferred from Program Element 1206434F, Midterm Polar MILSATCOM System to Program Element 1206432F, Polar MILSATCOM (SPACE). In FY 2021, EPS-R continues to develop and acquire two Extremely High Frequency (EHF) payloads hosted on Space Norway-procured spacecraft and continues to upgrade/modify the existing EPS Ground Control and Gateway.

The FY 2021 funding request was reduced by \$1.702 million to account for the availability of prior year execution balances.

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.

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This program element may include necessary civilian pay expenses required to manage, execute, and deliver Polar MILSATCOM 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.

Funding in this exhibit was previously budgeted in PE 0605432F, Polar MILSATCOM (SPACE), and PE 1206434F, Midterm Polar MILSATCOM System.

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	0.000	0.000	0.000	0.000	0.000
Current President's Budget	0.000	0.000	190.235	0.000	190.235
Total Adjustments	0.000	0.000	190.235	0.000	190.235
• 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	0.000	0.000			
• Other Adjustments	0.000	0.000	190.235	0.000	190.235

Change Summary Explanation

FY 2021: +\$190.235M; funds starting in FY 2021 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: Space Segment	0.000	0.000	103.837
Description: Develop and acquire two EHF payloads, using AEHF's XDR waveform, for integration on host spacecraft.			
FY 2020 Plans: N/A			
FY 2021 Plans: Continue development, fabrication, and testing of the two EPS-R payloads that were initiated in FY 2018. Ship one of two payloads to space vehicle (SV) vendor for integration onto the SV. Continue developing interface documentation and integration plans with international partner. Fund FY 2021 USAF share of Arctic Memorandum of Agreement (MOA) collaboration costs for hosting of the EPS-R payloads. Facilitate coordination between Space Norway, space vehicle vendor, and payload contractor.			

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2019	FY 2020	FY 2021
<p>Provide representation, technical expertise, and assistance as necessary at Space Norway and/or space vehicle vendor facilities to support activities including payload integration and testing. Continue cyber certification efforts to include crypto procurement activities. Support development and integration for the EPS-R system strategic requirements. Rapidly respond to implement system resiliency and situational awareness necessary to operate in the contested space domain. Activities may include, but are not limited to program office support, studies, technical analysis, experimentation, prototyping, etc.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: N/A</p>				
<p>Title: Ground Updates</p> <p>Description: Modify and upgrade the existing EPS CAPS to provide command and control and XDR mission planning capability for the two new payloads.</p> <p>FY 2020 Plans: N/A</p> <p>FY 2021 Plans: Continue risk reduction efforts on and upgrade CAPS. Conduct Software Item Qualification Test (SIQT) for EPS-R CAPS Software (SW) items. Deliver Factory Acceptance Test (FAT) SW build. Conduct integration testing demonstrating interoperability of EPS-R CAPS with space vehicle, Host ground, and EPS-R payload. Accomplish link functionality testing between EPS-R CAPS and Space Norway Space Operations Center (SOC) location. Support development and integration for the EPS-R system strategic requirements. Rapidly respond to implement system resiliency and situational awareness necessary to operate in the contested space domain. Activities may include, but are not limited to program office support, studies, technical analysis, experimentation, prototyping, etc.</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: N/A</p>		0.000	0.000	51.618
<p>Title: Gateway Updates</p> <p>Description: Modify and upgrade the existing EPS Gateway to support the two new payloads.</p> <p>FY 2020 Plans: N/A</p> <p>FY 2021 Plans:</p>		0.000	0.000	34.780

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2019	FY 2020	FY 2021
Execute risk reduction efforts, EPS Gateway upgrades, and system integration testing. Continue installation efforts for a second telemetry and control terminal. Upgrade additional telemetry and control terminals as necessary to support EPS-R. Support development and integration for the EPS-R system strategic requirements.			
<i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> N/A			
Accomplishments/Planned Programs Subtotals	0.000	0.000	190.235

