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Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Air Force **Date:** February 2016

Appropriation/Budget Activity 3600: <i>Research, Development, Test & Evaluation, Air Force I BA 7: Operational Systems Development</i>	R-1 Program Element (Number/Name) PE 0305111F / <i>Weather Service</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
Total Program Element	-	19.404	29.826	19.974	0.000	19.974	26.577	27.133	27.691	28.181	Continuing	Continuing
672738: <i>Weather Service</i>	-	19.404	29.826	19.974	0.000	19.974	26.577	27.133	27.691	28.181	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

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 both current program planning and execution and future program planning. Program Management Administration costs include Federally Funded Research and Development Centers and Advisory and Assistance Service. 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.

Weather Data Collection provides automated atmospheric and space environmental sensing capabilities at fixed and deployed locations worldwide. Projects include Next Generation Radar (WSR-88D) and Upper Air Observing Follow-On. Funding will enhance system technical performance based upon state-of-the-art signal processor technology for enhanced discrimination of precipitation types, severe weather detection, and rainfall amount estimations and will continue operationalizing new upper air sounding capability.

Weather Data Analysis and Dissemination provides a net-centric infrastructure that assimilates worldwide sources of atmospheric and space weather data and produces decision-quality information for warfighters. Improved analysis of real-time weather information supports DoD's Warfighting and Enterprise Information Environment Mission Areas, as well as DoD's role in transformation of the National Airspace System through the Next Generation Air Transportation System, and enhances Air Force energy security plans. In FY16 the Air Force Weather-Web Services (AFW-WEBS) moved into this capability area from Weather Forecasting to better align its function of integration of net-centric capabilities. FY17 funding will implement 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.

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; Weather Services - Live, Virtual, Constructive (WS-LVC, formerly Environmental Data Cube System Support), and the Space Weather Analysis and Forecast System. FY17 funding will complete Air Force Global Air Land Weather

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Exploitation Model (GALWEM) integration 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.

Product Tailoring/Warfighter Applications provide timely, local, and regional target-scale weather information to operational commanders for a given Area of Responsibility and at tactical levels they provide front-line weather information to warfighters, including weather forces, conducting combat operations. This supports the 'train as you fight' concept by assuring fixed and deployable systems have an equivalent operator look and feel. Wx Common Component.

The FY17 funding request was reduced by \$6.590M to account for the availability of prior year execution funds.

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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	20.102	29.955	26.564	0.000	26.564
Current President's Budget	19.404	29.826	19.974	0.000	19.974
Total Adjustments	-0.698	-0.129	-6.590	0.000	-6.590
• Congressional General Reductions	0.000	-0.129			
• 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	-0.698	0.000			
• Other Adjustments	0.000	0.000	-6.590	0.000	-6.590

Change Summary Explanation

AF FY16 FFRDC reduction of \$129K
 AF FY17 funding request was reduced by \$6.590M to account for the availability of prior year execution funds.

C. Accomplishments/Planned Programs (\$ in Millions)	FY 2015	FY 2016	FY 2017
Title: Next Generation Radar (NEXRAD)	0.191	0.450	0.200
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 2015 Accomplishments:			

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>- Participated with National Weather Service and Federal Aviation Administration to fine tune and develop differential reflectivity (ZDR) calibration methods.</p> <p>FY 2016 Plans:</p> <p>- Participating with National Weather Service and Federal Aviation Administration to develop hail size discriminator algorithms.</p> <p>FY 2017 Plans:</p> <p>- Will participate with National Weather Service and Federal Aviation Administration to develop algorithms to aid in hydrometeor classification, and determining melting layer and quantitative precipitation values.</p>				
<p>Title: Weather Data Analysis (WDA)</p> <p>Description: WDA provides a net-centric infrastructure that assimilates worldwide sources of atmospheric and space weather data and produces decision-quality information for warfighters. In FY15, this effort included AF Weather Web Services (AFW-WEBS) which was formerly included in "Weather Forecasting."</p> <p>FY 2015 Accomplishments:</p> <p>- Implemented Inc4, Build B, Release 4 and developed Inc4, Build C, 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 improve the presentation system.</p> <p>FY 2016 Plans:</p> <p>- Implementing Inc 4, Build C, Release 1; developing and implementing Inc4, Build C, Release 2; and developing Release 3 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.</p> <p>FY 2017 Plans:</p> <p>- Will implement Inc4, Build C, Release 3, develop and implement Inc4, Build C, Release 4, and develop Inc4, 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.</p>		5.960	13.334	7.909
Title: Numerical Weather Modeling (NWM)		3.860	10.717	8.704

