Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force												Date: February 2018
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 1206422F / *Weather System Follow-on*							
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	193.238	82.506	112.088	138.052	0.000	138.052	122.897	57.275	37.392	38.073	297.300	1,078.821
644289: *Weather Satellite Follow-On*	193.238	82.506	112.088	138.052	0.000	138.052	122.897	57.275	37.392	38.073	297.300	1,078.821
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	1		
Program MDAP/MAIS Code: 488												

Note

This program, BA 4, PE 1206422F, project 644289, Military Application of the Space Environment (MASE), is a new start.

A. Mission Description and Budget Item Justification

Based on completion of the Space-Based Environmental Monitoring (SBEM) JROC Memo 092-14, capabilities will be developed to satisfy weather gaps for which no known mitigation exists. Weather System Follow-on (WSF) is a component of SBEM efforts to develop capabilities to satisfy weather Gap 3 Ocean Surface Vector Winds (OSVW), Gap 8 Tropical Cyclone Intensity (TCI), and Gap 11 Low Earth Orbit (LEO) Energetic Charged Particles (LEO ECP). Gap 3 OSVW and Gap 8 TCI require a space-based microwave sensor to provide polarimetric ocean surface wind direction and speed required for naval sea operations, as well as fighter sortie generations and marine amphibious operations. Gap 11 LEO ECP requires in situ ECP sensor for space situational awareness. The earliest possible launch options are being integrated in the design for critical gaps.

DoD established WSF as a Pre-Major Defense Acquisition Program (MDAP) with the Air force as the lead component. Based on the SBEM AoA results, the WSF initial thrusts will be to enable:
1) DoD use of data collected by civil, international and other DoD space systems;
2) Timely weather collection over broad oceans in support of maneuvering forces;
3) 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 Meteorological and Oceanographic (METOC) Initial Capability Document (ICD).

The Military Application of the Space Environment (MASE) is a program to demonstrate mature space environment technology to improve combat operations. MASE will enhance regional ionospheric specification (nowcasts) and predictions (forecasts) affecting signal propagation paths. MASE uses traditional and non-traditional ionospheric measurements in advanced space environment models to forecast and predict impacts to weapon systems. Contributes to satisfying Gaps 4 and 7 of the SBEM AoA results as supplemented by the AFRDM 02-17-02 (SBEM JDCR).

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,

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force	Date: February 2018
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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 WSF weapon system capability. The use of such program funds would be in addition to the civilian pay expenses budgeted in program elements 1206392F and 1206398F.

The FY2019 funding request was reduced by $42.70 million to account for the availability of prior year execution balances.

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.

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	118.953	112.088	153.391	0.000	153.391
Current President's Budget	82.506	112.088	138.052	0.000	138.052
Total Adjustments	-36.447	0.000	-15.339	0.000	-15.339
• Congressional General Reductions	0.000	0.000			
• Congressional Directed Reductions	-30.000	0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds	0.000	0.000			
• Congressional Directed Transfers	0.000	0.000			
• Reprogrammings	-3.111	0.000			
• SBIR/STTR Transfer	-3.336	0.000			
• Other Adjustments	0.000	0.000	-15.339	0.000	-15.339

Change Summary Explanation

FY2017: -$30.00M Appropriations Congressional Mark; -$3.111 Reprogrammed for higher Air Force priority.
FY2019: -$42.70M Reduction for under execution; +$10.000 ECP, +$18.400M MASE; -$1.039M Inflation

C. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: WSF Microwave Satellite (SV1-2)	55.457	83.520	100.654
Description: WSF Microwave Satellite (SV1-2): The Air Force awarded a contract to Ball Aerospace and Technologies Corp. to develop the WSF - Microwave (WSF-M) Space Vehicle (SV) to meet all three capability gaps. WSF-M SV-2 will be an option to exercise, should AF wish to replenish WSF constellation post-SV-1. SV-2 will be functionally equivalent to SV-1. The WSF-M SV-1			

