Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Air Force	Date: March 2023
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 0604002SF *I Space Force Weather Services Research*

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	-	0.000	0.816	0.849	0.000	0.849	0.865	0.886	0.904	0.936	Continuing	Continuing
645353: *SF Weather Services Research*	-	0.000	0.816	0.849	0.000	0.849	0.865	0.886	0.904	0.936	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This budget activity funds the development necessary to evaluate integrated technologies and models for future operationalization into segments of the Space Force Weather Services (SFWS) in support of the 2018 National Defense Strategy's (NDS) three lines of effort. To improve readiness for a more lethal force, SFWS provides timely, accurate, resilient and relevant environmental information, to include space and terrestrial weather, for global battlespace situational awareness for Air Force (AF), Army, Special Operations Forces (SOF), Space Force (USSF), combatant commands, the Intelligence Community (IC), and other government agencies. SFWS capabilities at home station and deployed provide critical environmental information in support of decision makers to gain the asymmetric advantage during the full spectrum of air and space combat operations. SFWS development enhances the lethality, effectiveness, and survivability of AF & SF weapon systems and precision munitions by modernizing capability and seeking the military advantage to accurately predict friendly and foe environmental impacts to optimize mission execution and planning, targeting, weaponeering, battle damage assessment, and space systems operations. To strengthen alliances and partnerships, SFWS development efforts integrate Department of Defense (DoD), government agency, commercial, and international partner environmental data with SFWS information system equipment for processing, storing, exploiting, and disseminating all-domain weather information for analysis, forecasting, mission integration, and greater interoperability. To ensure greater performance and affordability for the AF and SF, SFWS systems are being modernized through improvements to architecture and system efficiency, cybersecurity, joint all-domain command and control (JADC2) and sensing grid integration, migration to cloud computing, and expanding agile software development practices.

SFWS aligns activities under four capability areas: Weather Data Collection, Weather Data Analysis and Dissemination, Weather Forecasting, and Product Tailoring/ Warfighter Applications (PTWA). This alignment ensures an integrated and systems-oriented approach to program management decisions. A portion of the Weather Forecasting capability is addressed by RDT&E, BA 04, PE 0604002S, Project 645353 - Space Force Weather Services Research.

Weather Forecasting provides global and regional advanced scientific numerical weather prediction capabilities for automated, high-resolution forecast products for mission planning and execution. Space weather modeling assists in characterizing and forecasting the near-earth environment to the sun and enables space weather anomaly and space weather impact assessments. Weather Forecasting includes activities for Numerical Weather Modeling (NWM) and Space Weather Analysis and Forecast System (SWAFS). SWAFS is a software suite of 47 models and applications to ingest, process, and store space environmental data, run space environmental models to specify and forecast the near-earth environment, and run space effects characterization applications.

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

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B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	0.000	0.816	0.845	0.000	0.845
Current President's Budget	0.000	0.816	0.849	0.000	0.849
Total Adjustments	0.000	0.000	0.004	0.000	0.004
• 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	0.004	0.000	0.004

Change Summary Explanation

FY 2024: +0.004M inflation increase for non-pay and non-fuel purchases.

C. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Title: Space Weather Analysis and Forecast System (SWAFS) Radio Frequency Ionospheric Scintillation Application (RISA version 2) software upgrade	0.000	0.816	0.849

Description: SWAFS RISA is an Air Force Research Laboratory (AFRL) Analysis of Alternatives (AoA) to upgrade software allowing use of model algorithms that utilize sensor packages on the Constellation Observing System to monitor Meteorology, Ionosphere, and Climate (COSMIC II) to understand space environment conditions affecting satellites and communications. Johns Hopkins University/Applied Physics Lab (JHU/APL) will perform model upgrades to Ionospheric Data Assimilation - Four Dimensional (IDA4D) to ensure compatibility with a Gov Cloud environment within the SWAFS Space Domain Awareness Environmental Toolkit - for Defense (SET4D) baseline.

FY 2023 Plans:

AFRL continues prototype development of solar forecasting tools. JHU/APL will develop IDA4D and upgrade Ovation Prime 2013 Auroral boundary models for compatibility with the SET4D cloud environment. These models deliver global ionospheric density predictions and inform pilots and radar operators of the hazards to radio communication operations when flying near the poles and it supports early warning radar operators in determining environment impacts to operate their radars during high peak aurora times. Begin development of the Radio Frequency Ionospheric Scintillation Analysis Tool (RISA v2) upgrade applications for data exploitation of advanced data Integrity tools that include: Wideband Satellite Communication Support (Mobile User Objective System (MUOS); Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC-2) electron density Ion Velocity Meter (IVM) Algorithm; Global-scale Observations of the Limb and Disk/Ionospheric Connection Explorer (GOLD/ICON)