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
<p>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.</p> <p>FY 2015 Accomplishments: - Continued integration of advanced atmospheric and space weather forecast capabilities, including continued development and integration of the unified cloud detection capabilities and evaluation of satellite radiances for inclusion in atmospheric models.</p> <p>FY 2016 Plans: - Implementing the Air Force Global Air Land Weather Exploitation Model (GALWEM) and developing and integrating ensemble and four-dimensional data ingest schemes in order to improve convection and cloud forecasting techniques and enhancing aerosol modeling algorithms.</p> <p>FY 2017 Plans: - Will complete Air Force Global Air Land Weather Exploitation Model (GALWEM) integration 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.</p>				
<p>Title: Space Weather Analysis and Forecast System (SWAFS)</p> <p>Description: 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.</p> <p>SWAFS was declared FOC in FY15 and then modified to focus on the Global Assimilation of Ionospheric Measurements(GAIM)Full Physics 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. Funding also provides for program office and related support activities.</p> <p>Capabilities provided:</p> <p>Return to service; corrective, adaptive, and capability improvement maintenance for the operational software baseline</p> <p>SWAFS accepts space weather data and uses models and/or algorithms to create and disseminate specified space weather analysis and forecast products</p>		6.483	4.000	2.274

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C. Accomplishments/Planned Programs (\$ in Millions)		FY 2015	FY 2016	FY 2017
Users: COCOMs, MAJCOMs, SPADOC, NRO, Navy & Army				
<p><i>FY 2015 Accomplishments:</i></p> <ul style="list-style-type: none"> - SWAFS development focused on integration of Global Assimilation of Ionospheric Measurements (GAIM) Full Physics model to improve ionospheric specifications and forecasts; add to the net centric data delivery of space weather to AFW-WEBS to ensure warfighter access to authoritative, deliverable, resilient, and timely space weather data/products. - New data ingests of COSMIC2/SSAEM, GOES-R, RINEX, and GPS particle data will be applied to provide necessary data for scintillation/ionospheric modeling and satellite anomaly attribution; and model upgrades for the auroral oval, HF comm coverage maps and point-to-point forecasts. <p><i>FY 2016 Plans:</i></p> <ul style="list-style-type: none"> - The SWAFS program is continuing with the Net-Centric data transition as well as SCINDA 2.0 and OVATION Prime integration. Also, SWAFS is starting work on GAIM-Full Physics enhancements such a D-Region and GAIM CAP. Furthermore, the funding will be utilized for Program Support and lab activities to meet user requirements. <p><i>FY 2017 Plans:</i></p> <ul style="list-style-type: none"> - GAIM-Full Physics model will reach FOC, incorporating 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. Funding also provides for program office and related support activities. 				
<p><i>Title:</i> Weather Services-Live, Virtual, and Constructive (WS-LVC)</p> <p><i>Description:</i> - 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."</p> <p><i>FY 2015 Accomplishments:</i></p> <ul style="list-style-type: none"> - Continued development of platform specific data and effects for Air Force assets integration into operational systems. <p><i>FY 2016 Plans:</i></p> <ul style="list-style-type: none"> - Continuing incremental development of Air and Space Natural Environment data and associated effects for use in tailorable scenarios within warfighter models and simulations. <p><i>FY 2017 Plans:</i></p>		0.690	1.325	0.887

