Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy											Date: February 2018	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0603207N *I Air/Ocean Tactical Applications*							
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	571.862	44.175	48.365	29.747	-	29.747	33.642	34.763	34.956	37.582	Continuing	Continuing
2341: *METOC Data Acquisition*	167.779	4.268	5.483	3.471	-	3.471	5.238	5.741	5.948	7.859	Continuing	Continuing
2342: *METOC Data Assimilation and Mod*	231.124	20.082	21.111	17.441	-	17.441	21.117	21.596	21.495	22.441	Continuing	Continuing
2343: *Tactical METOC Applications*	153.449	10.275	11.715	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	175.439
2344: *Precise Time and Astrometry*	10.689	4.844	5.190	4.556	-	4.556	2.946	3.006	3.017	3.079	Continuing	Continuing
2363: *Remote Sensing Capability Development*	7.355	3.773	3.959	0.324	-	0.324	0.327	0.328	0.328	0.000	0.000	16.394
3207: *Fleet Synthetic Training*	1.466	0.933	0.253	0.266	-	0.266	0.283	0.305	0.326	0.332	Continuing	Continuing
3404: *Tactical Environmental Support*	0.000	0.000	0.327	2.595	-	2.595	2.616	2.643	2.671	2.685	Continuing	Continuing
3405: *Decision Support Products & Dissemination*	0.000	0.000	0.327	1.094	-	1.094	1.115	1.144	1.171	1.186	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Tactical Applications (AOTA) Program Element is aligned with the Navy's maritime strategy to enhance the future mission capabilities of the Navy-Marine Corps Meteorological and Oceanographic (METOC) Team supporting naval warfighters worldwide. New state-of-the art government and commercial technologies are identified, transitioned, demonstrated and then integrated into Combat Systems and programs of record to provide capabilities that provide real-time and near-real-time operational effects of the physical environment on the performance of combat forces and their new and emerging platforms, sensors, systems and munitions. The AOTA program element focuses on sensing and characterizing and predicting the littoral and deep-strike battlespace in the context of regional conflicts and crisis response scenarios. Projects in this program element transition state-of-the art sensing, assimilation, modeling and decision aid technologies from government and commercial sources. Unique project development efforts include atmospheric and oceanographic data assimilation techniques, forecast models, data base management systems and associated software for use in mainframe, desktop and laptop computers. Model data, products and services can be used by forward-deployed personnel or in a reach-back mode to optimize sensor placement and force allocation decisions. Global Geospatial Information and Services efforts within this program address the bathymetric needs of the Navy. Also developed are algorithms to process new satellite sensor data for integration into Navy and Marine Corps decision support systems and for display as part of the common operational and tactical pictures. In addition, the projects provide for demonstration and validation of specialized atmospheric and oceanographic instrumentation and measurement techniques, new sensors, communications and interfaces. Included are new capabilities to assess, predict and enhance the performance of current and emerging undersea warfare and mine warfare weapons systems. AOTA capabilities are designed to support the latest versions of the Global Command and Control System and specific unit-level combat systems. This program element develops technological upgrades for the U.S. Naval

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy	Date: February 2018
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 Program Element (Number/Name)** PE 0603207N *I Air/Ocean Tactical Applications*

Observatory's Master Clock system to meet requirements of Department of Defense communications, cryptographic, intelligence, geolocation, and targeting systems; develops near-real-time earth orientation predictions; develops very precise determination of positions of both faint and bright stars; and supports satellite tracking and space debris studies.

Major emphasis areas include the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) and the METOC Data Acquisition, the METOC Data Assimilation & Modeling, the Precise Timing and Astrometry, the Fleet Synthetic Training, the Tactical Environmental Support, Decision Support Products & Dissemination, the Earth System Prediction Capability projects, and the Remote Sensing Capability Development.

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	48.536	48.365	49.741	-	49.741
Current President's Budget	44.175	48.365	29.747	-	29.747
Total Adjustments	-4.361	0.000	-19.994	-	-19.994
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.015	0.000			
• SBIR/STTR Transfer	-0.746	0.000			
• Program Adjustments	0.000	0.000	-17.673	2.500	-15.173
• Rate/Misc Adjustments	0.000	0.000	-2.321	-2.500	-4.821
• Congressional Directed Reductions Adjustments	-3.600	-	-	-	-

Change Summary Explanation

Schedule- 1) The schedule for PTA is updated to reflect the additional required research and upgrades.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2341 / *METOC Data Acquisition*	

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
2341: *METOC Data Acquisition*	167.779	4.268	5.483	3.471	-	3.471	5.238	5.741	5.948	7.859	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The major work of the Meteorology and Oceanography (METOC) Data Acquisition Project is to provide future mission capabilities to warfighters allowing them to detect and monitor the conditions of the physical environment throughout the entire battlespace. The most promising new sensor technologies (including unmanned vehicles, tactical sensor exploitation, in-situ sensors) are transitioned from the government's and commercial industry's technology base. These new sensor technologies are demonstrated, validated and integrated into operational programs for warfighters. These new sensor capabilities provide timely and accurate METOC data to operational and tactical commanders. METOC data requirements have evolved with emphasis on naval warfare shifting to littoral and deep strike battlespace. The need to accurately characterize dynamic conditions are crucial in planning and executing warfare operations and effectively allocating force weapon and sensor systems. Routinely available data sources, such as climatology, oceanographic and meteorological numerical models are necessary but not sufficient to support the littoral and deep strike regions. Operational sensors are deployed great distances from the target area of interest. The challenge is to collect and disseminate METOC data in variable and dynamic littoral environmental conditions or in denied, remote or inaccessible areas over extended periods of time.

This project: 1) provides the means to rapidly and automatically acquire a broad array of METOC data using off-board and on-board sensors; 2) provides an on-scene assessment capability for the tactical commander; 3) provides the tactical commander with real-time METOC data and products for operational use; 4) demonstrates and validates the use of tactical workstations and desktop computers for processing and display of METOC data and products; 5) demonstrates and validates techniques which employ data compression, connectivity and interface technologies to obtain, store, process, distribute and display these METOC data and products; 6) develops new charting and bathymetric survey techniques necessary to reduce the existing shortfall in coastal hydrographic survey requirements; 7) develops an expanded database for predictive METOC models in areas of interest; and 8) supports the development of radar weather using through-the-sensor techniques. Major emphasis area Tactical Oceanographic Capabilities project.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC)	4.061	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: Fleet Naval METOC has updated the definition and structure of the METOC program along the lines of operational mission needs. This update focuses on the operational characteristics of Tasking, Collection, Processing, Exploitation, and Dissemination (TCPED) of METOC data and information. Identified efforts supporting METOC are realigned to projects and activities that align to the TCPED updated program structure.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
FY2018 funding realigned to sub project METOC Data Acquisition, project unit (PU) 3404 Tactical Environmental Support, and PU 3405 Decision Support Products & Dissemination. ***FY 2018 Plans:*** NA ***FY 2019 Base Plans:*** N/A ***FY 2019 OCO Plans:*** N/A					
Title: Tactical Oceanography Capabilities (TOC) / Undersea Warfare (USW) ***Articles:***	0.207 -	0.000 -	0.000 -	0.000 -	0.000 -
Description: Fleet Naval METOC has updated the definition and structure of the METOC program along the lines of operational mission needs. This update focuses on the operational characteristics of Tasking, Collection, Processing, Exploitation, and Dissemination (TCPED) of METOC data and information. Identified efforts supporting METOC are realigned to projects and activities that align to the TCPED updated program structure. FY2018 funding realigned to sub project METOC Data Acquisition, project unit (PU) 3404 Tactical Environmental Support, and PU 3405 Decision Support Products & Dissemination. ***FY 2018 Plans:*** NA ***FY 2019 Base Plans:*** NA ***FY 2019 OCO Plans:*** NA ***FY 2018 to FY 2019 Increase/Decrease Statement:*** FY2018 funding realigned to sub project METOC Data Acquisition, project unit (PU) 3404 Tactical Environmental Support, and PU 3405 Decision Support Products & Dissemination.					
Title: Meteorological and Oceanographic (METOC) Data Acquisition ***Articles:***	0.000 -	5.483 -	3.471 -	0.000 -	3.471 -

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Description: Efforts falling within the Meteorology and Oceanography (METOC) Collections Project provide future scientific and technological warfighting capabilities that detect and continuously monitor environmental (atmospheric, sea surface, oceanographic and seabed) conditions throughout the battlespace. The Navy's mission continues to require focus on blue-water operations, littoral and deep-strike (inland) battlespaces. Each of these operating areas (and the transitions between them) has its own dynamic and complex environmental characteristics and behaviors that require modifying METOC Collections and associated sensing strategies and methodologies. Without reliable characterization of ocean and atmosphere in these operating areas, the Navy risks ineffective allocation and employment of warfighters and weapon systems, and the sensors that fully enable them. Fleet Naval METOC has updated the definition and structure of the METOC program along the lines of operational mission needs. This update focuses on the operational characteristics of Tasking, Collection, Processing, Exploitation, and Dissemination (TCPED) of METOC data and information. Identified efforts supporting METOC are realigned to projects and activities that align to the TCPED updated program structure. FY2018 funding realigned to project unit (PU) 2341 METOC Data Acquisition from PU 2341 Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC) and Tactical Oceanography Capabilities (TOC)/ Undersea Warfare (USW) and PE 0604218N (Air/Ocean Equipment Engineering) PU 2345. This is not a new Start FY2019 funding in this project is realigned to PU 3404 Tactical Environmental Support for follow-on efforts that will more fully transition tactical environmental technologies into Fleet operations, as well as address operational lessons learned from fielding of recently introduced technologies. ***FY 2018 Plans:*** - Continue: Test, validate, and transition new components for data assimilation capabilities for global and mesoscale atmospheric models that address multiple scales. - Begin: Implement a "rapid innovation" weather-ocean capability that emphasizes observing systems. - Continue: Supplement efforts in a FY17-19 Rapid Transition Project to solve the overall Forward ocean data assimilation problem and integrate results into Anti-submarine Warfare Tactical Decision Aids.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue: Provide technical support to passive microwave and weather satellite follow-on remote sensing projects for all phases of pre- and post-launch sensor calibration, algorithm validation, data exploitation, dissemination and quality control of critical synoptic atmospheric and geophysical environmental data products. - Continue: Develop and test a Navy Coupled Ocean Data Assimilation-based capability for forward platforms to assimilate collected oceanographic data into an oceanographic model field in an acoustically consistent way. - Continue: Develop, validate and transition bias correction for extended-range forecasts in the global and regional coupled systems, using information from the satellite observations to measure the bias and guide the correction. - Continue: Collect in-situ transmission loss from tactical platforms in support of a Low Frequency Bottom Loss database. - Continue: Develop a methodology for creating a bottom backscattering database in Deep Water, i.e., water depths deeper than the continental rise, and apply the methodology to regions of operational interest to create a Prototype Deep Ocean Bottom Scattering database. - Begin: Assimilate satellite optical data streams into the Coupled Ocean-Atmosphere Mesoscale Prediction System ocean model component. - Continue: Characterize/assess biological scattering and attenuation at tactical frequencies, known to have a significant impact on mid-frequency active sonar systems. - Complete: Deliver environmental data collected by the P-8 aircraft, to be incorporated into prediction tools.					
FY 2019 Base Plans: Continue all efforts of FY18 less those noted as completed. The effort also plans to focus on each category as described below: - Continue: Implement a "rapid innovation" weather-ocean capability that emphasizes observing systems. - Continue: Assimilate satellite optical data streams into the Coupled Ocean-Atmosphere Mesoscale Prediction System ocean model component. - Complete: Test, validate, and transition new components for data assimilation capabilities for global and mesoscale atmospheric models that address multiple scales. - Complete: Supplement efforts in a FY17-19 Rapid Transition Project to solve the overall Forward ocean data assimilation problem and integrate results into Anti-submarine Warfare Tactical Decision Aids. - Complete: Provide technical support to passive microwave and weather satellite follow-on remote sensing projects for all phases of pre- and post-launch sensor calibration, algorithm validation, data exploitation, dissemination and quality control of critical synoptic atmospheric and geophysical environmental data products.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Complete: Develop and test a Navy Coupled Ocean Data Assimilation-based capability for forward platforms to assimilate collected oceanographic data into an oceanographic model field in an acoustically consistent way. - Complete: Develop, validate and transition bias correction for extended-range forecasts in the global and regional coupled systems, using information from the satellite observations to measure the bias and guide the correction. - Complete: Collect in-situ transmission loss from tactical platforms in support of a Low Frequency Bottom Loss database. - Complete: Develop a methodology for creating a bottom backscattering database in Deep Water, i.e., water depths deeper than the continental rise, and apply the methodology to regions of operational interest to create a Prototype Deep Ocean Bottom Scattering database. - Complete: Characterize/assess biological scattering and attenuation at tactical frequencies, known to have a significant impact on mid-frequency active sonar systems. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Funding Decreases from FY18 to FY19 in this project are realigned to PROJ 3404 for follow-on efforts that will more fully transition tactical environmental technologies into Fleet operations, as well as address operational lessons learned from fielding of recently introduced technologies. This feedback mechanism enables agility, thus accelerating the improvement of capabilities that provide a distinct tactical advantage to the Fleet and Marine Corps.					
Accomplishments/Planned Programs Subtotals	4.268	5.483	3.471	0.000	3.471

C. Other Program Funding Summary ($ in Millions)

Line Item	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
• RDTEN/0604218N/2345: *FLEET METOC EQUIPMENT*	2.222	2.411	2.438	-	2.438	2.456	2.505	0.000	0.000	Continuing	Continuing

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Meteorological and Oceanographic (METOC) Data Acquisition Project to develop, demonstrate, and validate METOC data collection methods and sensors, and to evolve the ability to provide timely and accurate METOC data and products to the Tactical Commander, all with management oversight by the Navy.

