Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force											Date: May 2017	
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0305111F / *Weather Service*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	-	28.812	19.974	26.654	0.000	26.654	27.144	27.703	28.184	28.761	Continuing	Continuing
672738: *Weather Service*	-	28.812	19.974	26.654	0.000	26.654	27.144	27.703	28.184	28.761	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

Note

In FY2017, PE 0305111F, Next Generation Radar (NEXRAD), efforts were transferred to PE 0305111F, Weather Data Analysis (WDA), in order to cover funding shortfalls in WDA.

In FY2016, PE 0305111F, Next Generation Radar (NEXRAD), research efforts were completed.

A. Mission Description and Budget Item Justification

This budget activity funds operational development necessary to acquire, sustain, and enhance segments of the Air Force Weather Weapon System (AFWWS). Activities also include studies and analysis to support current program planning. Management Service costs include Federally Funded Research and Development Centers (FFRDC) and Advisory and Assistance Service (A&AS). AFWWS provides timely, accurate, consistent and relevant space and atmospheric (a.k.a. terrestrial) weather information for global battlespace situational awareness. AFWWS supports worldwide operations of Air Force and Army warfighters, Special Operation Forces, and other government agencies with weather observing and forecasting capabilities at in-garrison and deployed locations, as well as centralized, reach-back capabilities. AFWWS activities align under four capability areas: Weather Data Collection, Weather Data Analysis and Dissemination, Weather Forecasting, and Product Tailoring/ Warfighter Applications. This alignment ensures an integrated and systems-oriented approach to program management decisions.

Next Generation Radar (NEXRAD) is a tri-agency program between the National Weather Service, Federal Aviation Administration and the US Air Force that operates 159 WSR-88D Doppler weather radars throughout the United States, two territories and select overseas military locations.

The Weather Data Analysis (WDA) program of record provides a large-scale data processing, product generation, and presentation system supporting Open Geospatial Consortium (OGC) services architecture and providing capability to ingest, process, store, access, and disseminate meteorological oceanographic (METOC) data. DoD Warfighter Capability/Benefits include the following; centralized Weather Web Service capability, increased availability of weather impacts and products, improved global, regional, and execution forecasts, specific, mission-tailored weather data on demand, and finally integrated M2M interfaces that shorten the COCOM kill chain.

Weather Forecasting provides advanced scientific numerical weather prediction capabilities for automated, high resolution forecast products for mission execution, rehearsal, and planning. Weather Forecasting includes projects for Numerical Weather Modeling (NWM); Weather Services - Live, Virtual, Constructive (WS-LVC) and the Space Weather Analysis and Forecast System.

Space Weather and Forecasting Systems (SWAFS) is a custom developed suite of software that rapidly ingests, processes and stores all available space environmental data, and disseminates products DoD-wide. It provides space weather products to decision makers in support of 1) Satellite operations, 2) Predictions of HF & UHF/

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force	Date: May 2017
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*

SHF (SATCOM) communications outages, 3) GPS inaccuracies in navigation, 4) Tracking objects like satellites, debris, projectiles in space and forecasts for radar outages and early warning radar false launch indications, 5) National, strategic, operational & tactical intelligence collection, 6) Radiation forecasts for high altitude space flight operations. SWAFS will integrate with the Global Assimilation of Ionosphere Measurement -Full Physics (GAIM-FP) application and provide enhancements to Air Force Weather's communication outage forecasting capability.

This program is in Budget Activity 7, Operational System Development, because this budget activity includes development efforts to upgrade systems that have been fielded or have received approval for full rate production and anticipate production funding in the current or subsequent fiscal year.

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	29.826	19.974	26.577	0.000	26.577
Current President's Budget	28.812	19.974	26.654	0.000	26.654
Total Adjustments	-1.014	0.000	0.077	0.000	0.077
• 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	-1.014	0.000			
• Other Adjustments	0.000	0.000	0.077	0.000	0.077

C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Title: Next Generation Radar (NEXRAD)	0.190	0.000	0.000
Description: NEXRAD is a tri-agency program that manages a nation-wide doppler weather radar network to provide radar data and products for flight operations and resource protection. This effort was formerly included in "Weather Data Collection." ***FY 2016 Accomplishments:*** - Participated with National Weather Service and Federal Aviation Administration to develop hail size discriminator algorithms. ***FY 2017 Plans:*** N/A ***FY 2018 Plans:*** N/A			
Title: Weather Data Analysis (WDA)	14.227	9.623	10.317