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C. Accomplishments/Planned Programs (\$ in Millions)	FY 2015	FY 2016	FY 2017
- Will 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.			
Title: Joint Environmental Toolkit (JET) Description: JET provides timely, local and regional target-scale weather information to operational commanders for a given Area of Responsibility, and at tactical levels provides weather information to front-line warfighters in support of combat operations. This effort was formerly titled "Product Tailoring/Warfighter Applications." FY 2015 Accomplishments: - Finalized software development and integration of regional and tactical weather systems and integration with warfighter command and control systems. No future RDT&E efforts are planned with this system.	2.220	-	-
Accomplishments/Planned Programs Subtotals			
	19.404	29.826	19.974

D. Other Program Funding Summary (\$ in Millions)											
Line Item	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
• OPAF: BA07: Line Item # 833070: <i>Weather Observation Forecast</i>	16.309	21.511	21.667	0.000	21.667	23.725	20.283	21.737	22.127	Continuing	Continuing
• OPAF: BA07: Line Item # 838010: <i>Comm Elect Mods</i>	12.075	8.492	8.646	0.000	8.646	10.058	8.837	8.994	9.155	Continuing	Continuing
• OPAF: BA07: Line Item # 86190A: <i>Spares and Repair Parts</i>	1.605	0.278	0.719	0.000	0.719	0.932	0.797	0.811	0.824	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.

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The Air Force Program Executive Officer for Battle Management (AFPEO BM) and the Air Force Program Executive Officer for the Space Systems (AFPEO SMC) 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 SMC 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 SMC 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.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Air Force **Date:** February 2016

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Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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			
WDA 1, Develop centralised web service capability (WDA 4C)	C/CPIF	Northrop Grumman : Bellevue, NE	-	3.111	Mar 2015	6.635	Dec 2015	3.326	Dec 2016	0.000		3.326	Continuing	Continuing	-
WDA 2, Development and integration of weather analysis software (AFW-WEBS)	C/CPFF	Raytheon : Long Beach, CA	-	1.762	Jul 2015	4.059	Nov 2015	3.410	Dec 2016	0.000		3.410	Continuing	Continuing	-
WDA 4, Development Contract and integration of weather analysis software	MIPR	AFRL : Wright - Patterson, OH	-	0.040	Sep 2015	0.040	Sep 2016	0.040	Sep 2017	0.000		0.040	Continuing	Continuing	-
WDA 5, Weather Common Component (WX CC)	C/CPIF	Northrop Grumman : Bellevue, NE	-	0.000		1.000	Feb 2016	0.000		0.000		0.000	Continuing	Continuing	-
JET. Integrate weather systems with warfighter C4I systems	C/CPIF	Raytheon : Omaha, NE	-	1.139	Nov 2014	0.000		0.000		0.000		0.000	Continuing	Continuing	-
NWM 1 - Perform software enhancements to the mesoscale production model	MIPR	NCAR : Boulder, CO	-	0.327	Mar 2015	2.284	Feb 2016	0.503	Feb 2017	0.000		0.503	Continuing	Continuing	-
NWM 2 - Improve land information system (LIS) application, providing earth surface boundary characterization for numerical modeling	MIPR	NASA : Greenbelt, MD	-	0.701	May 2015	2.047	Feb 2016	1.046	Feb 2017	0.000		1.046	Continuing	Continuing	-
NWM 3 - Develop model data assimilation application, ensemble forecast procedures, and convective-scale resolution model capability.	C/CPIF	Northrop Grumman : Bellevue, NE	-	2.090	Mar 2015	5.298	Dec 2015	5.579	Jan 2017	0.000		5.579	Continuing	Continuing	-
WS-LVC	MIPR	NWACT : Orlando, FL	-	0.491	Feb 2015	1.087	Feb 2016	0.663	Apr 2017	0.000		0.663	Continuing	Continuing	-
NEXRAD	MIPR	NOAA/NWS : Silver Spring, MD	-	0.191	Jun 2015	0.448	Jun 2016	0.200	Jun 2017	0.000		0.200	Continuing	Continuing	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Air Force **Date:** February 2016

