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Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Air Force **Date:** April 2022

Appropriation/Budget Activity 3620F: <i>Research, Development, Test & Evaluation, Space Force I BA 4: Advanced Component Development & Prototypes (ACD&P)</i>					R-1 Program Element (Number/Name) PE 1206422SF / <i>Weather System Follow-on</i>							
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	0.000	77.379	53.421	0.000	0.000	0.000	10.562	7.043	0.000	0.000	0.000	148.405
644289: <i>Weather Satellite Follow-On</i>	0.000	77.379	53.421	0.000	0.000	0.000	10.562	7.043	0.000	0.000	0.000	148.405

A. Mission Description and Budget Item Justification

In FY 2023, PE 1206422SF, Weather System Follow-On, Project 644289, Weather Satellite Follow-On, R-1 Line #8 efforts were transferred to PE 1206422SF, Weather System Follow-On, Project 65A039, Weather System Follow-on - Microwave (WSF-M), R-1 Line #20 to reflect the successful completion of Milestone B on 15 May 2020. Residual budget in FY24-25 funds will be transferred from BA04 to BA05 in future budget cycle.

Weather System Follow-on (WSF) is a Low-Earth Orbit (LEO) microwave imaging system developed and delivered by the United States Space Force's Space Systems Command (SSC). WSF is the next generation of space-based passive microwave sensing technology. It will provide U.S. and Allied warfighters with essential weather data, including the measurement of ocean surface wind speed and direction, ice thickness, snow depth, soil moisture, and local spacecraft energetic charged particle environment. The ocean surface wind speed measurement enables tropical cyclone intensity determination by the Joint Typhoon Warning Center. The data gathered by WSF will be provided to meteorologists in support of the generation of a wide variety of weather products necessary to conduct mission planning and operations globally.

WSF is an Acquisition Category IB program comprised of two Space Vehicles (SV) and their associated command, control, and data dissemination network. Global environmental monitoring data is gathered, stored, and down-linked through the Satellite Control Network (SCN) and disseminated to Air Force and Navy weather centers. Additionally, data is broadcast real time by the satellite for utilization by heritage Direct Readout Terminals that use the data for local weather forecasting.

WSF is a Major Defense Acquisition Program (MDAP) with the Space Force as the lead component. Founded on the Space-Based Environmental Monitoring (SBEM) Analysis of Alternatives (AoA) results, the WSF will be to enable:

- 1) Timely weather collection over broad oceans in support of maneuvering forces;
- 2) Space weather capabilities to characterize operational orbits, space situational awareness, and the ionosphere.

Secondary investments may be supported to address weather gaps identified in the SBEM AoA and validated by the JROC.

Compact Ocean Wind Vector Radiometer (COWVR) is an on-orbit demonstration project of the new COWVR technology to deliver Weather Gap #3, Ocean Surface Vector Winds (OSVW) and Gap #8, Tropical Cyclone Intensity (TCI).

Energetic Charged Particles (ECP) supports the SBEM Weather Gap #11, Low Earth Orbit Energetic Charged Particle Characterization. To support this requirement, the ECP sensor will be integrated on the WSF-M satellites.

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Appropriation/Budget Activity 3620F: <i>Research, Development, Test & Evaluation, Space Force I BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 1206422SF / <i>Weather System Follow-on</i>
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Space acquisition must respond with speed and agility to emerging adversary threats. 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 capabilities.

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

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	83.384	61.521	0.000	0.000	0.000
Current President's Budget	77.379	53.421	0.000	0.000	0.000
Total Adjustments	-6.005	-8.100	0.000	0.000	0.000
• Congressional General Reductions	-2.662	0.000			
• Congressional Directed Reductions	0.000	-8.100			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-3.343	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Other Adjustments	0.000	0.000	0.000	0.000	0.000

Change Summary Explanation

FY 2021: -3.343M transferred for higher SF priorities.
FY 2022: -8.1M product development excess to need.