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force	Date: May 2017
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
Description: WDA provides a net-centric infrastructure that assimilates worldwide sources of atmospheric and space weather data and produces decision-quality information for warfighters. This effort includes AF Weather Web Services (AFW-WEBS) which was formerly included in "Weather Forecasting." ***FY 2016 Accomplishments:*** - Implemented Inc 4, Build C, Release 1 2 and 3. Which enhances the capability to ingest, process, store, access, and disseminate meteorological/oceanographic data via upgrades to the web services architecture to expand the Open Geospatial Consortium services and upgrade the large-scale data processing to accommodate new environmental satellite and numerical weather modeling data. ***FY 2017 Plans:*** - Complete implementation of Inc 4, Build C, Release 3, develop and implement Inc 4, Build C, Release 4, and develop Inc 4, Build D, Release 1 in order to enhance the capability to ingest, process, store, access, and disseminate meteorological/ oceanographic data via upgrades to the web services architecture to expand the Open Geospatial Consortium services and upgrade the large-scale data processing to accommodate new environmental satellite and numerical weather modeling data as well as begin efforts to implement an Air Force Weather Weapon System Single Services Baseline. ***FY 2018 Plans:*** - Will implement Inc 4, Build D, Release 2, will develop and implement Inc 4, Build 1, Release 2, and will develop Inc 4, Build D, Release 1 in order to enhance the capability to ingest, process, store, access, and disseminate meteorological/oceanographic data via upgrades to the web services architecture to expand the Open Geospatial Consortium services and upgrade the large-scale data processing to accommodate new environmental satellite and numerical weather modeling data as well as begin efforts to implement an Air Force Weather Weapon System Single Services Baseline. In addition, AFW-WEBS Build 2.0 will employ adequate software to maximize services based architecture and be responsive to delivering weather products and services to support warfighter operations. AFW-WEBS will evolve into the single web interface optimized for accessing authoritative AF meteorological information and services. Meteorological information will be serviced in geospatially-enabled formats for direct integration into warfighter systems and decision cycles.			
Title: Numerical Weather Modeling (NWM)	8.180	6.930	11.985
Description: NWM provides advanced scientific numerical weather prediction capabilities for automated, high resolution forecast products for mission planning, rehearsal, and execution. This effort was formerly titled "Weather Forecasting" and included efforts that are now identified separately.			
FY 2016 Accomplishments:			

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force	Date: May 2017
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
- Implemented the Air Force Global Air Land Weather Exploitation Model (GALWEM). Developed and integrated the ensemble and four-dimensional data ingest schemes in order to improve convection and cloud forecasting techniques and enhancing aerosol modeling algorithms. ***FY 2017 Plans:*** - Integrate GALWEM into operations and continue to integrate ensemble and four-dimensional data ingest schemes in order to improve convection and cloud forecasting techniques and enhancing aerosol modeling algorithms. ***FY 2018 Plans:*** - Will refresh both hardware and software of the Cloud Depiction Forecast System Version 2.0 (CDFS II), will develop software for exploitation of new satellite data sources, and will purchase HPC hardware for a development and test enclave in support of Prod 11 operations.			
Title: Space Weather Analysis and Forecast System-Global Assimilation Ionospheric Measurement (SWAFS-GAIM) ***Description:*** Space Weather and Forecasting Systems (SWAFS) is designed to enhance and sustain a single integrated space weather software baseline operating in a net-centric environment at all security levels within the 557th Weather Wing enterprise architecture. SWAFS was declared FOC in FY15 and then modified to focus on the Global Assimilation of Ionospheric Measurements Full Physics (GAIM-FP) model, to satisfy future requirements, including the development of other new models and science algorithms that do not currently exist and processing space weather data that is not currently available. Capabilities provided: Return to service; corrective, adaptive, and capability improvement maintenance for the operational software baseline SWAFS accepts space weather data and uses models and/or algorithms to create and disseminate specified space weather analysis and forecast products Users: COCOMs, MAJCOMs, SPADOC, NRO, Navy & Army ***FY 2016 Accomplishments:*** - Continued with the Net-Centric data transition as well as Scintillation Network Decision Aid (SCINDA) 2.0 and Oval Variation, Analysis, Tracking, Intensity, and Online Nowcasting (OVATION) Prime integration. Also, SWAFS started work on GAIM-FP	4.000	2.274	3.609

