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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2019 Air Force **Date:** February 2018

<b>Appropriation/Budget Activity</b> 3600: <i>Research, Development, Test &amp; Evaluation, Air Force I BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 1206434F / <i>Midterm Polar MILSATCOM System</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	-	0.000	63.092	383.113	0.000	383.113	446.461	294.383	147.632	35.550	Continuing	Continuing
643720: <i>EPS Recapitalization</i>	-	0.000	63.092	383.113	0.000	383.113	446.461	294.383	147.632	35.550	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

The Enhanced Polar System Recapitalization (EPS-R) program will provide continuous, protected, Low Probability of Intercept/Low Probability of Detection communications to tactical and strategic warfighters in the North Polar Region in benign and contested environments. EPS-R will develop and acquire 1) two Extremely High Frequency (EHF) payloads, using Advanced EHF's eXtended Data Rate (XDR) waveform, on hosted spacecraft, 2) upgrades/modifications to the existing Enhanced Polar System (EPS) Control and Planning Segment (CAPS) to provide command and control and XDR mission planning capability, and 3) upgrades/modifications to the existing EPS gateway to provide connectivity between polar and midlatitude users through the Global Information Grid.

The EPS-R program is timed to prevent a gap in Arctic Military Satellite Communications (MILSATCOM) coverage after EPS end of life. To ensure polar MILSATCOM continuity beyond FY 2025, the DoD will begin funding activities to bridge the gap between the current EPS program and future protected systems being planned for the late 2020s. The EPS-R program has examined performance, mission needs, schedules, and costs to avoid a mission gap. EPS-R intends to host the payloads on a Space Norway bus, which is scheduled to launch in CY 2022. EPS-R will reuse EPS Gateway and ground control elements to the greatest extent feasible.

To meet the warfighter requirements for protected tactical and strategic polar MILSATCOM, RDT&E funding is required to continue program office and other related support activities that may include, but are not limited to studies, technical analysis, architectural development, acquisition strategy development, system requirements and system trades analysis, risk reduction activities, technology maturation, System Engineering, Integration and Test of all polar MILSATCOM segments and hosted payloads.

The current and future space domain demands that space systems be responsive to new and changing threats, and can rapidly integrate new capabilities to make our warfighting force more resilient in a contested battlespace. This agility, survivability, and rapid reconstitution must extend through the entire space warfighting enterprise, to include how we learn about the threat; develop solutions; acquire, test, deploy, train, operate and integrate new systems into the greater system of systems; and ensure our space mission force is ready to defeat a thinking adversary in a complex, multi-domain battlespace. The enterprise will use all of its elements to accelerate decision-making, prototype potential solutions, rapidly integrate decision-making tools and sustain a war-winning capability by delivering multi-domain effects in, from, and through space and cyberspace enabling battle management and resilience options to "fight through."

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

This program 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

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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019 Base</b>	<b>FY 2019 OCO</b>	<b>FY 2019 Total</b>
Previous President's Budget	0.000	63.092	189.075	0.000	189.075
Current President's Budget	0.000	63.092	383.113	0.000	383.113
Total Adjustments	0.000	0.000	194.038	0.000	194.038
• 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	194.038	0.000	194.038

**Change Summary Explanation**

FY 2019: +\$194.038: +\$196.921M to accelerate payload development in order to meet the Norway rideshare schedule, -\$2.883M inflation adjustment.

<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019</b>
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<b>Title:</b> Acquisition Strategy Development and Source Selection	0.000	35.931	0.000
<b>Description:</b> Conduct market research to inform the development of an acquisition strategy. Develop acquisition strategy and Request for Proposal. Release RFP to industry, conduct source selection, and award the development contract.			
<b>FY 2018 Plans:</b> Develop acquisition strategy and associated documentation required for EPS-R milestone decisions to comply with statutory and regulatory requirements. Develop Request for Proposal (RFP). Release EPS-R RFP to industry and conduct source selection. Award development contract and provide design and development oversight. Begin program office and other related support activities that may include, but are not limited to studies, technical analysis, etc.			
<b>FY 2019 Plans:</b> N/A			
<b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> This Major Thrust has changed since the FY 2018 PB submission. Three new Major Thrusts (Payload, Ground Upgrades, and Gateway Upgrades) were created to describe the accelerated system development/upgrades to meet the Space Norway launch scheduled in CY 2022.			
<b>Title:</b> Technical Baseline and Architectural Engineering	0.000	27.161	0.000