E. Performance Metrics

Goal: Develop techniques and tools to acquire Meteorological and Oceanographic (METOC) data to improve the accuracy of global and regional scale meteorological and oceanographic forecast models. Wherever applicable, and based on favorable Science & Technology (S&T) assessments, tasks shall leverage or transition existing Small Business Innovative Research and/or RDT&E Budget Activity (BA) 2 and 3 S&T work. Metric -- Tasks will address no less than 75% of applicable capability gaps and requirements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

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
METOC (DATA) Collections	WR	NRL : Washington, DC	77.695	3.237	Nov 2016	0.432	Nov 2017	0.431	Nov 2018	-		0.431	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	WR	SSC PAC : California	23.063	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	Various	Various : Various	45.516	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	Various	Various : Various	5.764	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	Various	Various : Various	8.422	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	WR	NSWC : Bethesda, MD	0.988	0.205	Nov 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	APPLIED SCIENCE ASSOCIATED : RHODE ISLAND	0.000	0.226	Dec 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	University of Washington : Seattle, WA	0.000	0.000		0.050	Nov 2017	0.470	Nov 2018	-		0.470	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	METRON : Reston, VA	0.000	0.000		0.314	Nov 2017	0.110	Dec 2018	-		0.110	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC : Virginia	1.481	0.300	Dec 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	Various : Various	0.000	0.000		0.000		0.000		-		0.000	0.328	0.328	-
METOC Future Mission Capabilities	C/FP	CSC : Virginia	0.431	0.300	Dec 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC (DATA) Collections	WR	NRL : Monterry,CA Stennis Space Center, MS	0.000	0.000		1.896	Nov 2017	0.915	Dec 2018	-		0.915	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

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
METOC Future Mission Capabilities	C/CPFF	GDIT : Virginia	0.138	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	Penn State University : PA	0.000	0.000		2.791	Nov 2017	1.545	Dec 2018	-		1.545	Continuing	Continuing	Continuing
		Subtotal	163.498	4.268		5.483		3.471		-		3.471	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
METOC Future Mission Capabilities	C/CPIF	Various : Various	2.672	0.000		0.000		0.000		-		0.000	0.000	2.672	-
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	C/FP	SAIC : Virginia	0.600	0.000		0.000		0.000		-		0.000	0.000	0.600	-
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	WR	SSC PAC : California	0.247	0.000		0.000		0.000		-		0.000	0.000	0.247	-
METOC Future Mission Capabilities	C/CPFF	PSS/BAH : California	0.066	0.000		0.000		0.000		-		0.000	0.000	0.066	-
		Subtotal	3.585	0.000		0.000		0.000		-		0.000	0.000	3.585	N/A

Test and Evaluation ($ 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
METOC Future Mission Capabilities	Various	Various : Various	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
		Subtotal	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2341 / *METOC Data Acquisition*	

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
Acquisition Workforce	Various	Not Specified : Not Specified	0.096	0.000		0.000		0.000		-		0.000	0.000	0.096	-
METOC Future Mission Capabilities Management Support	C/FP	BAH : Virginia	0.400	0.000		0.000		0.000		-		0.000	0.000	0.400	-
		Subtotal	0.496	0.000		0.000		0.000		-		0.000	0.000	0.496	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	167.779	4.268		5.483		3.471		-		3.471	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

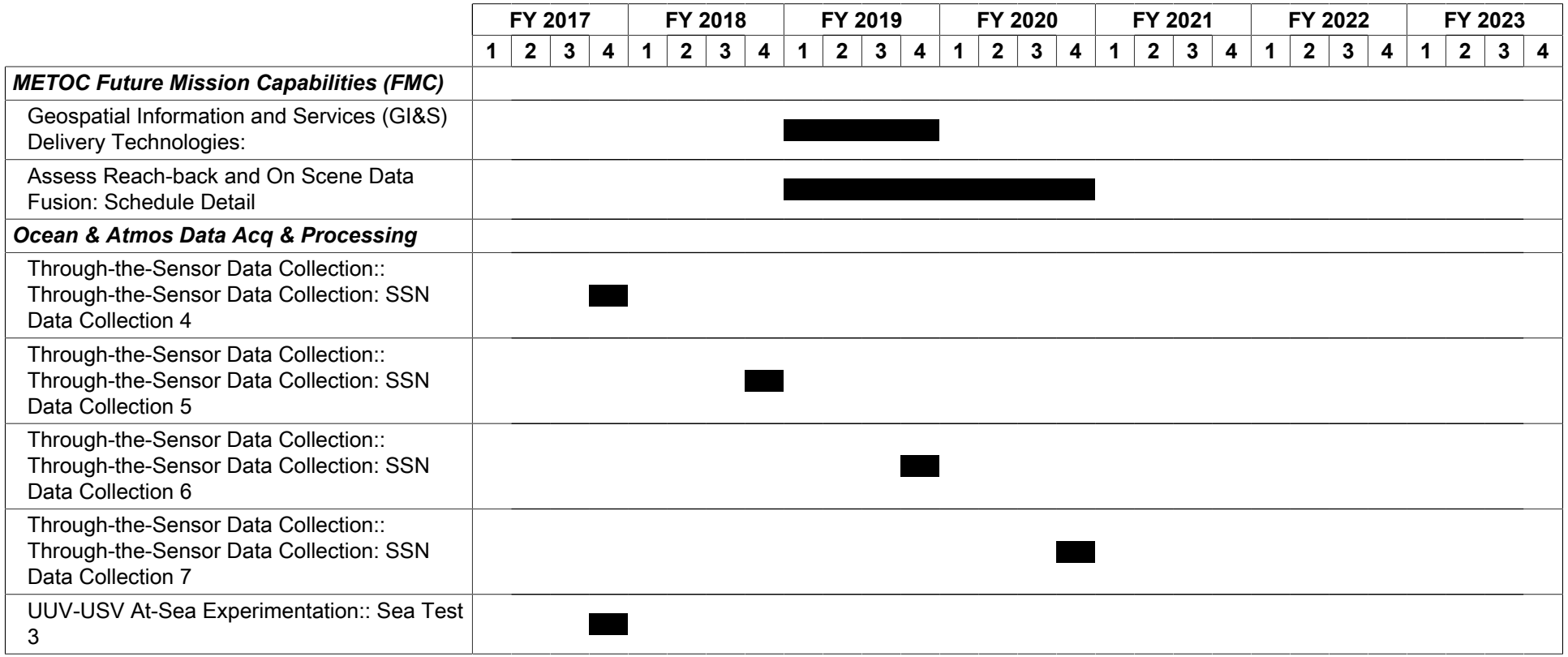

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2341 / *METOC Data Acquisition*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOC Future Mission Capabilities (FMC)				
Geospatial Information and Services (GI&S) Delivery Technologies:	1	2019	4	2019
Assess Reach-back and On Scene Data Fusion: Schedule Detail	1	2019	4	2020
Ocean & Atmos Data Acq & Processing				
Through-the-Sensor Data Collection:: Through-the-Sensor Data Collection: SSN Data Collection 4	4	2017	4	2017
Through-the-Sensor Data Collection:: Through-the-Sensor Data Collection: SSN Data Collection 5	4	2018	4	2018
Through-the-Sensor Data Collection:: Through-the-Sensor Data Collection: SSN Data Collection 6	4	2019	4	2019
Through-the-Sensor Data Collection:: Through-the-Sensor Data Collection: SSN Data Collection 7	4	2020	4	2020
UUV-USV At-Sea Experimentation:: Sea Test 3	4	2017	4	2017

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2342 / *METOC Data Assimilation and Mod*	