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Appropriation/Budget Activity 3620F / 4	R-1 Program Element (Number/Name) PE 1206422SF / <i>Weather System Follow-on</i>	Project (Number/Name) 644289 / <i>Weather Satellite Follow-On</i>
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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
644289: <i>Weather Satellite Follow-On</i>	0.000	77.379	53.421	0.000	0.000	0.000	10.562	7.043	0.000	0.000	0.000	148.405
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

In FY 2023, PE 1206422SF, Weather System Follow-On, Project 644289, Weather Satellite Follow-On, R-1 Line #8 efforts were transferred to PE 1206422SF, Weather System Follow-On, Project 65A039, Weather System Follow-on - Microwave (WSF-M), R-1 Line #20 to reflect the successful completion of Milestone B on 15 May 2020. Residual budget in FY24-25 funds will be transferred from BA04 to BA05 in future budget cycle.

Weather System Follow-on (WSF) is a Low-Earth Orbit (LEO) microwave imaging system developed and delivered by the United States Space Force's Space Systems Command (SSC). WSF is the next generation of space-based passive microwave sensing technology. It will provide U.S. and Allied warfighters with essential weather data, including the measurement of ocean surface wind speed and direction, ice thickness, snow depth, soil moisture, and local spacecraft energetic charged particle environment. The ocean surface wind speed measurement enables tropical cyclone intensity determination by the Joint Typhoon Warning Center. The data gathered by WSF will be provided to meteorologists in support of the generation of a wide variety of weather products necessary to conduct mission planning and operations globally.

WSF is an Acquisition Category IB program comprised of two Space Vehicles (SV) and their associated command, control, and data dissemination network. Global environmental monitoring data is gathered, stored, and down-linked through the Satellite Control Network (SCN) and disseminated to Air Force and Navy weather centers. Additionally, data is broadcast real time by the satellite for utilization by heritage Direct Readout Terminals that use the data for local weather forecasting.

WSF is a Major Defense Acquisition Program (MDAP) with the Space Force as the lead component. Founded on the Space-Based Environmental Monitoring (SBEM) Analysis of Alternatives (AoA) results, the WSF will be to enable:

- 1) Timely weather collection over broad oceans in support of maneuvering forces;
- 2) Space weather capabilities to characterize operational orbits, space situational awareness, and the ionosphere.

Secondary investments may be supported to address weather gaps identified in the SBEM AoA and validated by the JROC.

Compact Ocean Wind Vector Radiometer (COWVR) is an on-orbit demonstration project of the new COWVR technology to deliver Weather Gap #3, Ocean Surface Vector Winds (OSVW) and Gap #8, Tropical Cyclone Intensity (TCI).

Energetic Charged Particles (ECP) supports the SBEM Weather Gap #11, Low Earth Orbit Energetic Charged Particle Characterization. To support this requirement, the ECP sensor will be integrated on the WSF-M satellites.

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Appropriation/Budget Activity 3620F / 4	R-1 Program Element (Number/Name) PE 1206422SF / <i>Weather System Follow-on</i>	Project (Number/Name) 644289 / <i>Weather Satellite Follow-On</i>
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This program element may include necessary civilian pay expenses required to manage, execute, and deliver WSF 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.

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
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Title: WSF Microwave Satellite (SV1-2)	73.799	52.766	0.000
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Description: Develop, build, integrate, and test the WSF Microwave (WSF-M) satellites, including bus, payloads, and ground upgrades to satisfy JROC-directed SBEM Capability gaps.

FY 2022 Plans:

Complete the manufacturing of MWI payload and continue SV-1 I&T. Receive all Spacecraft hardware deliveries from the subcontractors, and continue Bus Integration. Complete WSF-M Ground Segment Development to include, but not limited to Command and Control System MUS to operate the WSF-M SV. Initiate and complete WSF-M Ground Segment Integration & Test, to include, but not limited to Day-In-The-Life Compatibility testing. Continue program office and other related support activities that may include, but are not limited to studies, technical analysis, prototyping, etc.