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 Complete</u>	<u>Total Cost</u>
• RDTE 04 1206434F: <i>Midterm Polar MILSATCOM System</i>	370.353	-	-	-	-	-	-	-	-	0.000	370.353

Remarks

E. Acquisition Strategy
 Awarded payloads contract to Northrop Grumman Aerospace Systems (NGAS) and initiated fabrication of two EPS functional equivalent payloads in FY 2018 (PE 1206434F). In FY 2019, the USAF and Norwegian Ministry of Defence signed the Arctic Memorandum of Agreement, which enforces the international collaboration with Norway to host the two EPS-Recapitalization (EPS-R) payloads on the Space Norway-procured spacecraft. Conducted market research to identify industry capabilities and acquisition concepts. Awarded CAPS contract for EPS ground upgrade. Gateway updates will be accomplished by Naval Information Warfare Center Pacific, the EPS Gateway Segment developer. The program office initiates the procurement of a replacement terminal for the Telemetry and Command Terminal. This acquisition strategy updates the EPS Ground Segment to accommodate the EPS functional equivalent payloads and extend operations and sustainment beyond 2028. The U.S. Government will retain the system integrator role, as it was for EPS program of record.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Air Force **Date:** February 2020

Appropriation/Budget Activity 3620F / 5	R-1 Program Element (Number/Name) PE 1206432SF / Polar MILSATCOM (SPACE)	Project (Number/Name) 654215 / EPS Recap
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
EPS-R Tactical Payloads 1-2	SS/CPIF	NGAS : Redondo Beach, CA	-	-		-		84.933	Nov 2020	-		84.933	77.379	162.312	409.958
Control and Planning Segment Upgrades	SS/CPIF	NGMS : Redondo Beach, CA	-	-		-		42.221	Nov 2020	-		42.221	24.092	66.313	82.320
Gateway Upgrades	Various	Various : Various, CA	-	-		-		28.448	Nov 2020	-		28.448	26.191	54.639	68.895
Technical Mission Analysis	MIPR	Aerospace : El Segundo, CA	-	-		-		9.264	Nov 2020	-		9.264	12.088	21.352	-
Enterprise SE&I	C/CPAF	LinQuest : Los Angeles, CA	-	-		-		19.063	Nov 2020	-		19.063	17.357	36.420	-
Subtotal			-	-		-		183.929		-		183.929	157.107	341.036	N/A

Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
FFRDC	MIPR	Aerospace : El Segundo, CA	-	-		-		2.316	Oct 2020	-		2.316	3.697	6.013	-
A&AS	Various	Various : Various	-	-		-		3.840	Oct 2020	-		3.840	14.009	17.849	-
Other Support	Various	Various : Various	-	-		-		0.150	Oct 2020	-		0.150	0.250	0.400	-
Subtotal			-	-		-		6.306		-		6.306	17.956	24.262	N/A

	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract	
Project Cost Totals		-	-	0.000	190.235	-	190.235	175.063	365.298	N/A

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

Space Segment	
Payload Design/Build	████████████████████
International Collaboration w/ Norway	██
Space Vehicle Integration/Test	████████████████████████████
Payloads Ready to Ship	████████
Ground and Gateway Upgrades/ Modifications	
Risk Reduction Activities/Studies	██
Acquire Telemetry and Control Terminals	████████████████████████████
Upgrades/Modifications	██
System Level Integration and Test	██

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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
Space Segment				
Payload Design/Build	1	2021	1	2022
International Collaboration w/ Norway	1	2021	1	2024
Space Vehicle Integration/Test	4	2021	1	2023
Payloads Ready to Ship	4	2021	1	2022
Ground and Gateway Upgrades/Modifications				
Risk Reduction Activities/Studies	1	2021	4	2023
Acquire Telemetry and Control Terminals	1	2021	4	2022
Upgrades/Modifications	1	2021	4	2023
System Level Integration and Test	2	2021	1	2024