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force	Date: May 2017
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*

C. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018
enhancements such a D-Region and GAIM Coverage Analysis Program (CAP). Furthermore, the funding was utilized for Program Support and lab activities to meet user requirements. ***FY 2017 Plans:*** - Incorporate D-Region capability and closing the capability gap in the lower ionospheric layers. Funds integration of Global Ionospheric Scintillation Model in order to forecast scintillation's impact on the phase and amplitude of signals passing through the ionosphere. Continue program office and other related program support activities that may include, but not limited to studies, technical analysis, etc. ***FY 2018 Plans:*** - Will develop and integrate a new Radiation Exposure model into the SWAFS baseline. The Radiation Exposure model will provide the operator with an assessment of the level of radiation for flight. Since the legacy system no longer meets mission requirements to sense, obtain, analyze and predict particle environments responsible for radiation threat to the aircrew, FY18 funds will develop a new model to fulfill operational capability gaps. Continue Program Office and other related support activities that may include, but not limited to studies, technical analysis, etc.			
Title: Weather Services-Live, Virtual Constructive (WS-LVC) ***Description:*** - WS-LVC provides environmental representations to the DoD Modeling and Simulation community. This effort was formerly called Environmental Data Cube System Support (EDCSS) and included in "Weather Forecasting." ***FY 2016 Accomplishments:*** - Developed the Air and Space Natural Environment data and the associated effects that was used in the scenarios within warfighter models and simulations. ***FY 2017 Plans:*** - Integrate weather data and effects into Air Force and Army Warfighter Modeling and Simulation platforms by improving representation of Air and Space Natural Environment data and associated effects, mitigating data gaps in air and space domains, and developing software to transition to a agile software development process. ***FY 2018 Plans:*** - Will transition to cloud computing environment, will support RIF cloud proof of concept, will develop next generation forward-deployed Distributor capability, and will investigate use of Air Force Weather Open Geospatial Consortium (OGC) services for live weather feeds to support Live and Constructive simulations.	2.215	1.147	0.743
Accomplishments/Planned Programs Subtotals	28.812	19.974	26.654

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Air Force	Date: May 2017
Appropriation/Budget Activity 3600: *Research, Development, Test & Evaluation, Air Force* / BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*

D. Other Program Funding Summary ($ in Millions)

Line Item	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
• OPAF: BA03: Line Item # 833070: *Weather Observation Forecast*	21.511	21.667	40.116	0.000	40.116	38.633	21.953	25.535	22.751	Continuing	Continuing
• OPAF: BA03: Line Item # 838010: *Comm Elect Mods*	8.492	8.646	10.155	0.000	10.155	8.924	9.083	9.246	9.412	Continuing	Continuing
• OPAF: BA05: Line Item # 86190A: *Spares and Repair Parts*	0.278	0.719	0.941	0.000	0.941	0.805	0.819	0.832	0.847	Continuing	Continuing

Remarks

E. Acquisition Strategy

AF Weather utilizes spiral and incremental development efforts using multiple contracts supporting a family of ACAT III Programs of Record through development, fielding, and sustainment.

Cost Plus contracts are utilized for software development and sustainment and Fixed Firm Price contracts for COTS systems procurements, hardware procurements and Contract Logistics Support (CLS) system sustainment efforts. Pre-competed GSA and Defense MicroElectronics Activity (DMEA) contract vehicles are leveraged when appropriate, and competitive and small-business awards are favored.

The Air Force Program Executive Officer for Battle Management (AFPEO BM)and the Air Force Program Executive Officer for Space (AFPEO SP) are the PEOs for the AFWWS. AFPEO BM manages the ground-based atmospheric sensing and data analysis, atmospheric forecast systems, and product tailoring warfighter applications. AFPEO SP manages the ground-based segments of space weather collection platforms as well as the Space Weather Analysis and Forecasting System. Both the AFPEO BM and AFPEO SP are their respective program's Milestone Decision Authority (MDA).