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>		<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019</b>
<p><b>Description:</b> Develop EPS-R technical baseline and architectural engineering.</p> <p><b>FY 2018 Plans:</b> Develop technical baseline and system requirements. Conduct studies to identify necessary upgrades/modifications to the EPS CAPS and EPS Gateway segment; execute risk reduction efforts and upgrades/modifications to sustain/modify these segments for MPS. Purchase long lead parts to drive down schedule risk. Conduct system architecture and trade analyses. Begin program office and other related support activities that may include, but are not limited to studies, technical analysis, etc.</p> <p><b>FY 2019 Plans:</b> N/A</p> <p><b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> This Major Thrust has changed since the FY 2018 PB submission. Three new Major Thrusts (Payload, Ground Upgrades, and Gateway Upgrades) were created to describe the accelerated system development/upgrades to meet the Space Norway launch scheduled in CY 2022.</p>				
<p><b>Title:</b> Payload</p> <p><b>Description:</b> Develop and acquire two Extremely High Frequency (EHF) payloads, using Advanced EHF's eXtended Data Rate (XDR) waveform, for integration on host spacecraft.</p> <p><b>FY 2018 Plans:</b> Payload effort was previously included in Major Thrusts "Acquisition Strategy Development and Source Selection" and "Develop Midterm Polar technical baseline and architectural engineering."</p> <p><b>FY 2019 Plans:</b> Continue development, production, and testing of the two payloads that were initiated in FY 2018. Conduct payload Critical Design Review. Develop interface documentation and integration plans with Space Norway. 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, prototyping, etc.</p> <p><b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> In FY 2019 additional funds were added to the program to accelerate Payload development to meet the Space Norway launch.</p>		0.000	0.000	333.667
<p><b>Title:</b> Ground Upgrades</p> <p><b>Description:</b> Modify and upgrade to the existing EPS Control and Planning Segment (CAPS) to provide command and control and XDR mission planning capability for the two new payloads.</p>		0.000	0.000	29.163

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<b>C. Accomplishments/Planned Programs (\$ in Millions)</b>	FY 2017	FY 2018	FY 2019
<p><b>FY 2018 Plans:</b> Ground Upgrades effort was previously included in Major Thrusts "Acquisition Strategy Development and Source Selection" and "Develop Midterm Polar technical baseline and architectural engineering."</p> <p><b>FY 2019 Plans:</b> Continue studies/risk reduction efforts on EPS CAPS Segment, issue Request For Proposal for tactical ground modifications, and award contract. 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, prototyping, etc.</p> <p><b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> In FY 2019 additional funds were added to the program to accelerate Ground Upgrades to meet the Space Norway launch and to support strategic requirements.</p>			
<p><b>Title:</b> Gateway Upgrades</p> <p><b>Description:</b> Modify and upgrade to the existing EPS Gateway Segment to support the two new payloads.</p> <p><b>FY 2018 Plans:</b> Gateway Upgrades effort was previously included in Major Thrusts "Acquisition Strategy Development and Source Selection" and "Develop Midterm Polar technical baseline and architectural engineering."</p> <p><b>FY 2019 Plans:</b> Continue studies/risk reduction efforts, and begin EPS Gateway Segment upgrades. Make preparations for installing a second telemetry and control terminal. Purchase additional telemetry and control terminals to recapitalize fleet that is becoming obsolete. 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, prototyping, etc.</p> <p><b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> In FY 2019 additional funds were added to the program to accelerate Gateway Upgrades to meet the Space Norway launch.</p>	0.000	0.000	20.283
<b>Accomplishments/Planned Programs Subtotals</b>	0.000	63.092	383.113