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force	Date: February 2018
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 1206422F / *Weather System Follow-on*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
projected Initial Launch Capability (ILC) is FY2023. Secondary investments may also be considered to address weather gaps identified in the Meteorological and Oceanographic (METOC) Initial Capabilities Document (ICD). ***FY 2018 Plans:*** Complete WSF-M system Preliminary Design Review (PDR) and enter WSF-M Milestone B with all required acquisition documentation. Complete WSF-M ground system Telemetry, Tracking & Commanding (TT&C) development. Fund program support activities. Continue program office and other related support activities that may include, but are not limited to studies, technical analysis, etc. ***FY 2019 Plans:*** Will complete WSF-M System PDR, WSF-M Milestone B required acquisition documentation, Microwave Imager (MWI) Critical Design Review (CDR), and Spacecraft CDR. Will initiate work on WSF-M System CDR. 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. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY 2019 increased compared to FY 2018 by $17.134M. Justification for this increase is described in plans above.			
Title: COWVR Tech Demo ***Description:*** Air Force priority is to deliver an interim materiel solution to mitigate projected WindSat mission End of Life (EOL). In order to achieve this goal, Space and Missile Systems Center/Remote Sensing Systems Directorate (SMC/RS) is working with the Operationally Responsive Space (ORS) office to launch Compact Ocean Surface Wind Vector Radiometer (COWVR) technical demonstration payload, which would provide residual operational capability to address the immediate Gap 3 requirements, once on-orbit checkout is successfully completed. ***FY 2018 Plans:*** Will complete COWVR calibration/validation and initiate steps to transition sensor to Navy operation. ***FY 2019 Plans:*** Continue to conduct calibration/validation and transition to Navy operation. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY 2019 decreased compared to FY 2018 by $17.500M. Justification for this decrease is described in plans above.	21.966	25.200	7.700
Title: WSF ECP ***Description:*** WSF Energetic Charged Particles (ECP) will fulfill the Space-based Environmental Monitoring (SBEM) Weather Gap 11 and address the Secretary of the Air Force (SECAF) policy which directs each USAF Satellite Office to plan for and integrate	5.083	3.368	11.298

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force	Date: February 2018
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 1206422F / *Weather System Follow-on*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
ECP sensors on all pre-Milestone B new satellite acquisitions. To accomplish this requirement, the ECP sensor will be integrated on the WSF-M satellite. ***FY 2018 Plans:*** Will complete source selection and award contract. Will stand up contractor personnel, purchase long-lead items for WSF-M and start development/procurement effort for payload algorithms. Will compete launch service contract. Continue program office and other related support activities that may include, but are not limited to studies, technical analysis, etc. ***FY 2019 Plans:*** Complete ECP sensor and put in storage. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY 2019 increased compared to FY 2018 by $7.930M. Justification for this increase is described in plans above.			
Title: Military Application of the Space Environment (MASE) ***Description:*** MASE demonstrates a sensor-to-shooter solution to improve mission effectiveness by providing commanders an operational risk assessment tool. MASE will deliver a capability comprised of weapon system tailored visualizations/decision aids to allow warfighter integration into operational plans and tactics, techniques, and procedures. MASE products and services will be evaluated using quantitative standard measures of performance, effectiveness, and outcome against theater operational requirements. ***FY 2019 Plans:*** Transition prototype capability into operations and continue the R&D effort for future phases. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** This is a new start for FY19.	-	-	18.400
Accomplishments/Planned Programs Subtotals	82.506	112.088	138.052

D. Other Program Funding Summary ($ in Millions)

N/A

Remarks

E. Acquisition Strategy

DoD established WSF as a pre-MDAP. The acquisition strategy for WSF is based on validated SBEM AoA results from FY2014 and subsequent acquisition strategy development activities that were conducted in FY2015. The WSF acquisition strategy focuses on streamlined acquisition process 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

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Air Force	Date: February 2018
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environment sensing solution to address LEO ECP capabilities for on-orbit attributions and anomaly resolutions. Impending WindSat mission EOL required WSF to approach the program acquisition in two phases; Phase I to address imminent OSVW/TCI needs via COWVR tech demo option, while Phase II involves a more robust set of capabilities for WSF-M.

In Phase I, the AF intends to deliver an interim materiel solution to address the immediate OSVW and TCI needs to mitigate WindSat EOL. In order to achieve this goal in a timely manner, WSF program plans on utilizing Jet Propulsion Lab (JPL)-developed COWVR sensor for integration with ORS office's Modular Space Vehicle (MSV) spacecraft as the ORS-6 mission. ORS office will lead contractual actions to procure the space vehicle, the launch service and reserve commercial ride-share spot for projected FY2018 ILC. Once COWVR sensor is launched and completes on-orbit checkout, the payload is expected to provide partial residual operational capabilities until WSF-M satellite is implemented.

In Phase II, the program intends to procure a more robust WSF-M Satellite, capable of meeting all three weather capability gaps, in a full and open competition environment, in order to reduce overall program cost. There will be one WSF-M to be procured, with option for a second satellite. WSF-M first satellite (SV-1) ILC is FY2023 to mitigate any potential weather coverage gaps. WSF-M SV-2 ILC is currently projected for FY2028. The WSF-M SV-2 will be functionally equivalent to SV-1.

The WSF ECP sensor development will leverage current AFRL sensor and hazard assessment technology to accelerate availability of ECP sensor for integration on WSF-M and other planned AF satellite acquisitions. The AF intends to transition AFRL's technology to industry for production via competitive award. Two Tech Demo ECP sensors are projected to be delivered and ready for satellite integration by FY2020. Post-Tech Demo ECP phase, each respective program offices will be responsible for the procurement/integration and sustainment of the sensors required to meet the SecAF's Space Situational Awareness (SSA) policy.