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
2342: *METOC Data Assimilation and Mod*	231.124	20.082	21.111	17.441	-	17.441	21.117	21.596	21.495	22.441	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Battlespace Data Assimilation and Prediction Project (2342) enables the future warfighter to leverage observed environmental data gathered under Project 2341 (METOC Collections) by assimilating data into and fusing them with sophisticated high-resolution (spatial and temporal) assessment and prediction models made possible by high-performance computing. These models gain increasing importance as weapons and sensors grow in sophistication and complexity, making them all the more sensitive to the effects of the natural environment. Meteorology and Oceanography (METOC) Processing enables full understanding of the limitations and constraints imposed by ocean and atmosphere, in space and time, thus quantifying and minimizing their impact on weapons, sensors and mission. However, METOC Processing itself is limited by the temporal and spatial resolutions at which data are collected and numerically analyzed and predicted. Thus Projects 2341 and 2342 must remain aggressive in delivering higher and higher resolutions, demanding greater and greater computational and database capacities. METOC Processing efforts must also rise to the challenge of assimilating smaller-scale phenomena, particularly in the littorals, and predicting their spatial and temporal effects, as stated by Fleet and Force Commanders who require remote autonomous, clandestine, littoral battlespace sensing in near-shore areas to enable Sea Shield & Sea Basing. This next step in the Information Warfare (IW) Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) continuum, METOC Processing, is critical to fully characterize the physical battlespace environment in real-time and in predictive / forecasting modes, and gives the warfighter a decisive advantage in the complex blue-water, littoral and deep-strike battlespaces.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC)	4.408	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: FY2018 funding from project unit (PU) 2342 Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC) realigned to PE 0603207N PU 2342 METOC Data Assimilation and Mod, Battlespace Data Assimilation and Prediction.					
FY 2018 Plans: NA					
FY 2019 Base Plans: N/A					
FY 2019 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
N/A					
Title: Meteorological and Oceanographic (METOC) Space-Based Sensing Capabilities	3.544	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: FY2018 funding from project unit 2342 METOC Data Assimilation and Mod, Meteorological and Oceanographic (METOC) Space-Base Sensing Capabilities is realigned to PE 0603207N AIR/OCEAN TACTICAL APPLICATIONS PU 2342 METOC Data Assimilation and Mod, Battlespace Data Assimilation and Prediction.					
FY 2018 Plans: NA					
FY 2019 Base Plans: N/A					
FY 2019 OCO Plans: N/A					
Title: Tactical Oceanographic Capabilities (TOC) / Undersea Warfare (USW)	2.310	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: FY18 funding from project 2342 sub project Tactical Oceanography Capabilities (TOC)/Undersea Warfare (USW) realigned to PE 0603207N project 2342 METOC Data Assimilation and Mod, sub project Battlespace Data Assimilation and Prediction.					
FY 2018 Plans: NA					
FY 2019 Base Plans: N/A					
FY 2019 OCO Plans: N/A					
Title: Battlespace Data Assimilation and Prediction	0.000	10.389	8.443	0.000	8.443
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Description: The Battlespace Data Assimilation and Prediction Project (2342) enables the future warfighter to leverage observed environmental data gathered under Project 2341 (METOC Collections) by assimilating data into and fusing them with sophisticated high-resolution (spatial and temporal) assessment and prediction models made possible by high-performance computing. These models gain increasing importance as weapons and sensors grow in sophistication and complexity, making them all the more sensitive to the effects of the natural environment. METOC Processing enables full understanding of the limitations and constraints imposed by ocean and atmosphere, in space and time, thus quantifying and minimizing their impact on weapons, sensors and mission. However, METOC Processing itself is limited by the temporal and spatial resolutions at which data are collected and numerically analyzed and predicted. Thus Projects 2341 and 2342 must remain aggressive in delivering higher and higher resolutions, demanding greater and greater computational and database capacities. METOC Processing efforts must also rise to the challenge of assimilating smaller-scale phenomena, particularly in the littorals, and predicting their spatial and temporal effects, as stated by Fleet and Force Commanders who require remote autonomous, clandestine, littoral battlespace sensing in near-shore areas to enable Sea Shield & Sea Basing. This next step in the TCPED continuum, METOC Processing, is critical to fully characterize the physical battlespace environment in real-time and in predictive / forecasting modes, and gives the warfighter a decisive advantage in the complex blue-water, littoral and deep-strike battlespaces. FY18 funding realigned to PE 0603207N (Air/Ocean Tactical Applications) project 2342 Battlespace Data Assimilation and Prediction from PE 0603207N (Air/Ocean Tactical Applications) project 2342 Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC), Meteorological and Oceanographic (METOC) Space-Base Sensing Capabilities and Tactical Oceanography Capabilities (TOC)/Undersea Warfare (USW). This is not a new start ***FY 2018 Plans:*** - Continue: Advance the use of satellite observations targeting battlespace environment characterization, supporting global and mesoscale models currently at resolutions of 5-30km horizontally; with vertical extents from the surface and boundary layer, through the models depth which reaches up to ~80km. - Continue: Advance the capability and forecast skills of the Navy's global numerical weather prediction system NAVGEM and to transition improvements and new technologies into operational NAVGEM. - Continue: Work toward transition of emerging short term (5 day) high-resolution analysis and forecast capabilities to Fleet Numerical Meteorology and Oceanography Center (FNMOC) that address small-scale (meso- and micro-scale) atmospheric, coupled (atmospheric-land-ocean-wave), tropical cyclone, and mesoscale					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
ensemble prediction using the current small-scale Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS?). - Continue: Deliver capability to rapidly relocate and exercise a high-resolution coupled air-ocean-wave environmental assimilation and prediction system. - Continue: Improve the passive acoustic model, NSPE, and uBand and provide ongoing NSPE and uBand support to operational community, with special focus on guiding implementation within the Ocean Observing Systems (OOS) Performance Prediction & Mitigation project. - Continue: Work toward transition of product algorithms to improve environmental characterization and tropical cyclone structural and intensity analysis through sensor data visualization, customized imagery, automated sensor data fusion, and automated image analysis. - Continue: Take advantage of real-time spectrum operations (RTSO)-based through-the-sensor (TTS) observations to improve the characterization of the electromagnetic environment. - Continue: Work toward transition of a high resolution global weather prediction system NAVGEM with resolution of approximately T1023L100 (13 km horizontal resolution and 100 vertical layers) that is highly competitive in predictive skill with other operational global NWP systems. - Continue: Work toward transition of a probabilistic tropical cyclone forecasting system, which represents the key uncertainties associated with initial and boundary conditions, based on a COAMPS-TC ensemble and fully integrated into the COAMPS-OS. - Continue: Work toward delivery of a global Naval ocean/ice nowcasting and forecasting capability based on the HYbrid Coordinate Ocean Model (HYCOM) two-way coupled to the Community Ice CodE (CICE) and using the Navy Coupled Ocean Data Assimilation (NCODA) that runs daily at production centers. - Continue: Work toward delivery of an in-situ submarine (BQH-9) capability to produce an estimate of the seabed bottom loss (BL), and deliver data to NAVO for inclusion in the HFBL database. - Continue: Improve the accuracy of Tactical Decision Aids (TDA) acoustic performance calculations in support of surface ship operations by reconciling Fleet sonar data with the Ocean-Atmosphere Master Library (OAML) models and databases, and also starts to test candidate parameterizations for the high-frequency bottom loss (HFBL) database. - Continue: Work toward implementation of new remote sensing data assimilation and determine impacts on NAAPS (aerosol) forecast skill and deliver code to FNMOC. - Continue: Post-process the first moment of NUOPC ensemble forecasts of low-level temperature and humidity, with comparative analysis of EM/EO conditions in raw and bias-corrected grids. - Continue: Prepare the Navy Aerosol Analysis and Prediction System (NAAPS) to run using fields from NAVGEM v2.0.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue: Leverage an existing prototype of a probabilistic aerosol forecasting system that has been ported to the Navy DoD Supercomputing Resource Center (DSRC) computers and continue work towards developing it as a quasi- operational system. - Continue: Develop an improved boundary roughness reflection loss (or forward loss) model that will improve accuracy in propagation and reverberation modeling with particular focus on mid frequencies (1-3 kHz). - Begin: Reduce NAVGEM's error in the calculations of the EAAMF, which are provided to the Naval Observatory for calculation of the changes in the length of day (LOD). - Continue: Improve the hydrodynamic and wave prediction capability of the Coupled Atmosphere-Ocean Mesoscale Prediction System (COAMPS) for the coastal ocean (shelf- break to estuarine and surf zone) environment. - Continue: Improve short-term (7day) forecast skill of global and regional scale ocean and coupled numerical weather prediction by transitioning capabilities to derive, assimilate, and evaluate the impact of assimilating sea surface temperature (SST) and ancillary data from satellite retrievals. - Continue: Develop methodologies for retrieval, quality control, and gridded analysis of remotely sensed satellite observations for measurement of latent, sensible, radiation and momentum fluxes. - Continue: Provide mission planners and operators with operationally relevant ocean color data and products. - Continue: Improve short term (5-7 day) forecast skill of sea ice predictions by assimilating current and future satellite derived ice products into the Navy's operational ice forecast systems. - Continue: Migrate the OAML library, administrative, and management functions to a cloud-based approach. - Continue: Improve short-term (7 day) forecast skill of global and regional scale ocean and coupled NWP by transitioning capabilities to NAVOCEANO and other operational centers to assimilate satellite and in situ observations in a manner that realistically projects high resolution altimeter and other surface information into the sparsely sampled ocean interior. - Continue: Provide operational multi-sensor high-resolution satellite visible/near-infrared/infrared (Vis/NIR/IR) and passive microwave (PMW) sea ice concentration retrievals for improved sea ice forecasts and safe navigation in both the Arctic and Antarctic. - Continue: Leverage swell data from the Sentinel-1A satellite to generate a monthly climatology of ocean swell, useful as a first guess of the expected climate in mission-critical regions determined in consultation with Navy forecasters; also leverage output from the global wave model run in hind-cast mode to augment the ocean swell database. - Continue: Work toward transition of a 4DVar (4-Dimensional Variance) data assimilation capability with highly nonlinear ocean circulation regimes such as western boundary currents; test 4DVar with very high resolution configurations of regional domains; estimate an analysis error covariance; initialize an ensemble forecast.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue: Improve the state of the art of tropical cyclone (TC) forecast guidance and tactical applications for operational decision makers.					
FY 2019 Base Plans: - Complete: Advance the use of satellite observations targeting battlespace environment characterization, supporting global and mesoscale models currently at resolutions of 5-30km horizontally; with vertical extents from the surface and boundary layer, through the models depth which reaches up to ~80km. - Complete: Advance the capability and forecast skills of the Navy's global numerical weather prediction system NAVGEM and to transition improvements and new technologies into operational NAVGEM. - Complete: Work toward transition of emerging short term (5 day) high-resolution analysis and forecast capabilities to Fleet Numerical Meteorology and Oceanography Center (FNMOC) that address small-scale (meso- and micro-scale) atmospheric, coupled (atmospheric-land-ocean-wave), tropical cyclone, and mesoscale ensemble prediction using the current small-scale Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS?). - Complete: Deliver capability to rapidly relocate and exercise a high-resolution coupled air-ocean-wave environmental assimilation and prediction system. - Complete: Improve the passive acoustic model, NSPE, and uBand and provide ongoing NSPE and uBand support to operational community, with special focus on guiding implementation within the Ocean Observing Systems (OOS) Performance Prediction & Mitigation project. - Complete: Work toward transition of product algorithms to improve environmental characterization and tropical cyclone structural and intensity analysis through sensor data visualization, customized imagery, automated sensor data fusion, and automated image analysis. - Complete: Take advantage of real-time spectrum operations (RTSO)-based through-the-sensor (TTS) observations to improve the characterization of the electromagnetic environment. - Complete: Work toward transition of a high resolution global weather prediction system NAVGEM with resolution of approximately T1023L100 (13 km horizontal resolution and 100 vertical layers) that is highly competitive in predictive skill with other operational global NWP systems. - Complete: Work toward transition of a probabilistic tropical cyclone forecasting system, which represents the key uncertainties associated with initial and boundary conditions, based on a COAMPS-TC ensemble and fully integrated into the COAMPS-OS. - Complete: Work toward delivery of a global Naval ocean/ice nowcasting and forecasting capability based on the Hybrid Coordinate Ocean Model (HYCOM) two-way coupled to the Community Ice Code (CICE) and using the Navy Coupled Ocean Data Assimilation (NCODA) that runs daily at production centers.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Complete: Work toward delivery of an in-situ submarine (BQH-9) capability to produce an estimate of the seabed bottom loss (BL), and deliver data to NAVO for inclusion in the HFBL database. - Complete: Improve the accuracy of Tactical Decision Aids (TDA) acoustic performance calculations in support of surface ship operations by reconciling Fleet sonar data with the Ocean-Atmosphere Master Library (OAML) models and databases, and also starts to test candidate parameterizations for the high-frequency bottom loss (HFBL) database. - Complete: Work toward implementation of new remote sensing data assimilation and determine impacts on NAAPS (aerosol) forecast skill and deliver code to FNMOC. - Complete: Post-process the first moment of NUOPC ensemble forecasts of low-level temperature and humidity, with comparative analysis of EM/EO conditions in raw and bias-corrected grids. - Complete: Prepare the Navy Aerosol Analysis and Prediction System (NAAPS) to run using fields from NAVGEM v2.0. - Complete: Leverage an existing prototype of a probabilistic aerosol forecasting system that has been ported to the Navy DoD Supercomputing Resource Center (DSRC) computers and continue work towards developing it as a quasi- operational system. - Complete: Develop an improved boundary roughness reflection loss (or forward loss) model that will improve accuracy in propagation and reverberation modeling with particular focus on mid frequencies (1-3 kHz). - Continue: Reduce NAVGEM's error in the calculations of the EAAMF, which are provided to the Naval Observatory for calculation of the changes in the length of day (LOD). - Complete: Improve the hydrodynamic and wave prediction capability of the Coupled Atmosphere-Ocean Mesoscale Prediction System (COAMPS) for the coastal ocean (shelf- break to estuarine and surf zone) environment. - Complete: Improve short-term (7day) forecast skill of global and regional scale ocean and coupled numerical weather prediction by transitioning capabilities to derive, assimilate, and evaluate the impact of assimilating sea surface temperature (SST) and ancillary data from satellite retrievals. - Complete: Develop methodologies for retrieval, quality control, and gridded analysis of remotely sensed satellite observations for measurement of latent, sensible, radiation and momentum fluxes. - Complete: Provide mission planners and operators with operationally relevant ocean color data and products. - Complete: Improve short term (5-7 day) forecast skill of sea ice predictions by assimilating current and future satellite derived ice products into the Navy's operational ice forecast systems. - Complete: Migrate the OAML library, administrative, and management functions to a cloud-based approach. - Complete: Improve short-term (7 day) forecast skill of global and regional scale ocean and coupled NWP by transitioning capabilities to NAVOCEANO and other operational centers to assimilate satellite and in situ					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
observations in a manner that realistically projects high resolution altimeter and other surface information into the sparsely sampled ocean interior. - Complete: Provide operational multi-sensor high-resolution satellite visible/near-infrared/infrared (Vis/NIR/IR) and passive microwave (PMW) sea ice concentration retrievals for improved sea ice forecasts and safe navigation in both the Arctic and Antarctic. - Complete: Leverage swell data from the Sentinel-1A satellite to generate a monthly climatology of ocean swell, useful as a first guess of the expected climate in mission-critical regions determined in consultation with Navy forecasters; also leverage output from the global wave model run in hind-cast mode to augment the ocean swell database. - Complete: Work toward transition of a 4DVar (4-Dimensional Variance) data assimilation capability with highly nonlinear ocean circulation regimes such as western boundary currents; test 4DVar with very high resolution configurations of regional domains; estimate an analysis error covariance; initialize an ensemble forecast. - Complete: Improve the state of the art of tropical cyclone (TC) forecast guidance and tactical applications for operational decision makers. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding decrease from FY18 to FY19 in this project is to realign resources to PROJ 3405 which will result in follow-on efforts that more fully address the needs of Fleet and Marine Corps decision makers, and to include technologies that fully integrate state-of-the-art and tactically-relevant atmospheric and ocean modeling capabilities as well as state-of-the-art information technologies such as cloud-based and high-performance computing, as well as "big data analytics" and machine learning.					
Title: Chief of Naval Operations Speed to Fleet Initiative	1.058	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: This Speed to Fleet effort will develop a parameterization for the Advanced Propagation Model (APM) electromagnetic energy propagation model to improve modeling of the long range radar performance. This effort will demonstrate the effectiveness of the parameterization and deliver the upgrade to the APM developers for inclusion into future releases of APM to fleet programs. This effort was previously funded in R2A Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC). ***FY 2018 Plans:***					