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: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*	**Project (Number/Name)** 672738 / *Weather Service*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
WDA 1, Develop centralised web service capability (WDA 4C)	C/CPIF	Northrop Grumman : Bellevue, NE	-	5.117	Dec 2015	3.326	Dec 2016	4.752	Dec 2017	0.000		4.752	Continuing	Continuing	-
WDA 2, Development and integration of weather analysis software (AFW-WEBS)	C/CPFF	Raytheon : Long Beach, CA	-	5.902	Nov 2015	3.610	Dec 2016	4.076	Dec 2017	0.000		4.076	Continuing	Continuing	-
WDA 4, Development Contract and integration of weather analysis software	MIPR	AFRL : Wright - Patterson, OH	-	0.040	Sep 2016	0.040	Sep 2017	0.040	Sep 2018	0.000		0.040	Continuing	Continuing	-
WDA 5, Weather Common Component (WX CC)	C/CPIF	Northrop Grumman : Bellevue, NE	-	1.483	Feb 2016	0.000		0.000		0.000		0.000	Continuing	Continuing	-
NWM 1 - Perform software enhancements to the mesoscale production model	MIPR	NCAR : Boulder, CO	-	0.669	Feb 2016	0.503	Feb 2017	0.000		0.000		0.000	Continuing	Continuing	-
NWM 2 - Improve land information system (LIS) application, providing earth surface boundary characterization for numerical modeling	MIPR	NASA : Greenbelt, MD	-	1.054	Feb 2016	1.046	Feb 2017	1.125	Feb 2018	0.000		1.125	Continuing	Continuing	-
NWM 3 - Develop model data assimilation application, ensemble forecast procedures, and convective-scale resolution model capability.	C/CPIF	Northrop Grumman : Bellevue, NE	-	6.084	Dec 2015	5.579	Jan 2017	9.673	Dec 2017	0.000		9.673	Continuing	Continuing	-
WS-LVC	C/CPIF	NWACT : Orlando, FL	-	1.087	Feb 2016	0.663	Apr 2017	0.515	Mar 2018	0.000		0.515	Continuing	Continuing	-
NEXRAD	MIPR	NOAA/NWS : Silver Spring, MD	-	0.448	Jun 2016	0.000		0.000		0.000		0.000	Continuing	Continuing	-
SWAFS development integration and sustainment of the GAIM-full physics version	C/CPIF	Northrop Grumman : Bellevue, NE	-	3.590	Sep 2016	1.989	Oct 2016	3.000	Apr 2018	0.000		3.000	Continuing	Continuing	-

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0305111F / *Weather Service*	Project (Number/Name) 672738 / *Weather Service*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SWAFS 2- perform verification and validation report on the GAIM-full physics model	Various	Various : Various	-	0.000		0.000		0.159	Jan 2018	0.000		0.159	Continuing	Continuing	-
		Subtotal	-	25.474		16.756		23.340		0.000		23.340	-	-	-

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Subtotal	-	-		-		-		-		-	-	-	-

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
46th TS/JITC AFLCMC	WR	46 TS : Offutt AFB, NE	-	0.563	Nov 2015	0.434	Nov 2016	0.443	Nov 2017	0.000		0.443	Continuing	Continuing	-
		Subtotal	-	0.563		0.434		0.443		0.000		0.443	-	-	-

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Administration AFLCMC	C/CPFF	AFLCMC : Hanscom AFB, MA	-	2.365	Oct 2015	2.374	Oct 2016	2.421	Oct 2017	0.000		2.421	Continuing	Continuing	-
FFRDC SMC	SS/CPFF	SMC : Los Angeles AFB, CA	-	0.410	Oct 2015	0.410	Oct 2016	0.450	May 2018	0.000		0.450	Continuing	Continuing	-
		Subtotal	-	2.775		2.784		2.871		0.000		2.871	-	-	-

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Air Force			Date: May 2017
Appropriation/Budget Activity 3600 / 7	R-1 Program Element (Number/Name) PE 0305111F / *Weather Service*	Project (Number/Name) 672738 / *Weather Service*	

	Prior Years	FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	-	28.812		19.974		26.654		0.000		26.654	-	-	-

Remarks

Exhibit R-4, RDT&E Schedule Profile: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*	**Project (Number/Name)** 672738 / *Weather Service*