<b>D. Other Program Funding Summary (\$ in Millions)</b>											
<u>Line Item</u>	<u>FY 2017</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2019</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>Cost To</u>	<u>Total Cost</u>
			<u>Base</u>	<u>OCO</u>	<u>Total</u>					<u>Complete</u>	
• RDTE 05 PE 1206432F: <i>Polar MILSATCOM (Space)</i>	44.306	33.644	27.337	-	27.337	-	-	-	-	0.000	105.287

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

<u>Line Item</u>	<u>FY 2017</u>	<u>FY 2018</u>	<u>FY 2019</u> <u>Base</u>	<u>FY 2019</u> <u>OCO</u>	<u>FY 2019</u> <u>Total</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
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**Remarks**

**E. Acquisition Strategy**

Award payloads contract to Northrop Grumman Aerospace Systems (NGAS) and initiate production of two EPS functional equivalent payloads in FY 2018. Conduct market research to identify industry capabilities and acquisition concepts. Award CAPS contract to Northrop Grumman Mission Systems (NGMS) for EPS ground upgrade. Gateway updates will be accomplished by Space and Naval Warfare Systems Command-Pacific, the EPS Gateway developer. The program office will initiate 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.

**F. Performance Metrics**

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Air Force** **Date:** February 2018

<b>Appropriation/Budget Activity</b> 3600 / 4	<b>R-1 Program Element (Number/Name)</b> PE 1206434F / <i>Midterm Polar MILSATCOM System</i>	<b>Project (Number/Name)</b> 643720 / <i>EPS Recapitalization</i>
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<b>Product Development (\$ in Millions)</b>				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 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/ Various	NGAS : Redondo Beach, CA	-	-		22.968	Jul 2018	295.768	Nov 2018	-		295.768	Continuing	Continuing	-
Long Lead Parts	SS/FFP	NGAS : Redondo Beach, CA	-	-		10.000	Jan 2018	-		-		-	Continuing	Continuing	-
Control and Planning Segment Upgrades	TBD	NGMS : Redondo Beach, CA	-	-		10.000	Apr 2018	25.851	Nov 2018	-		25.851	Continuing	Continuing	-
Gateway Upgrades	Various	Various : CA	-	-		5.000	Apr 2018	17.979	Nov 2018	-		17.979	Continuing	Continuing	-
Technical Mission Analysis	MIPR	Aerospace : El Segundo, CA	-	-		2.161	Jan 2018	6.256	Nov 2018	-		6.256	Continuing	Continuing	-
Enterprise SE&I	C/CPAF	LinQuest : Los Angeles, CA	-	-		5.704	Jan 2018	27.384	Nov 2018	-		27.384	Continuing	Continuing	-
<b>Subtotal</b>			-	-		55.833		373.238		-		373.238	Continuing	Continuing	N/A

<b>Management Services (\$ in Millions)</b>				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 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	Various	Various : TBD	-	-		2.162	Jan 2018	1.564	Oct 2018	-		1.564	Continuing	Continuing	-
A&AS	Various	Various : TBD	-	-		5.047	Jan 2018	8.151	Oct 2018	-		8.151	Continuing	Continuing	-
Other Support	Various	Various : TBD	-	-		0.050	Jan 2018	0.160	Oct 2018	-		0.160	Continuing	Continuing	-
<b>Subtotal</b>			-	-		7.259		9.875		-		9.875	Continuing	Continuing	N/A

	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
<b>Project Cost Totals</b>	-	-	63.092	383.113	-	383.113	Continuing	Continuing	N/A

**Remarks**



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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2019 Air Force		<b>Date:</b> February 2018
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Payload</i></b>				
Long Lead Parts	2	2018	4	2019
Contract Initiation/Definitization	2	2018	4	2018
Payload Segment Design/Build	2	2018	4	2021
Preliminary Design Review (PDR)	4	2018	4	2018
Critical Design Review (CDR)	3	2019	3	2019
<b><i>Ground and Gateway Upgrades/Modifications</i></b>				
Risk Reduction Activities/Studies	2	2018	1	2019
Upgrades/Modifications	3	2018	4	2021
Control and Planning Segment Upgrades, Contract Award	1	2019	1	2019
System Level Integration	2	2021	1	2023