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Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
NA ***FY 2019 Base Plans:*** N/A ***FY 2019 OCO Plans:*** N/A					
Title: Earth System Prediction Capability (ESPC) ***Articles:***	8.762 -	10.722 -	8.998 -	0.000 -	8.998 -
Description: The Navy Earth System Prediction Capability (ESPC) program will provide a more accurate, longer range, global ocean and atmospheric forecast system for decision support to DoD Maritime Operations through the development of an integrated, coupled atmosphere, ocean, sea ice, land and near-space prediction system with improved deterministic and probabilistic skill over the current operational modeling suite. It will result in increased accuracy for lead times of 1-30 days as well as a new capability for accurate forecasts in the Arctic at all lead times. Additionally it will seek to develop more computationally efficient environmental prediction for emerging architectures and provide Navy R&D support to the National ESPC. ***FY 2018 Plans:*** Continue all efforts from FY2017, less those noted as complete. - Characterize forecast dropouts, based on 500mb Anomaly Correlation (AC) methods, in the Navy Global Environmental Model (NAVGEM), including forecast statistics, common properties and causes. - Continue: Develop and implement a fully coupled global atmosphere/wave/ocean/land/ice prediction system providing daily high- resolution deterministic 16-day and lower-resolution ensemble predictions at longer lead times. - Continue: Optimize scripting for the deterministic and ensemble systems to better manage cycling tasks for model components and data assimilation, resulting in increased modularity, better parallelism, easier debugging through error trapping, and greater reuse. - Continue: Develop an ensemble prediction system for a fully coupled global atmosphere / wave / ocean / land / sea ice coupled model for predictions out to 90 days. - Continue: Develop a fully- coupled data assimilation capability to optimize the use of the observations across fluid interfaces, eliminating the transient inconsistences, increasing forecast skill and representing coupled uncertainties.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue: Evaluate and demonstrate the capabilities of a new generation of atmospheric dynamical systems that allow for variable resolution on the sphere, are highly scalable, and eliminate or mitigate spurious problems near the poles of the globe. - Continue: Further develop, validate, and evaluate the capability of a fully coupled regional Arctic prediction system. - Continue: Develop, integrate, and test improvements to the computational performance of models within the Navy global coupled forecast system as well as the coupling infrastructure to ensure that operational partners will meet their production schedules using available computational resources. - Continue: Improve capabilities for supporting long range Navy planning (lead times of one week and longer). - Continue: Develop and transition for operational implementation a high resolution global weather prediction system NAVGEM with resolution of approximately T1023L100 (13 km horizontal resolution and 100 vertical layers) that is highly competitive in predictive skill with other operational global NWP systems. - Continue: Define, develop and implement consistent quantitative skill metrics to assess the advancements in the Earth System Prediction Capability (ESPC), taking into account the applications and lead-times for which the ESPC environmental information will be used. - Continue: Evaluate and validate multi-model extended-range forecasts produced from interagency projects such as the North American Multi-model Ensemble (NMME). - Continue: Develop the NAVGEM global model to include inline aerosols to simulate aerosol life cycle and perform aerosol direct radiative heating of the atmosphere. - Continue: Participate in the North American Multi-Model Ensemble (NMME) by re-forecasting the global coupled (NAVGEM-HYCOM-CICE) Navy ESPC model for years 1999 to 2015. - Continue: Accelerate the rate of improvement in the US National Earth System Prediction Capability (ESPC) and National Unified Operational Prediction Capability (NUOPC), focusing primarily on the current and future generation global modeling enterprise. - Continue: Develop the NAVGEM global model to address middle atmosphere processes associated with sudden stratospheric warming and extended range prediction. ***FY 2019 Base Plans:*** Continue all efforts from FY2018, less those noted as complete. - Continue: Characterize forecast dropouts, based on 500mb Anomaly Correlation (AC) methods, in the Navy Global Environmental Model (NAVGEM), including forecast statistics, common properties and causes.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue: Develop and implement a fully coupled global atmosphere/wave/ocean/land/ice prediction system providing daily high- resolution deterministic 16-day and lower-resolution ensemble predictions at longer lead times. - Continue: Optimize scripting for the deterministic and ensemble systems to better manage cycling tasks for model components and data assimilation, resulting in increased modularity, better parallelism, easier debugging through error trapping, and greater reuse. - Continue: Develop an ensemble prediction system for a fully coupled global atmosphere / wave / ocean / land / sea ice coupled model for predictions out to 90 days. - Continue: Develop a fully- coupled data assimilation capability to optimize the use of the observations across fluid interfaces, eliminating the transient inconsistences, increasing forecast skill and representing coupled uncertainties. - Continue: Evaluate and demonstrate the capabilities of a new generation of atmospheric dynamical systems that allow for variable resolution on the sphere, are highly scalable, and eliminate or mitigate spurious problems near the poles of the globe. - Continue: Further develop, validate, and evaluate the capability of a fully coupled regional Arctic prediction system. - Continue: Develop, integrate, and test improvements to the computational performance of models within the Navy global coupled forecast system as well as the coupling infrastructure to ensure that operational partners will meet their production schedules using available computational resources. - Continue: Improve capabilities for supporting long range Navy planning (lead times of one week and longer). - Continue: Develop and transition for operational implementation a high resolution global weather prediction system NAVGEM with resolution of approximately T1023L100 (13 km horizontal resolution and 100 vertical layers) that is highly competitive in predictive skill with other operational global NWP systems. - Continue: Define, develop and implement consistent quantitative skill metrics to assess the advancements in the Earth System Prediction Capability (ESPC), taking into account the applications and lead-times for which the ESPC environmental information will be used. - Continue: Evaluate and validate multi-model extended-range forecasts produced from interagency projects such as the North American Multi-model Ensemble (NMME). - Continue: Develop the NAVGEM global model to include inline aerosols to simulate aerosol life cycle and perform aerosol direct radiative heating of the atmosphere. - Continue: Participate in the North American Multi-Model Ensemble (NMME) by re-forecasting the global coupled (NAVGEM-HYCOM-CICE) Navy ESPC model for years 1999 to 2015.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue: Accelerate the rate of improvement in the US National Earth System Prediction Capability (ESPC) and National Unified Operational Prediction Capability (NUOPC), focusing primarily on the current and future generation global modeling enterprise. - Continue: Develop the NAVGEM global model to address middle atmosphere processes associated with sudden stratospheric warming and extended range prediction. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding decrease from FY18 to FY19 in this project is to realign resources to PROJ 3405 which will result in follow-on efforts that more fully address the needs of Fleet and Marine Corps decision makers, and to include technologies that fully integrate state-of-the-art and tactically-relevant atmospheric and ocean modeling capabilities as well as state-of-the-art information technologies such as cloud-based and high-performance computing, as well as "big data analytics" and machine learning.					
Accomplishments/Planned Programs Subtotals	20.082	21.111	17.441	0.000	17.441

C. Other Program Funding Summary ($ in Millions)

Line Item	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
• RDTEN/0604218N/2345: *FLEET METOC EQUIPMENT*	0.354	0.491	0.480	-	0.480	0.458	0.467	0.000	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Meteorological and Oceanographic (METOC) Data Assimilation and Modeling Project to develop, demonstrate, and validate METOC data assimilation and environmental prediction capabilities, enabling timely and accurate delivery of METOC prediction data and products to the Tactical Commander, all with management oversight by the Navy.

E. Performance Metrics

Goal: Develop techniques and tools to assimilate Meteorological and Oceanographic (METOC) data in order to improve the accuracy of global and regional scale meteorological and oceanographic forecast models. Data assimilation is expanded to include new in-situ and remotely-sensed data types, based on operational need. Tasks are directed toward advanced software enabling assimilation of disparate sources on non-synoptic time scales. Acoustic, atmospheric, and oceanographic model development, prototyping and transition is focused on improved model physics, increased resolution, and computational efficiency.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Metric: Tasks will address no less than 75% of applicable capability gaps and requirements.

Goal (ESPC): Develop a more accurate global ocean, atmosphere, wave and sea ice forecast system with longer skillful forecast times from weeks to seasons through integrating and coupling atmosphere, ocean, ice, land and near-space forecast models into a seamless deterministic and ensemble prediction system that significantly improves skill over the current modeling suite. Additionally develop a common modeling architecture to improve cross- Agency collaboration, and greatly more efficient environmental modeling and computational architectures to allow for real-time operational prediction at comparable skill level to international competitors.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

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
METOC Future Mission Capabilities	WR	NRL : Washington DC	124.331	3.626	Nov 2016	0.845	Nov 2017	0.852	Nov 2018	-		0.852	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	Various	Various : Various	46.068	0.000		0.000		0.000		-		0.000	0.000	46.068	-
METOC Space-Based Sensing Capabilities	WR	NRL : Washington, DC	14.547	2.545	Nov 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	WR	NRL : Washington, DC	8.340	1.140	Nov 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	University of Texas : TX	1.163	0.000		0.100	Nov 2017	0.000		-		0.000	0.000	1.263	-
Tactical Oceanography Capabilities / Undersea Warfare	WR	NSWC Carderock : West Bethesda, MD	1.640	0.450	Nov 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	WR	NAVOCEANO : Mississippi	0.549	0.000		0.000		0.000		-		0.000	0.000	0.549	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	University of Washington : Seattle, WA	0.730	0.120	Dec 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Johns Hopkins University : MD	0.340	0.091	Dec 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC/QNA : Various	1.605	0.271	Nov 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC/QNA : Various	2.482	0.614	Dec 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Penn Sate University : Pennsylvania	0.125	0.000		0.000		0.000		-		0.000	0.000	0.125	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

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
Tactical Oceanography Capabilities / Undersea Warfare	WR	SSC LANT : North Charleston	0.050	0.000		0.000		0.000		-		0.000	0.000	0.050	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SPA : Virginia	0.375	0.000		0.000		0.000		-		0.000	0.000	0.375	-
METOC SUPPORT SPACE-SOFTWARE DEVELOPMENT	WR	NRL : WASHINGTON DC	0.000	0.515	Nov 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	METRON : Virginia	0.385	0.000		0.000		0.000		-		0.000	0.000	0.385	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Vencore : Virginia	0.239	0.000		0.000		0.000		-		0.000	0.000	0.239	-
METOC Battlespace Data Assimilation and Prediction	WR	NRL : Monterey, CAl Stennis Spoace Center,MS	0.000	0.000		8.924	Nov 2017	7.194	Dec 2018	-		7.194	0.000	16.118	-
Earth Systems Prediction Capability (ONR)	WR	NRL : Washington DC	15.883	7.431	Nov 2016	8.847	Nov 2017	6.611	Dec 2018	-		6.611	Continuing	Continuing	Continuing
ESPC	Various	Various : Various	6.006	1.661	Nov 2016	0.681	Nov 2017	0.981	Dec 2018	-		0.981	Continuing	Continuing	Continuing
CHIEF OF NAVAL OPERATIONS SPEED TO FLEET INITIATIVE	WR	NRL : WASHINGTON DC	0.000	0.850	Nov 2016	0.000		0.000		-		0.000	1.130	1.980	-
		Subtotal	224.858	19.314		19.397		15.638		-		15.638	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
METOC Future Mission Capabilities	Various	Various : Various	0.795	0.000		0.000		0.000		-		0.000	0.000	0.795	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2342 / *METOC Data Assimilation and Mod*	