FY 2023 Plans:

N/A

FY 2022 to FY 2023 Increase/Decrease Statement:

FY 2023 funding decreased due to the transfer of funding from PE 1206422SF BA04, Weather System Follow-On, Project 644289 to PE 1206442SF, BA05, Weather System Follow-On, Project 65A039.

Title: COWVR Tech Demo	1.180	0.275	0.000
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Description: The Compact Ocean Surface Wind Vector Radiometer (COWVR) launch objective supports Category A Weather Requirements, as codified in JROC Memo 092-014, providing on-orbit technology demonstration of the new COWVR technology to deliver Weather Gap #3, Ocean Surface Vector Winds (OSVW) and Gap #8, Tropical Cyclone Intensity (TCI). This will be a cooperative mission with NASA for integrating the sensor onto the International Space Station (ISS) as a weather technology demonstration project. The new mission designation for the COWVR launch will be Space Test Program Houston Mission #8 (STP-H8). Demonstrating COWVR technology in the space environment remains an important milestone for the microwave data weather mission in lieu of the ORS-6 cancellation. Unlike ORS-6, COWVR will fly on the ISS and the residual operational capability is not guaranteed as a result.

FY 2022 Plans:

Complete the COWVR sensor calibration and validation onboard the ISS. Continue operating the sensor and gathering data for potential inclusion into current weather models. This funding includes but is not limited to payload commanding, data interpretation and dissemination, and other ground operational support.

FY 2023 Plans:

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2021	FY 2022	FY 2023
N/A			
<i>FY 2022 to FY 2023 Increase/Decrease Statement:</i> FY 2023 funding decreased due to the transfer of funding from PE 1206422SF BA04, Weather System Follow-On, Project 644289 to PE 1206442SF, BA05, Weather System Follow-On, Project 65A039.			
<i>Title:</i> ECP <i>Description:</i> Energetic Charged Particles (ECP) will support the SBEM Weather Gap 11 and address the Secretary of the Air Force (SECAF) policy which directs each Space Force Satellite Office to plan for and integrate ECP sensors on all pre-Milestone B new satellite acquisitions. To support this requirement, the ECP sensor will be integrated on the WSF-M satellite. <i>FY 2022 Plans:</i> Pull WSF-M ECP sensor from storage/deliver flight unit to the prime contractor, along with associated integration and test support. Complete ECP sensor data processing software and all applicable pre-launch efforts. <i>FY 2023 Plans:</i> N/A <i>FY 2022 to FY 2023 Increase/Decrease Statement:</i> FY 2023 funding decreased due to the transfer of funding from PE 1206422SF BA04, Weather System Follow-On, Project 644289 to PE 1206442SF, BA05, Weather System Follow-On, Project 65A039.	2.400	0.380	0.000
Accomplishments/Planned Programs Subtotals	77.379	53.421	0.000

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

N/A

Remarks

D. Acquisition Strategy

The acquisition strategy for WSF is based on validated SBEM AoA results from FY 2014 and subsequent acquisition strategy development activities that were conducted in FY 2015. The WSF acquisition strategy focuses on streamlined acquisition processes for providing materiel solutions to OSVW, TCI & LEO ECP, as validated by the JROC; deliver microwave sensing solution to address DoD needs for OSVW and TCI capabilities and deliver space environment sensing solution to address LEO ECP capabilities for on-orbit attributions and support of anomaly resolutions.