Completed Broad Agency Announcement (BAA) proposal evaluation and negotiations for SBEM EO/IR.

The program intends to develop the MASE leave-behind capability at AFRL while optimizing, making RMF compliant, and operationalizing current AFRL MASE related prototypes/models. Award contracts to conduct studies and perform technical analysis for external data sources and optimal sensor laydown, system development and external system integration. Conduct field campaigns to validate scientific algorithms. Provision cloud services, deploy ionospheric ground sensors and provide program office support.

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.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Air Force			Date: February 2018
Appropriation/Budget Activity 3600 / 4	R-1 Program Element (Number/Name) PE 1206422F / *Weather System Follow-on*	Project (Number/Name) 644289 / *Weather Satellite Follow-On*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
ORS COWVR Technology Demonstration	Various	Various : Various	30.210	21.966	Jan 2017	25.200	Jan 2018	7.700	Jan 2019	-		7.700	0.000	85.076	-
WSF Microwave System (SV1-2)	Various	Ball Aerospace : Boulder, CO	-	46.100	Nov 2017	61.603	Feb 2018	57.979	Nov 2018	-		57.979	Continuing	Continuing	-
WSF ECP (Gap 11)	MIPR	Kirtland AFB : Albuquerque, NM	1.216	3.303	Apr 2017	3.368	Apr 2018	11.298	Apr 2019	-		11.298	Continuing	Continuing	-
MASE	Various	Various : Various	-	-		-		18.400	Dec 2018	-		18.400	Continuing	Continuing	-
Enterprise Systems Engineering & Integration	C/CPAF	The Analytical Science Corp : El Segundo, CA	0.535	1.411	Dec 2016	2.735	Dec 2017	9.604	Dec 2018	-		9.604	Continuing	Continuing	-
Technical Mission Analysis	RO	Aerospace Corp : El Segundo, CA	6.574	0.000	Oct 2016	6.659	Oct 2017	7.946	Oct 2018	-		7.946	Continuing	Continuing	-
BAA	Various	Various : Various	-	1.960	Mar 2017	-		-		-		-	0.000	1.960	-
EGS Ground	TBD	TBD : TBD	-	-		1.670	Dec 2017	6.911	Dec 2018	-		6.911	0.000	8.581	-
Pre-Acquisition Activities	Various	Various : Various	121.704	-		-		-		-		-	0.000	121.704	-
		Subtotal	160.239	74.740		101.235		119.838		-		119.838	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Advanced Concepts and Planning	TBD	TBD : TBD	-	-		-		-		-		-	8.000	8.000	-
Requirements/Engineering Analysis Support	RO	Defense Information Technical Center : El Segundo, CA	1.543	-		-		-		-		-	0.000	1.543	-
Engineering Risk Reduction Studies	Various	Various : Various	1.171	-		-		-		-		-	0.000	1.171	-
		Subtotal	2.714	-		-		-		-		-	8.000	10.714	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Air Force			Date: February 2018
Appropriation/Budget Activity 3600 / 4	R-1 Program Element (Number/Name) PE 1206422F / *Weather System Follow-on*	Project (Number/Name) 644289 / *Weather Satellite Follow-On*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FFRDC	RO	Aerospace Corp : El Segundo, CA	15.853	5.459	Oct 2016	5.771	Oct 2017	5.297	Oct 2018	-		5.297	Continuing	Continuing	-
Other Support	Various	Various : Various	4.612	0.200	Nov 2016	2.200	Nov 2017	3.500	Nov 2018	-		3.500	Continuing	Continuing	-
A&AS	Various	Various : Various	9.820	2.107	Nov 2016	2.882	Nov 2017	9.417	Nov 2018	-		9.417	Continuing	Continuing	-
		Subtotal	30.285	7.766		10.853		18.214		-		18.214	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
Project Cost Totals	193.238	82.506		112.088		138.052		-		138.052	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 4	**R-1 Program Element (Number/Name)** PE 1206422F / *Weather System Follow-on*	**Project (Number/Name)** 644289 / *Weather Satellite Follow-On*