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
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	C/FP	SAIC : Virginia	0.473	0.000		0.000		0.000		-		0.000	0.000	0.473	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC : Virginia	0.634	0.000		0.000		0.000		-		0.000	0.000	0.634	-
METOC Future Mission Capabilities	C/FP	SAIC : VIRGINIA	0.000	0.115	Nov 2016	0.100	Nov 2017	0.100	Dec 2018	-		0.100	Continuing	Continuing	Continuing
METOC SUPPORT SPACE-PROGRAM SUPPORT	WR	SSC PACIFIC : SAN DIEGO, CA	0.000	0.090	Nov 2016	0.100	Nov 2017	0.100	Dec 2018	-		0.100	Continuing	Continuing	Continuing
Earth System Modeling Framework - Common Software Architecture	Various	Various : Boulder, CO; Various	0.000	0.000		0.660	Nov 2017	0.660	Nov 2018	-		0.660	0.000	1.320	-
Program Support and Subject Matter Expertise	Various	UW-APL : Seattle, WA	1.563	0.000		0.358	Nov 2017	0.358	Dec 2018	-		0.358	Continuing	Continuing	Continuing
		Subtotal	3.465	0.205		1.218		1.218		-		1.218	Continuing	Continuing	N/A

Test and Evaluation ($ 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
Data Analytics and Machine Learning	TBD	Charles River : Boston, MA	0.000	0.000		0.234	Nov 2017	0.323	Dec 2018	-		0.323	0.000	0.557	-
		Subtotal	0.000	0.000		0.234		0.323		-		0.323	0.000	0.557	N/A

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
Acquisition Workforce	Various	Various : Various	0.090	0.000		0.000		0.000		-		0.000	0.000	0.090	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

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
METOC Space-Based Sensing Capabilities	Various	Various : Various	1.350	0.000		0.000		0.000		-		0.000	0.000	1.350	-
Tactical Oceanography Capabilities / Undersea Warfare	WR	SSC PAC : San Diego, CA	1.145	0.171	Nov 2016	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	PSS/BAH : San Diego, CA	0.216	0.000		0.000		0.000		-		0.000	0.000	0.216	-
METOC Space-Based Sensing Capabilities	C/FP	BAH : VIRGINIA	0.000	0.142	Nov 2016	0.100	Nov 2017	0.100	Nov 2018	-		0.100	Continuing	Continuing	Continuing
METOC Space-Based Sensing Capabilities	WR	SSC PAC : SAN DIEGO, CA	0.000	0.213	Nov 2016	0.100	Nov 2017	0.100	Nov 2018	-		0.100	Continuing	Continuing	Continuing
METOC Acquisition Management	C/CPFF	PSS/BAH : SAN DIEGO, CA	0.000	0.037	Nov 2016	0.062	Nov 2017	0.062	Nov 2018	-		0.062	Continuing	Continuing	Continuing
		Subtotal	2.801	0.563		0.262		0.262		-		0.262	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	231.124	20.082		21.111		17.441		-		17.441	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