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C. Accomplishments/Planned Programs ($ in Millions)	FY 2022	FY 2023	FY 2024
Ultraviolet Variability Data Assimilation; Global Navigation Satellite Systems (GNSS) Integration, and Rate of Total Electron Content Index (ROTI) exploitation. Additionally, numerous models such as Ovation Prime and IDA4D require re-architecture to ensure compatibility with the SET4D baseline to be operated within a Gov-Cloud environment. ***FY 2024 Plans:*** AFRL continues development of Radio frequency Ionosopheric Scintillation Application v2.0, Solar Forecasting System (SFS), and Ultra High Frequency (UHF) communication prototype AoAs. JHU/APL develops observation support from Super-Darn ground system and and Space-Based JHU/APL prototypes to begin initial evaluation of National Defense Authorization Act 2021 Arctic strategy. ***FY 2023 to FY 2024 Increase/Decrease Statement:*** FY 2024 increased due to inflation.			
Accomplishments/Planned Programs Subtotals	0.000	0.816	0.849

D. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• RDTE 07 0305111F: *Weather Service*	3.365	-	-	-	-	-	-	-	-	0.000	3.365
• RDTE 07 1203940S: *Space Situation Awareness Operations*	-	3.144	3.913	-	3.913	3.099	3.196	3.257	3.372	Continuing	Continuing

Remarks

E. Acquisition Strategy

SWAFS will use individual Federal Acquisition Regulation (FAR) based and rapid acquisition contracting methods, as well as AFRL for development works (Technology Readiness Level (TRL) 6 and below) to develop AoA, design solutions, and prototype code.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2024 Air Force			Date: March 2023
Appropriation/Budget Activity 3620F / 4	R-1 Program Element (Number/Name) PE 0604002SF / *Space Force Weather Services Research*	Project (Number/Name) 645353 / *SF Weather Services Research*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2022 Cost	FY 2022 Award Date	FY 2023 Cost	FY 2023 Award Date	FY 2024 Base Cost	FY 2024 Base Award Date	FY 2024 OCO Cost	FY 2024 OCO Award Date	FY 2024 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SWAFS Scintillation Nowcast Forecast Model Update AoA	PO	AFRL : Kirtland AFB, NM	-	-		0.816	Jan 2023	0.424	Jan 2024	-		0.424	0.000	1.240	-
Space Weather Model Upgrade Development	PO	JHU/APL : Laurel, MD	-	-		-		0.425	Jan 2024	-		0.425	Continuing	Continuing	-
		Subtotal	-	-		0.816		0.849		-		0.849	Continuing	Continuing	N/A

	Prior Years	FY 2022		FY 2023		FY 2024 Base		FY 2024 OCO		FY 2024 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	-		0.816		0.849		-		0.849	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3620F / 4	**R-1 Program Element (Number/Name)** PE 0604002SF / *Space Force Weather Services Research*	**Project (Number/Name)** 645353 / *SF Weather Services Research*

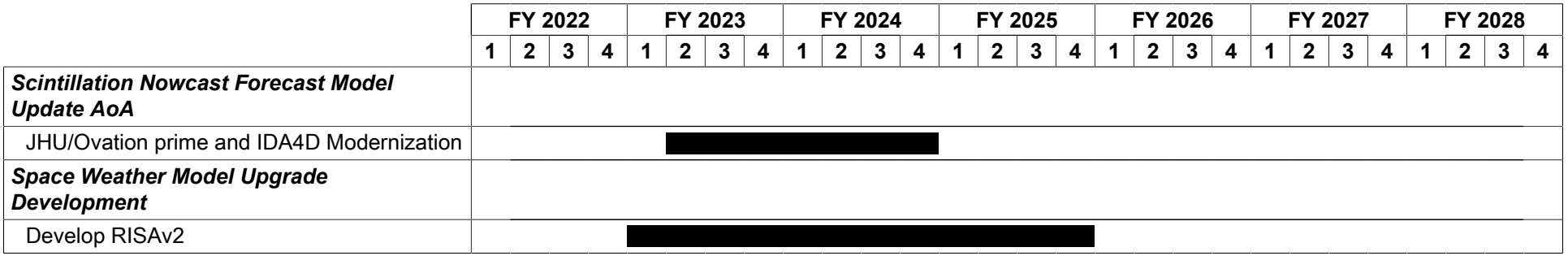

Exhibit R-4A, RDT&E Schedule Details: PB 2024 Air Force		Date: March 2023
Appropriation/Budget Activity 3620F / 4	**R-1 Program Element (Number/Name)** PE 0604002SF / *Space Force Weather Services Research*	**Project (Number/Name)** 645353 / *SF Weather Services Research*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Scintillation Nowcast Forecast Model Update AoA				
JHU/Ovation prime and IDA4D Modernization	2	2023	4	2024
Space Weather Model Upgrade Development				
Develop RISAv2	1	2023	4	2025