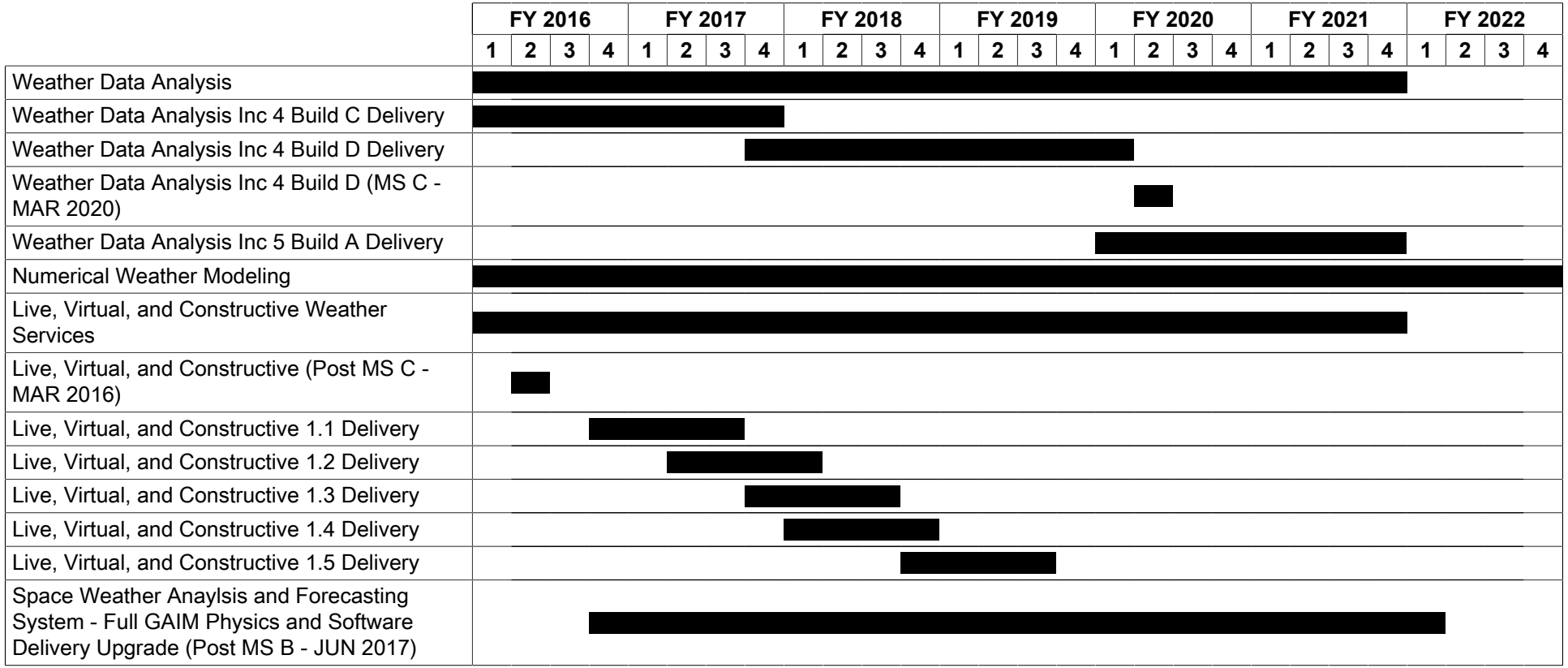

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Air Force		Date: May 2017
Appropriation/Budget Activity 3600 / 7	**R-1 Program Element (Number/Name)** PE 0305111F / *Weather Service*	**Project (Number/Name)** 672738 / *Weather Service*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Weather Data Analysis	1	2016	4	2021
Weather Data Analysis Inc 4 Build C Delivery	1	2016	4	2017
Weather Data Analysis Inc 4 Build D Delivery	4	2017	1	2020
Weather Data Analysis Inc 4 Build D (MS C - MAR 2020)	2	2020	2	2020
Weather Data Analysis Inc 5 Build A Delivery	1	2020	4	2021
Numerical Weather Modeling	1	2016	4	2022
Live, Virtual, and Constructive Weather Services	1	2016	4	2021
Live, Virtual, and Constructive (Post MS C - MAR 2016)	2	2016	2	2016
Live, Virtual, and Constructive 1.1 Delivery	4	2016	3	2017
Live, Virtual, and Constructive 1.2 Delivery	2	2017	1	2018
Live, Virtual, and Constructive 1.3 Delivery	4	2017	3	2018
Live, Virtual, and Constructive 1.4 Delivery	1	2018	4	2018
Live, Virtual, and Constructive 1.5 Delivery	4	2018	3	2019
Space Weather Anaylsis and Forecasting System - Full GAIM Physics and Software Delivery Upgrade (Post MS B - JUN 2017)	4	2016	1	2022