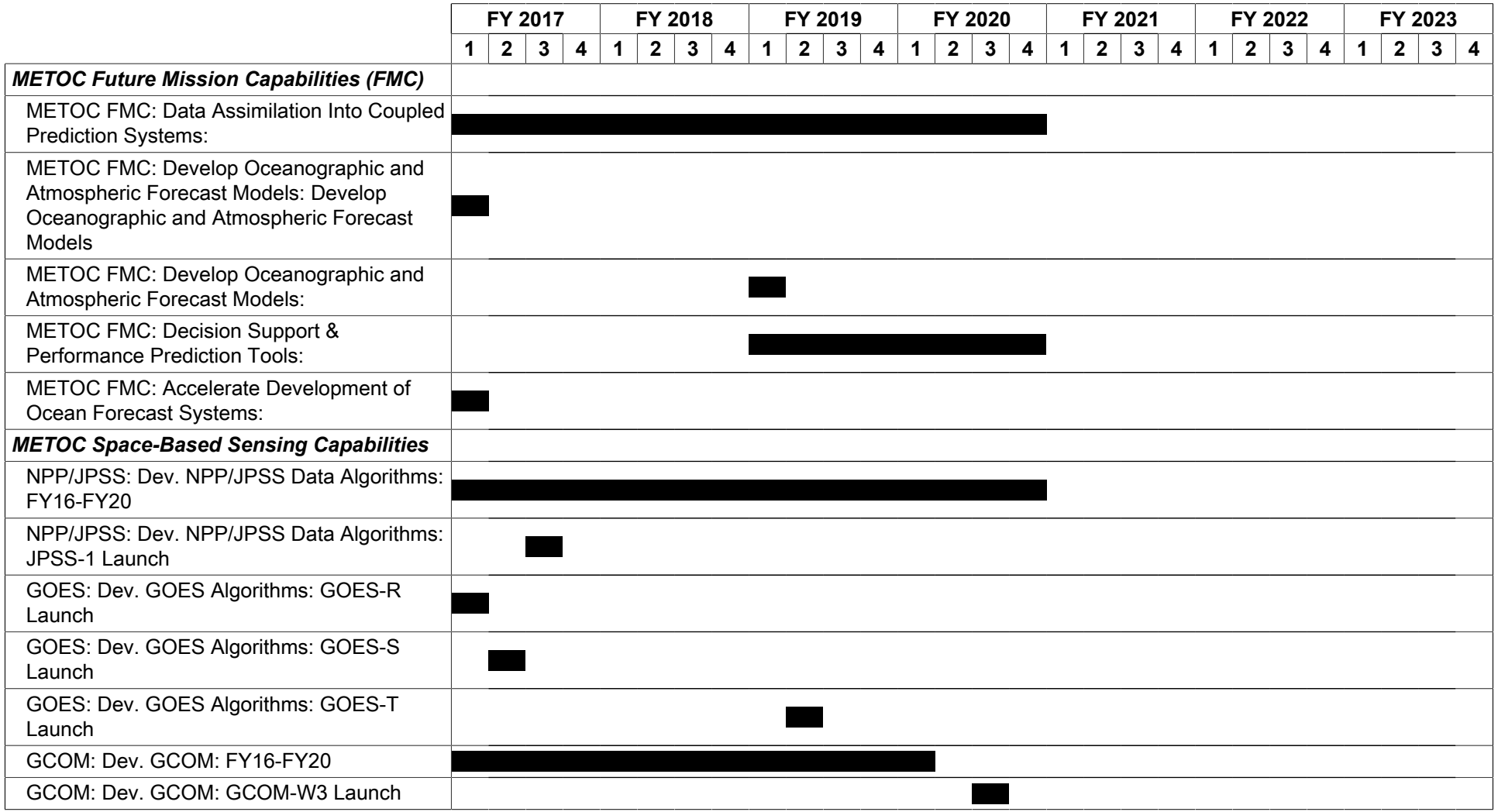


Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

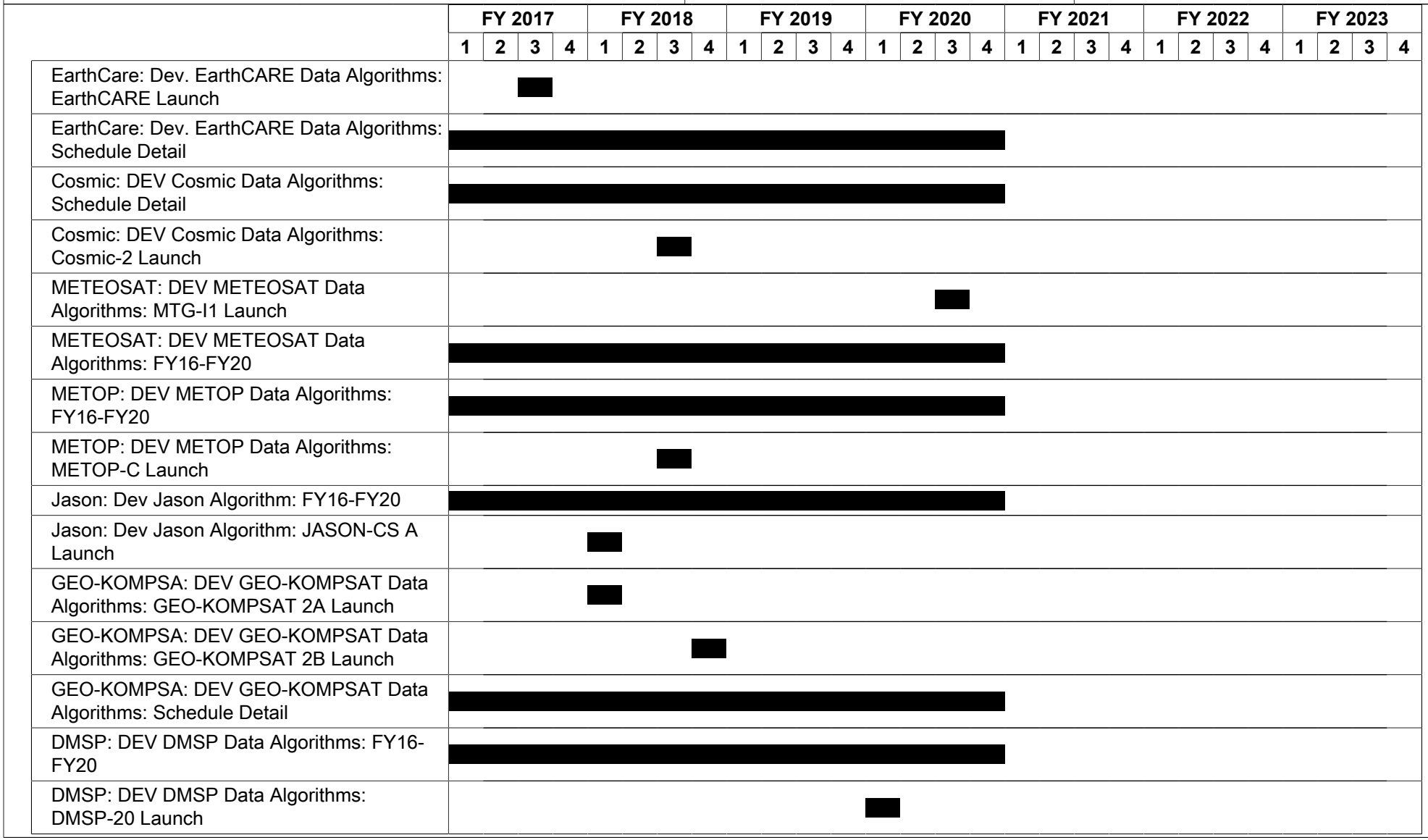


Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

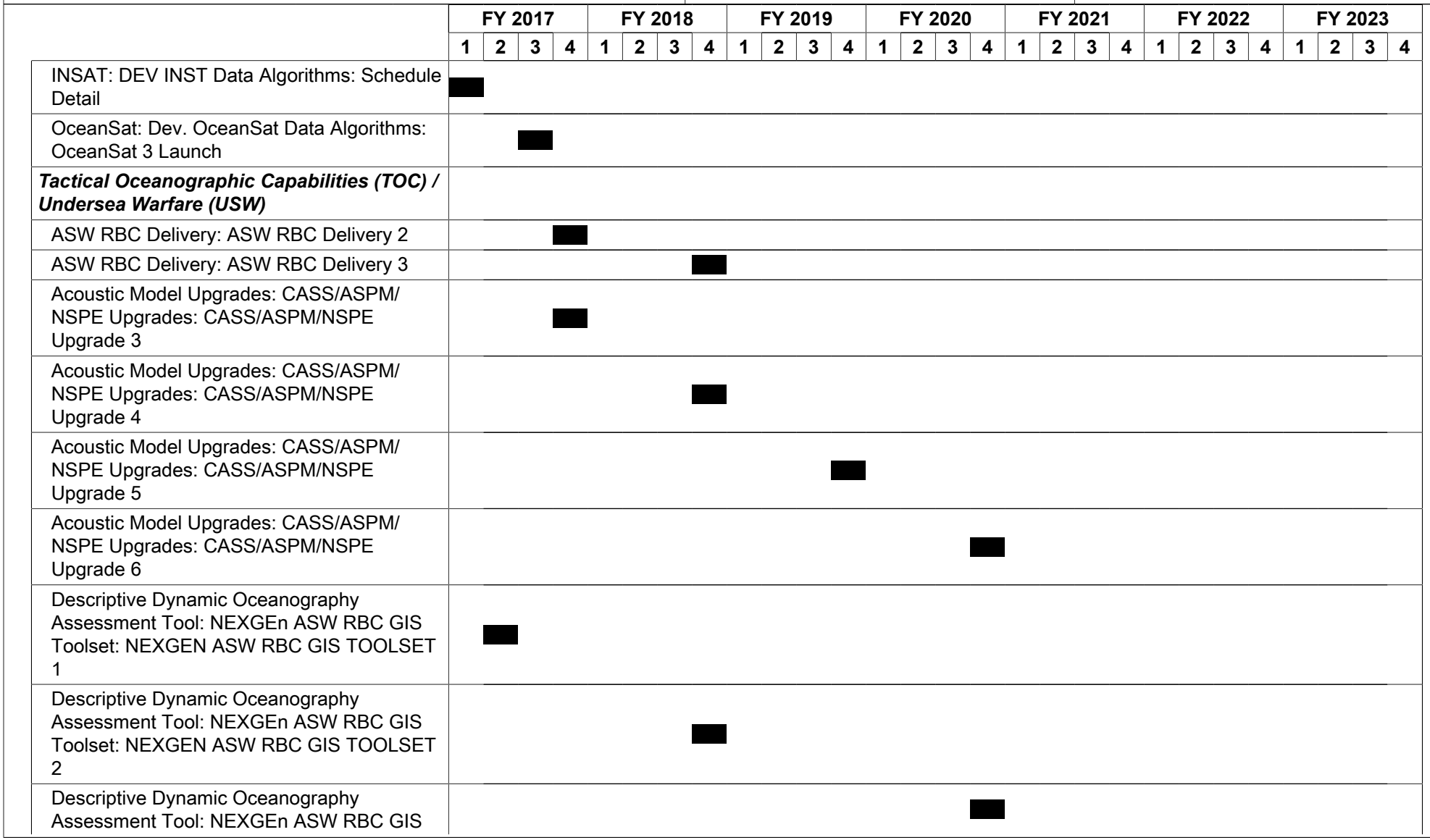


Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

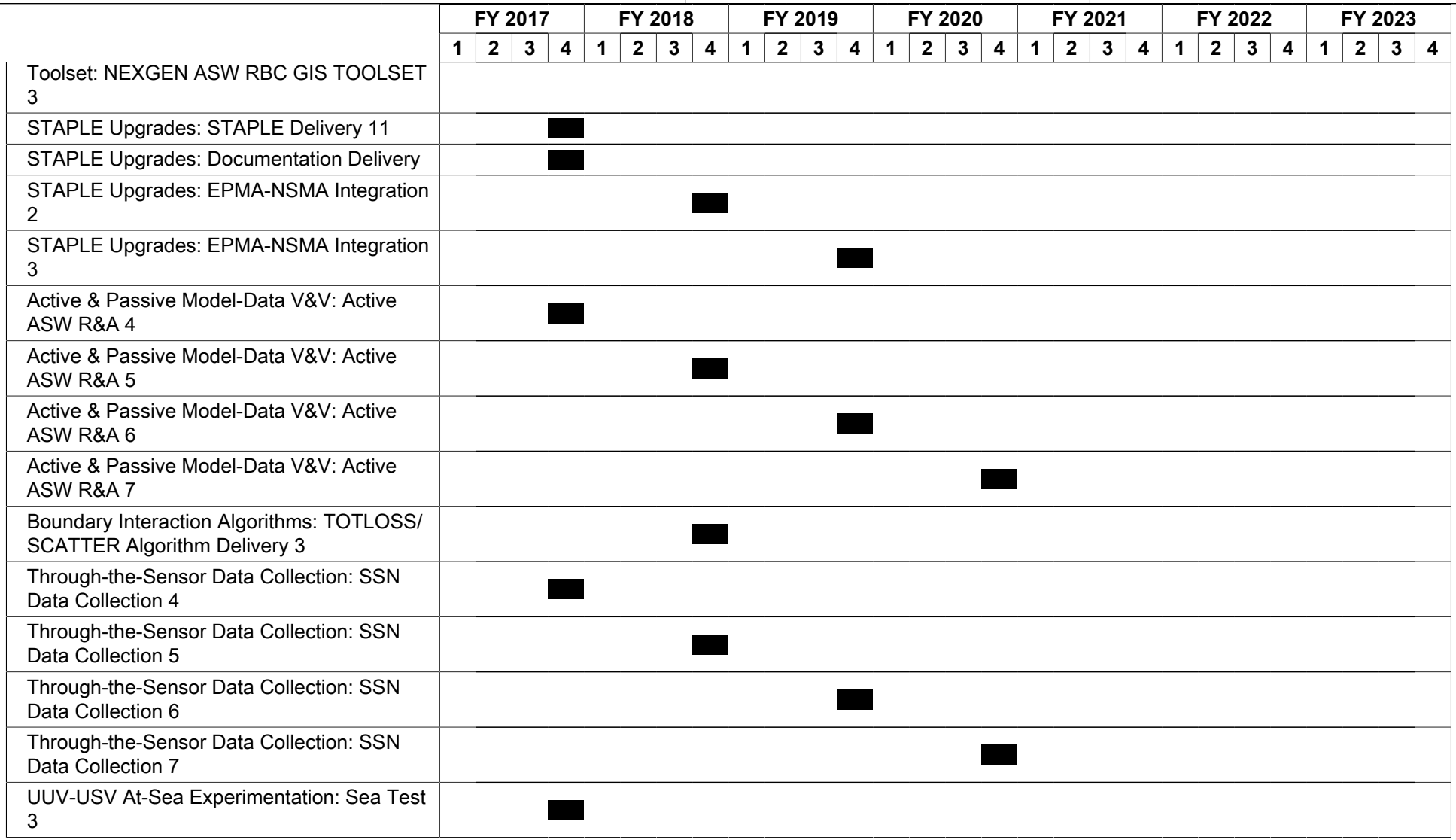


Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

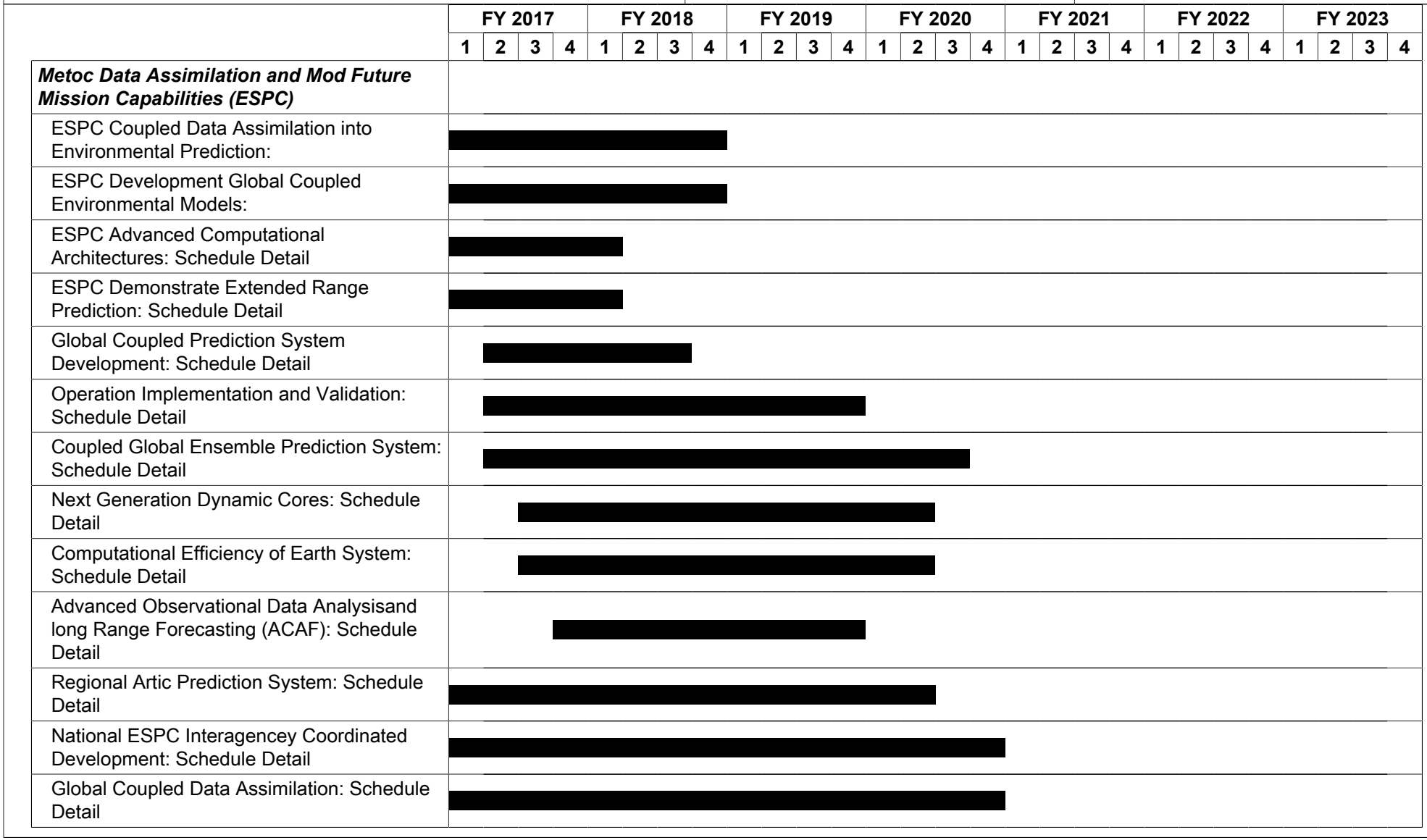


Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

	FY 2017				FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023			
	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
Navy METOC Support (SPACE)																												
Navy METOC Support (SPACE): Schedule Detail: Schedule Detail	[redacted]																											