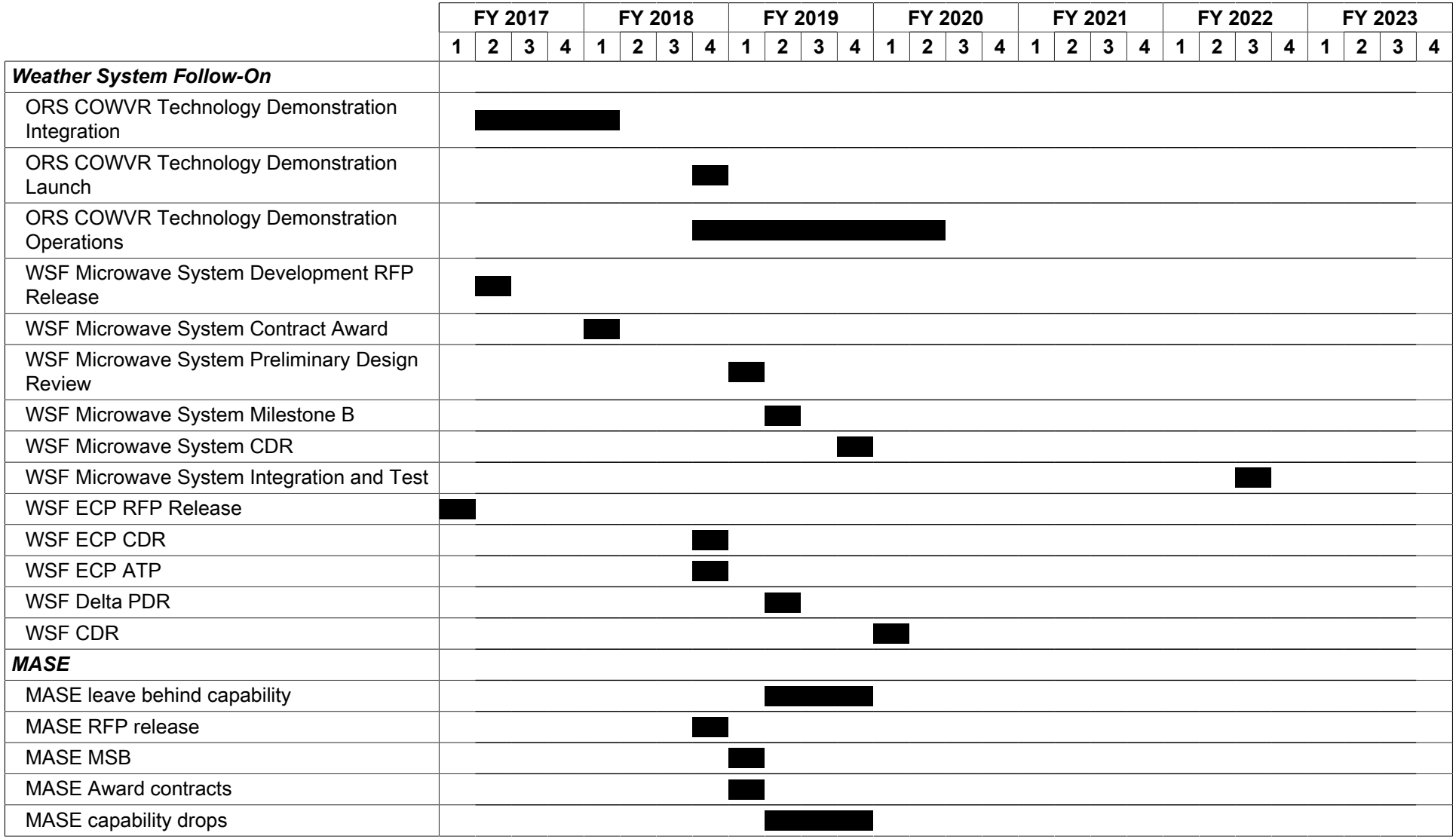

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Air Force		Date: February 2018
Appropriation/Budget Activity 3600 / 4	**R-1 Program Element (Number/Name)** PE 1206422F / *Weather System Follow-on*	**Project (Number/Name)** 644289 / *Weather Satellite Follow-On*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Weather System Follow-On				
ORS COWVR Technology Demonstration Integration	2	2017	1	2018
ORS COWVR Technology Demonstration Launch	4	2018	4	2018
ORS COWVR Technology Demonstration Operations	4	2018	2	2020
WSF Microwave System Development RFP Release	2	2017	2	2017
WSF Microwave System Contract Award	1	2018	1	2018
WSF Microwave System Preliminary Design Review	1	2019	1	2019
WSF Microwave System Milestone B	2	2019	2	2019
WSF Microwave System CDR	4	2019	4	2019
WSF Microwave System Integration and Test	3	2022	3	2022
WSF ECP RFP Release	1	2017	1	2017
WSF ECP CDR	4	2018	4	2018
WSF ECP ATP	4	2018	4	2018
WSF Delta PDR	2	2019	2	2019
WSF CDR	1	2020	1	2020
MASE				
MASE leave behind capability	2	2019	4	2019
MASE RFP release	4	2018	4	2018
MASE MSB	1	2019	1	2019
MASE Award contracts	1	2019	1	2019
MASE capability drops	2	2019	4	2019