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Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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			
SWAFS development integration and sustainment of the GAIM-full physics version	C/CPIF	Northrop Grumman : Bellevue, NE	-	4.650	Sep 2015	3.590	Sep 2016	1.989	Oct 2016	0.000		1.989	Continuing	Continuing	-
SWAFS 2- perform verification and validation report on the GAIM-full physics model	MIPR	AFRL : Kirtland AFB, NM	-	0.449	Sep 2015	0.000		0.000		0.000		0.000	Continuing	Continuing	-
SWAFS 3- perform integration of DMSP SSULI data set into the GAIM- full physics model	MIPR	NRL : Washington, DC	-	0.188	Sep 2015	0.000		0.000		0.000		0.000	Continuing	Continuing	-
SWAFS 4- perform integration of DMSP SSUSI data set into the GIAM- full physics model	MIPR	NAVSEA/APL : Laurel, MD	-	0.159	Sep 2015	0.000		0.000		0.000		0.000	Continuing	Continuing	-
SWAFS 5- software maintenance to the National Geophysical Data Center	MIPR	Global Ionosonde : Boulder, CO	-	0.623		0.000		0.000		0.000		0.000	Continuing	Continuing	-
Subtotal			-	15.921		26.488		16.756		0.000		16.756	-	-	-

Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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			
Subtotal			-	-		-		-		-		-	-	-	-

Test and Evaluation (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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			
46th TS/JITC AFLCMC	Various	Various : Various, FL	-	0.631	Oct 2014	0.563	Nov 2015	0.434	Nov 2016	0.000		0.434	Continuing	Continuing	-
Subtotal			-	0.631		0.563		0.434		0.000		0.434	-	-	-

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Exhibit R-4, RDT&E Schedule Profile: PB 2017 Air Force **Date:** February 2016

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	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021			
	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
Joint Environmental Toolkit -- Inc 2 Build C Delivery																												

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Air Force **Date:** February 2016

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Schedule Details

Events	Start		End	
	Quarter	Year	Quarter	Year
Next Generation Radar	1	2015	4	2021
Upper Air Sensing	1	2015	4	2019
Weather Data Analysis	1	2015	4	2021
Weather Data Analysis Inc 4 Build B Delivery	1	2015	3	2015
Weather Data Analysis Inc 4 Build C Delivery	2	2015	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)	1	2020	1	2020
Weather Data Analysis Inc 4 Build E Delivery	1	2020	4	2021
Numerical Weather Modeling	1	2015	4	2021
Live, Virtual, and Constructive Weather Services	1	2015	4	2021
Live, Virtual, and Constructive 1.0 Delivery	1	2015	1	2016
Live, Virtual, and Constructive (MS C - MAR 2016)	1	2016	1	2016
Live, Virtual, and Constructive 1.1 Delivery	2	2015	3	2016
Live, Virtual, and Constructive 1.2 Delivery	2	2016	3	2017
Live, Virtual, and Constructive 1.3 Delivery	2	2017	3	2018
Live, Virtual, and Constructive 1.4 Delivery	2	2018	3	2019
Live, Virtual, and Constructive 1.5 Delivery	2	2019	3	2020
Space Weather Analysis and Forecasting System Software Delivery Upgrade	1	2015	4	2021
Space Weather Analysis and Forecasting System - Full GAIM Physics (Post MS B - JUN 2017)	4	2015	4	2021
Joint Environmental Toolkit -- Inc 2 Build C Delivery	1	2015	4	2015

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