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOC Future Mission Capabilities (FMC)				
METOC FMC: Data Assimilation Into Coupled Prediction Systems:	1	2017	4	2020
METOC FMC: Develop Oceanographic and Atmospheric Forecast Models: Develop Oceanographic and Atmospheric Forecast Models	1	2017	1	2017
METOC FMC: Develop Oceanographic and Atmospheric Forecast Models:	1	2019	1	2019
METOC FMC: Decision Support & Performance Prediction Tools:	1	2019	4	2020
METOC FMC: Accelerate Development of Ocean Forecast Systems:	1	2017	1	2017
METOC Space-Based Sensing Capabilities				
NPP/JPSS: Dev. NPP/JPSS Data Algorithms: FY16-FY20	1	2017	4	2020
NPP/JPSS: Dev. NPP/JPSS Data Algorithms: JPSS-1 Launch	3	2017	3	2017
GOES: Dev. GOES Algorithms: GOES-R Launch	1	2017	1	2017
GOES: Dev. GOES Algorithms: GOES-S Launch	2	2017	2	2017
GOES: Dev. GOES Algorithms: GOES-T Launch	2	2019	2	2019
GCOM: Dev. GCOM: FY16-FY20	1	2017	1	2020
GCOM: Dev. GCOM: GCOM-W3 Launch	3	2020	3	2020
EarthCare: Dev. EarthCARE Data Algorithms: EarthCARE Launch	3	2017	3	2017
EarthCare: Dev. EarthCARE Data Algorithms: Schedule Detail	1	2017	4	2020
Cosmic: DEV Cosmic Data Algorithms: Schedule Detail	1	2017	4	2020
Cosmic: DEV Cosmic Data Algorithms: Cosmic-2 Launch	3	2018	3	2018
METEOSAT: DEV METEOSAT Data Algorithms: MTG-I1 Launch	3	2020	3	2020
METEOSAT: DEV METEOSAT Data Algorithms: FY16-FY20	1	2017	4	2020
METOP: DEV METOP Data Algorithms: FY16-FY20	1	2017	4	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOP: DEV METOP Data Algorithms: METOP-C Launch	3	2018	3	2018
Jason: Dev Jason Algorithm: FY16-FY20	1	2017	4	2020
Jason: Dev Jason Algorithm: JASON-CS A Launch	1	2018	1	2018
GEO-KOMPSA: DEV GEO-KOMPSAT Data Algorithms: GEO-KOMPSAT 2A Launch	1	2018	1	2018
GEO-KOMPSA: DEV GEO-KOMPSAT Data Algorithms: GEO-KOMPSAT 2B Launch	4	2018	4	2018
GEO-KOMPSA: DEV GEO-KOMPSAT Data Algorithms: Schedule Detail	1	2017	4	2020
DMSP: DEV DMSP Data Algorithms: FY16-FY20	1	2017	4	2020
DMSP: DEV DMSP Data Algorithms: DMSP-20 Launch	1	2020	1	2020
INSAT: DEV INST Data Algorithms: Schedule Detail	1	2017	1	2017
OceanSat: Dev. OceanSat Data Algorithms: OceanSat 3 Launch	3	2017	3	2017
Tactical Oceanographic Capabilities (TOC) / Undersea Warfare (USW)				
ASW RBC Delivery: ASW RBC Delivery 2	4	2017	4	2017
ASW RBC Delivery: ASW RBC Delivery 3	4	2018	4	2018
Acoustic Model Upgrades: CASS/ASPM/NSPE Upgrades: CASS/ASPM/NSPE Upgrade 3	4	2017	4	2017
Acoustic Model Upgrades: CASS/ASPM/NSPE Upgrades: CASS/ASPM/NSPE Upgrade 4	4	2018	4	2018
Acoustic Model Upgrades: CASS/ASPM/NSPE Upgrades: CASS/ASPM/NSPE Upgrade 5	4	2019	4	2019
Acoustic Model Upgrades: CASS/ASPM/NSPE Upgrades: CASS/ASPM/NSPE Upgrade 6	4	2020	4	2020
Descriptive Dynamic Oceanography Assessment Tool: NEXGEn ASW RBC GIS Toolset: NEXGEN ASW RBC GIS TOOLSET 1	2	2017	2	2017
Descriptive Dynamic Oceanography Assessment Tool: NEXGEn ASW RBC GIS Toolset: NEXGEN ASW RBC GIS TOOLSET 2	4	2018	4	2018
Descriptive Dynamic Oceanography Assessment Tool: NEXGEn ASW RBC GIS Toolset: NEXGEN ASW RBC GIS TOOLSET 3	4	2020	4	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
STAPLE Upgrades: STAPLE Delivery 11	4	2017	4	2017
STAPLE Upgrades: Documentation Delivery	4	2017	4	2017
STAPLE Upgrades: EPMA-NSMA Integration 2	4	2018	4	2018
STAPLE Upgrades: EPMA-NSMA Integration 3	4	2019	4	2019
Active & Passive Model-Data V&V: Active ASW R&A 4	4	2017	4	2017
Active & Passive Model-Data V&V: Active ASW R&A 5	4	2018	4	2018
Active & Passive Model-Data V&V: Active ASW R&A 6	4	2019	4	2019
Active & Passive Model-Data V&V: Active ASW R&A 7	4	2020	4	2020
Boundary Interaction Algorithms: TOTLOSS/SCATTER Algorithm Delivery 3	4	2018	4	2018
Through-the-Sensor Data Collection: SSN Data Collection 4	4	2017	4	2017
Through-the-Sensor Data Collection: SSN Data Collection 5	4	2018	4	2018
Through-the-Sensor Data Collection: SSN Data Collection 6	4	2019	4	2019
Through-the-Sensor Data Collection: SSN Data Collection 7	4	2020	4	2020
UUV-USV At-Sea Experimentation: Sea Test 3	4	2017	4	2017
Metoc Data Assimilation and Mod Future Mission Capabilities (ESPC)				
ESPC Coupled Data Assimilation into Environmental Prediction:	1	2017	4	2018
ESPC Development Global Coupled Environmental Models:	1	2017	4	2018
ESPC Advanced Computational Architectures: Schedule Detail	1	2017	1	2018
ESPC Demonstrate Extended Range Prediction: Schedule Detail	1	2017	1	2018
Global Coupled Prediction System Development: Schedule Detail	2	2017	3	2018
Operation Implementation and Validation: Schedule Detail	2	2017	4	2019
Coupled Global Ensemble Prediction System: Schedule Detail	2	2017	3	2020
Next Generation Dynamic Cores: Schedule Detail	3	2017	2	2020
Computational Efficiency of Earth System: Schedule Detail	3	2017	2	2020
Advanced Observational Data Analysisand long Range Forecasting (ACAF): Schedule Detail	4	2017	4	2019

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2342 / *METOC Data Assimilation and Mod*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Regional Artic Prediction System: Schedule Detail	1	2017	2	2020
National ESPC Interagencey Coordinated Development: Schedule Detail	1	2017	4	2020
Global Coupled Data Assimilation: Schedule Detail	1	2017	4	2020
Navy METOC Support (SPACE)				
Navy METOC Support (SPACE): Schedule Detail: Schedule Detail	1	2017	1	2020

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2343 / *Tactical METOC Applications*	

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
2343: *Tactical METOC Applications*	153.449	10.275	11.715	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	175.439
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Total funding control for Fleet Meteorology & Oceanography (METOC) Equipment (2343) in FY19 and beyond was moved from Program Element (PE) 0603207N into PE 0604218N Air Ocean Equipment Engineering Projects as a result of a Budget Activity (BA) reclassification.

A. Mission Description and Budget Item Justification

The Tactical Meteorology and Oceanography (METOC) Applications Project provides cyber secure operational effects decision aid capabilities for Navy and Marine Corps warfighters in the context of Joint Operations in a net-centric environment. This project funds the agile software development of the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) program of record. NITES-Next program identifies and transitions state-of-the-art decision support software technologies from the government and commercial industry's technology base, and then demonstrates and validates these capabilities before fielding. These software decision support tools provide platform, sensor, communications, and weapon systems performance assessments for warfighters in terms of their littoral and deep-strike battlespace environments. These assessments allow mission planners and warfighters, from Unit to Theater level, to optimize their sensor employment on airborne, surface, and subsurface platforms in support of Naval Composite Warfare mission areas including Undersea Warfare (USW), Anti-Submarine Warfare (ASW), Mine Warfare (MIW), Amphibious Warfare (AMW), Anti-Surface Warfare (ASUW), Anti-Air Warfare (AAW), Strike Warfare (STW), Expeditionary Warfare (EXW), Electronic Warfare (EW), Information Operations (IO), Intelligence Operations (INT), Non-Combat Operations (NCO), Command, Control, Communication (CCC), and Naval Special Warfare (NSW). Performance assessments leading to improvements in operational and tactical control are conducted through a two-tiered approach: 1) Meteorological and Oceanographic (METOC) Decision Aids and, 2) Operational Effects Decision Aids (OEDAs). METOC Decision Aides consist of a series of analysis tools which characterize the physical environment conditions of the battlespace based on the best set of physical environment data available at the time (i.e., some combination of historical and/or real-time (or near real-time) in-situ, and numerically modeled forecast data). OEDAs use the METOC Decision Aide information by fusing it with relevant, often-classified, sensor and target data to predict how weapons and sensor systems will perform. Performance results are displayed in tabular and graphic formats integrated into net-centric visualization tools for use by mission planners, and combat/weapon system operators to develop localization plans, USW/AAW/ASUW screens, STW profiles, and AMW ingress and egress points. METOC Decision Aides and OEDAs typically use data derived from sensors developed in Project 2341 (METOC Data Acquisition) and assimilated by software produced by Project 2342 (METOC Data Assimilation and Modeling). METOC Decision Aides and OEDAs also use data obtained through direct interfaces to Navy combat systems. Cyber secure capabilities are a current emphasis required to characterize and/or predict sensor and weapons system performance in the highly complex littoral environments in support of regional conflict scenarios. It addresses multi-warfare areas, particularly shallow water ASW, NSW, and missile and air defense/strike capabilities.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2343 / *Tactical METOC Applications*

Funding supports development and integration efforts for Meteorological and Oceanographic (METOC) systems to generate and collect METOC data and fuse multiple intelligence inputs to more robustly characterize and predict tactical atmospheric and oceanographic conditions. This integrated METOC picture will support real-time battlespace awareness of propagation conditions affecting signals across the electromagnetic spectrum. METOC data will be fused with other intelligence data and automatically provided to shipboard combat systems to inform kinetic and non-kinetic fires.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Naval Integrated Tactical Environmental System Next Generation (NITES-Next)	10.275	11.715	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2018 Plans: Naval Integrated Tactical Environmental System Next Generation (NITES-Next) will continue working on the Fleet Capability Release (FCR)-2 (v2.0.2) Task Order in support of deployment in FY19/20, and also award the FCR-3 Task Order. The program will conduct a FCR-3 Build Technical Review (BTR) and seek to obtain a FCR-3 Building Decision (BD) from the Milestone Decision Authority (MDA). NITES-Next will begin initial software development of FCR 3 mobile variant, which integrates new mobile variant requirements with the previous afloat versions of FCR 2.x. The FCR-3 mobile variant software will also include anti-tamper proofing and will be releasable to our allies to enhance our interoperability with their information warfare systems. The new mobile variant will replace the current NITES-NEXT Naval Integrated Tactical Environmental System Fielded (NITES-Fielded) suite of systems that have been determined to have cyber vulnerabilities and need to be retired as soon as possible. Additionally, FCR-3 will accelerate/include the development of an Electromagnetic (EM) Prediction capability to be delivered in FY19/20. NITES-Next will plan for, and conduct, System Integration Testing (SIT), System Qualification Testing(SQT), User Assessment (UA), and Developmental Test and Evaluation (DT&E) for FCR-2 (v2.0.2) and FCR-3. NITES-Next will begin deployment of FCR-2 (v2.0.1) software. The program will obtain an Authority to Operate (ATO) for Fleet Capability Release (FCR)-2.x and FCR-3 software. The program will continue planning for the FCR-4 development and contracting activities (including updating of all required documentation, Requirements Development Package (RDP), Cost Analysis Requirements Document (CARD), Program Life Cycle Cost Estimate (PLCCE)). NITES-Next will continue using Amazon Web Services (AWS) cloud computing infrastructure to support Fleet operator training.					
FY 2019 Base Plans: N/A					
FY 2019 OCO Plans: N/A					
FY 2018 to FY 2019 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2343 / *Tactical METOC Applications*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Total funding control for Fleet Meteorology & Oceanography (METOC) Equipment (2343) in FY19 and beyond was moved from Program Element (PE) 0603207N into PE 0604218N as a result of a Budget Activity (BA) reclassification.					
Accomplishments/Planned Programs Subtotals	10.275	11.715	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The NITES-Next program acquisition, management and contracting strategies are to support the Tactical Meteorology & Oceanography (METOC) Applications project to continue the development of state-of-the-art software capabilities that provide sensor, communication, and weapon system performance assessment capabilities for open ocean and littoral operating environments. The Department of the Navy (DoN) maintains management oversight of the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) program's acquisition and contracting strategies. The Department of the Navy (DoN) requirements for the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) program's acquisition and contracting strategies are based on approved Joint Capabilities Integration and Development System (JCIDS) documentation.

E. Performance Metrics

Goal: Field software decision aid capabilities for Navy and Marine Corps war fighters in order to facilitate the characterization and prediction of the physical environment in the battlespace.

Metric: Meet the performance metrics identified in approved NITES-Next Program's requirements documents (e.g., Concept Definition Document (CDD) and individual Requirements Definition Packages (RDPs)).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2343 / *Tactical METOC Applications*	

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
Product Development Prior Year	Various	Various : Various	117.115	0.000		0.000		0.000		-		0.000	0.000	117.115	-
NITES-Next	WR	SSC Pacific : San Diego, CA	19.734	4.212	Oct 2016	3.758	Dec 2017	0.000		-		0.000	0.000	27.704	-
NITES-Next	C/FP	SAIC : Virginia	7.444	2.472	Feb 2017	2.051	Dec 2017	0.000		-		0.000	0.000	11.967	-
NITES-Next	WR	SSC Atlantic : South Carolina	0.271	0.105	Apr 2017	0.087	Oct 2017	0.000		-		0.000	0.000	0.463	-
NITES-Next / Engineering	C/IDIQ	NAVSUP : Pennsylvania	0.000	1.300	May 2017	0.000		0.000		-		0.000	0.000	1.300	-
NITES-Next / Engineering	C/IDIQ	SSC Pacific : Various	0.000	0.225	Jul 2017	3.791	May 2018	0.000		-		0.000	0.000	4.016	-
		Subtotal	144.564	8.314		9.687		0.000		-		0.000	0.000	162.565	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
Support Prior Year	Various	Various : Various	0.720	0.000		0.000		0.000		-		0.000	0.000	0.720	-
NITES-Next	C/FP	SAIC : Virginia	5.224	1.191	Feb 2017	1.232	Dec 2017	0.000		-		0.000	0.000	7.647	-
		Subtotal	5.944	1.191		1.232		0.000		-		0.000	0.000	8.367	N/A

Management Services ($ in Millions)