The Space Force is conducting a technology demonstration of the Compact Ocean Wind Vector Radiometer (COWVR) sensor on the International Space Station (ISS), utilizing its unique technology demonstration capabilities for on-orbit demonstration of COWVR technology. The Space Systems Command (SSC) Space Test Program

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<p>Office is the lead Space Force organization spearheading the NASA partnership, with the SSC Development Corps responsible for the COWVR sensor and providing programmatic support to enable COWVR sensor to ISS integration/technology demonstration.</p> <p>The program awarded a contract for WSF-M with up to two satellites through a full and open competition. The WSF-M first satellite (SV-1) Initial Launch Capability is 1st quarter FY 2024. The WSF-M SV-2 priced option will be exercised by Nov 2023. WSF-M SV-2 ILC is 4th quarter FY 2027. The WSF SV-2 will be functionally equivalent to SV-1. The Naval Research Lab Blossom Point Tracking Facility (BPTF) will be the Satellite Operations Center (SOC) for WSF-M.</p> <p>The WSF ECP sensor is developed by AFRL and will be integrated onto the WSF-M satellites.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2023 Air Force **Date:** April 2022

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Product Development (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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			
COWVR Technology Demonstration	Various	Various : Various	0.000	1.180	Apr 2021	0.275	Apr 2022	-		-		-	0.000	1.455	-
WSF Microwave System (SV1-2)	C/FFP	Ball Aerospace : Boulder, CO	0.000	58.062	Nov 2020	34.901	Nov 2021	-		-		-	0.000	92.963	-
ECP	Various	Various : Various	0.000	2.400	Jan 2021	0.380	Jan 2022	-		-		-	0.000	2.780	-
Enterprise Systems Engineering & Integration	C/CPAF	Engility Corp : Andover, MA	0.000	0.924	Dec 2020	2.306	Dec 2021	-		-		-	0.000	3.230	-
Technical Mission Analysis	RO	Aerospace Corp : El Segundo, CA	0.000	5.927	Oct 2020	5.293	Oct 2021	-		-		-	0.000	11.220	-
Ground	MIPR	NRL : Welcome, MD	0.000	3.236	Dec 2020	3.193	Dec 2021	-		-		-	0.000	6.429	-
Subtotal			0.000	71.729		46.348		-		-		-	0.000	118.077	N/A

Management Services (\$ in Millions)				FY 2021		FY 2022		FY 2023 Base		FY 2023 OCO		FY 2023 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	RO	Aerospace Corp : El Segundo, CA	0.000	2.261	Oct 2020	2.491	Oct 2021	-		-		-	0.000	4.752	-
A&AS	Various	Various : El Segundo, CA	0.000	3.220	Feb 2021	4.174	Feb 2022	-		-		-	0.000	7.394	-
Other Support	Various	Various : El Segundo, CA	0.000	0.169	Nov 2020	0.408	Nov 2021	-		-		-	0.000	0.577	-
Subtotal			0.000	5.650		7.073		-		-		-	0.000	12.723	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		0.000	77.379	53.421	-	-	0.000	130.800	N/A

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2023 Air Force **Date:** April 2022

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	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

<i>Weather System Follow-On</i>																												
WSF ECP Production/Integration																												
WSF ECP Storage/Delivery to Prime Contractor																												
WSF SV-1 Production/Integration and Test																												
COWVR Technology Demonstration I&T																												
COWVR Technology Demonstration Launch Ops																												
COWVR Technology Demonstration On-Orbit Operations																												

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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 1206422SF / <i>Weather System Follow-on</i>	Project (Number/Name) 644289 / <i>Weather Satellite Follow-On</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Weather System Follow-On</i>				
WSF ECP Production/Integration	1	2021	3	2021
WSF ECP Storage/Delivery to Prime Contractor	4	2021	4	2022
WSF SV-1 Production/Integration and Test	1	2021	4	2022
COWVR Technology Demonstration I&T	1	2021	4	2021
COWVR Technology Demonstration Launch Ops	4	2021	4	2021
COWVR Technology Demonstration On-Orbit Operations	4	2021	4	2022

Note
 FY 2023+ scheduled activities are captured within the budget justification exhibit for program 1206422SF, Weather System Follow-On, Project 65A039, Weather Satellite Follow-On, R-1 Line #20.