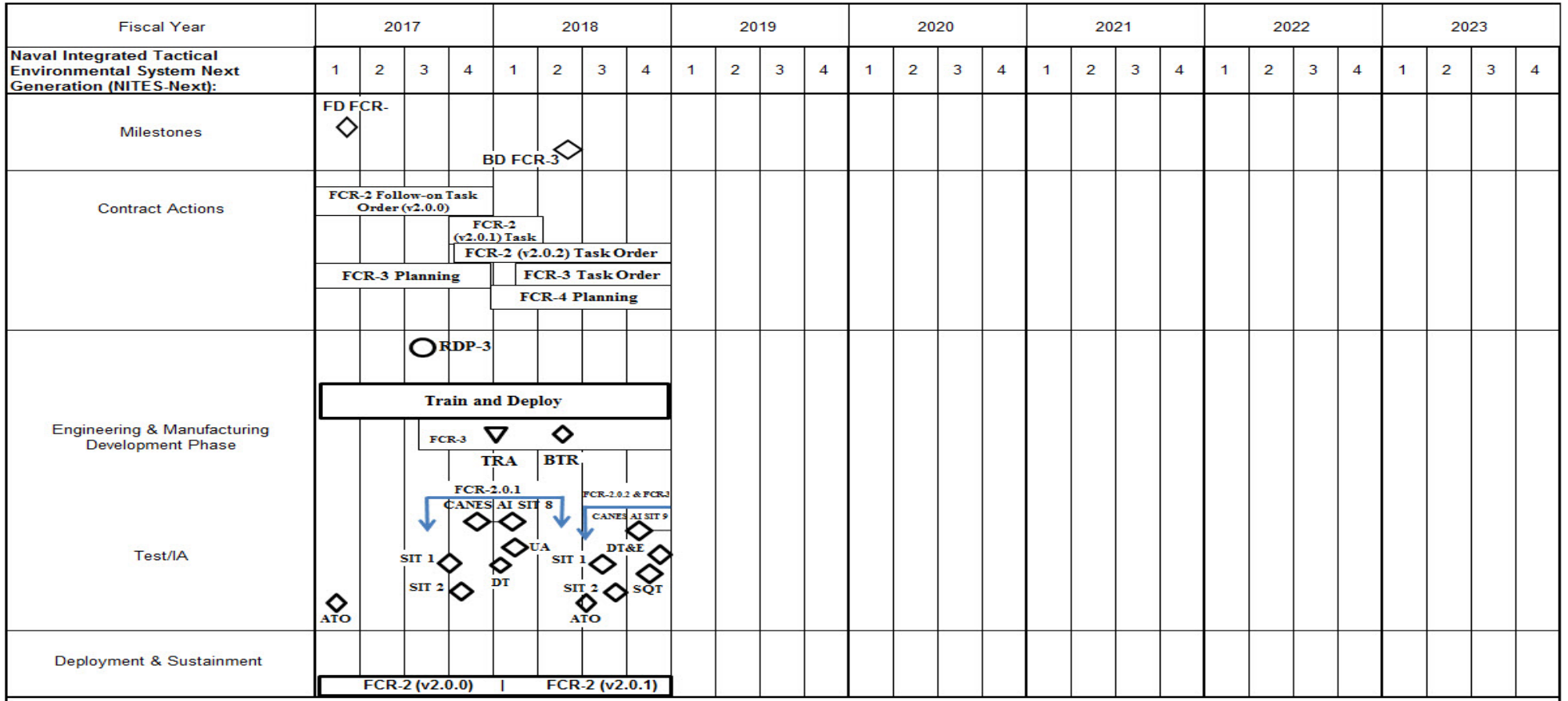
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management Services Prior Year	Various	Various : Various	0.031	0.000		0.000		0.000		-		0.000	0.000	0.031	-
NITES-Next	WR	SSC Pacific : San Diego, CA	1.140	0.293	Oct 2016	0.303	Dec 2017	0.000		-		0.000	0.000	1.736	-
NITES-Next	C/FP	BAH : San Diego, CA	1.770	0.477	Dec 2016	0.493	Dec 2017	0.000		-		0.000	0.000	2.740	-
		Subtotal	2.941	0.770		0.796		0.000		-		0.000	0.000	4.507	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2343 / *Tactical METOC Applications*	

	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	153.449	10.275		11.715		0.000		-		0.000	0.000	175.439	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2343 / *Tactical METOC Applications*



Acronyms: OTRR = Opertional Test Readiness Review. RDP = Requirements Definition Package. FCR = Fleet Capability Release. TRA = Technology Readiness Assessment. BD = Build Decision. FD = Fielding Decision. Limited Fielding Decision = LFD. IOC= Initial Operational Capability. IATO = Interim Authority to Operate. ATO = Authority to Operate. UA = User Assessment. BTR = Build Technical Review. Field Technical Reivew = FTR. SIT = System Integration Test. RALOT = Risk Assessment Level of Testing. DT&E = Developmental Test & Evaluation. ADM - Acquisition Decision Memorandum. SOVT = System Verification Operational Test. CANES = Consolidated Afloat Networks and Enterprise Services. AI = Application Integration.

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2343 / *Tactical METOC Applications*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Naval Integrated Tactical Environmental System Next Generation (NITES-Next)				
Milestones: Build Decision (BD) Fleet Capability Release - 3	2	2018	2	2018
Milestones: Fielding Decision (FD) Fleet Capability Release - 2	1	2017	1	2017
Contract Actions: FCR-2 Follow On Task Order (v2.0.0)	1	2017	4	2017
Contract Actions: FCR-2 Task Order (v2.0.1)	4	2017	2	2018
Contract Actions: FCR-2 Task Order (v2.0.2)	4	2017	4	2018
Contract Actions: FCR-3 Task Order	1	2018	4	2018
Contract Actions: FCR-3-Planning	1	2017	4	2017
Contract Actions: FCR-4 Planning	4	2017	4	2018
Engineering & Manufacturing Development Phase: Fleet Capability Release - 2 / Train Deploy	1	2017	4	2018
Engineering & Manufacturing Development Phase: Fleet Capability Release - 3 / Train Deploy	3	2017	4	2018
Engineering & Manufacturing Development Phase: Requirements Definition Package - 3	3	2017	3	2017
Engineering & Manufacturing Development Phase: Technology Readiness Assessment - 3	1	2018	1	2018
Test/IA: Fleet Capability Release - 2	3	2017	2	2018
Test/IA: Fleet Capability Release - 3	3	2018	4	2018
Test/IA: System Integration Test - 1 (FCR-2)	3	2017	3	2017
Test/IA: System Integration Test - 2 (FCR-2)	4	2017	4	2017
Test/IA: System Integration Test - 1 (FCR-3)	3	2018	3	2018
Test/IA: System Integration Test - 2 (FCR-3)	3	2018	3	2018

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2343 / *Tactical METOC Applications*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Test/IA: Authority to Operate FCR-2.0.1	1	2017	1	2017
Test/IA: Authority to Operate FCR-2.0.2	3	2018	3	2018
Test/IA: System Qualification Test FCR-3	4	2018	4	2018
Test/IA: Developmental Test Fleet Capability Release - FCR-2	1	2018	1	2018
Test/IA: Developmental Test Fleet Capability Release - FCR-3	4	2018	4	2018
Test/IA: User Assessment FCR-2	1	2018	1	2018
Test/IA: CANES AI SIT FCR-2	4	2017	1	2018
Test/IA: CANES AI SIT FCR-3	4	2018	4	2018
Test/IA: Deployment and Sustainment: Deployment, fielding and Sustainment (OMN)	1	2017	4	2018

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2344 / *Precise Time and Astrometry*	

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
2344: *Precise Time and Astrometry*	10.689	4.844	5.190	4.556	-	4.556	2.946	3.006	3.017	3.079	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Precise Timing and Astrometry (PTA) project funds research and development of improvements for the U.S. Master Clock (MC) System, the DoD Time Transfer capability, the Earth Orientation System, and the Astrometric Observation System. The MC System and Time Transfer provides precise time for use in modern military and National Technical Means (NTM) navigation, guidance, positioning, and tracking systems. The Earth Orientation System provides precise Earth Orientation Parameters for use by the DoD and the national civilian infrastructure to establish the specific orientation of the Earth and to provide input to the terrestrial reference frame. The Astrometric Observation System provides the basic data needed to generate the Celestial Reference Frame (CRF) which is the standard for calibrating all inertial navigation systems, satellite orbits, and earth rotation determinations. Improvement to the MC System, Time Transfer, Earth Orientation, and Astrometric Observation Systems are needed to ensure that new and upgraded DoD and NTM capabilities meet their performance requirements. By DoD Directive, the U.S. Naval Observatory (USNO), Washington, D.C., is responsible for coordinating Precise Time and Time Interval (PTTI) requirements and for maintaining a PTTI reference standard (astronomical and atomic) for use by all DoD, Federal agencies, and related scientific laboratories.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Precise Timing and Astronomy	4.844	5.190	4.556	0.000	4.556
Articles:	-	-	-	-	-
Description: Research and development of improvements for the U.S. Master Clock (MC) System, the DoD Time Transfer capability, the Earth Orientation System, and the Astrometric Observation System.					
FY 2018 Plans: *Field operational Optical Fiber timing link in DC metro area *Lab demonstration of Optical clock prototype *Critical Time Dissemination Activities *Transition Earth Orientation Parameters (EOP) automation products to operations (Initial Operating Capability, IOC) *Begin 1.8m telescope enclosure at Naval Observatory Flagstaff Station *Test GPS-denied reference frame data pipeline *Preliminary Design Review (PDR) for transceiver for next generation time transfer					
FY 2019 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
*Critical Design Review (CDR) for transceiver for next generation time transfer *Transition Earth Orientation Parameters (EOP) automation products to operations (Final Operating Capability, FOC) *Transition GPS-denied reference frame data pipeline to operations *Solar Lunar Almanac Core (SLAC) Shapiro illuminance model study/upgrade *System Requirements Review (SRR) for next generation infrared astrometric camera *Initiate development of prototype optical lattice clock (begin materials study) ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The decrease in funding from FY2018 to FY2019 is due to reduced investment in the next generation Master Clock and work on Earth Orientation Parameter (EOP) Optimization and Celestial Reference Frame (CRF) next generation instrumentation.					
Accomplishments/Planned Programs Subtotals	4.844	5.190	4.556	0.000	4.556

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The included technology developments are primarily in-house with selected contractor participation. However, the Kokee Park, HI, radio telescope upgrade and the SW Correlator contract will involve substantial non-Navy contract support.

E. Performance Metrics

(1) The Software Correlator will complete Phase 2 and will achieve Initial Operational Capability (IOC).
(2) FOC for antenna at Kokee Park, HI.
(3) Rb Fountain System will reach FOC at AMC in FY18.
(4) Delivery of first Next Generation Time Transfer transciever--transition to operations.
(5) 1.8 meter Enclosure Fabrication

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

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
Primary Hardware Development (NPOI) 1.8m Telescope Project (1)	SS/FFP	Lowell Observatory : Flagstaff, AZ	0.000	0.200	Mar 2017	0.000		0.000		-		0.000	0.000	0.200	-
Primary Hardware Development (NPOI) 1.8m Telescope (2)	SS/FFP	AZ Embeded System : Not Specified	0.300	0.200	Aug 2017	0.000		0.000		-		0.000	0.000	0.500	-
Ancillary Hardware Development 1	Various	U.S. Naval Observatory : Washington, DC	0.085	0.070	Dec 2016	0.022	Dec 2017	0.044	Dec 2018	-		0.044	0.000	0.221	-
Ancillary Hardware Development 2	Various	U.S. Naval Observatory : Washington, DC	0.084	0.070	Jan 2017	0.022	Jan 2018	0.035	Jan 2019	-		0.035	0.000	0.211	-
Ancillary Hardware Development 3	Various	U.S. Naval Observatory : Washington, DC	0.122	0.070	Apr 2017	0.022	Apr 2018	0.035	Apr 2019	-		0.035	0.000	0.249	-
Ancillary Hardware Development 4	Various	U.S. Naval Observatory : Washington, DC	0.027	0.070	Jul 2017	0.022	Jul 2018	0.035	Jul 2019	-		0.035	0.000	0.154	-
Primary Hardware Development for CTD (System Integration)	C/FP	Classified : Not Specified	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Primary Hardware Development for CTD (RF Interface)	MIPR	Classified : Not Specified	2.980	2.000	Mar 2017	0.780	Mar 2018	0.000		-		0.000	0.000	5.760	-
Primary Hardware Development for CTD (Line Interface)	MIPR	Classified : Not Specified	2.219	0.000		1.000	Mar 2018	0.000		-		0.000	0.000	3.219	-
Primary Hardware Development for CTD (Reference Upgrade)	C/FFP	Symmetricom : San Jose, CA	0.250	0.150	Jul 2017	0.000		0.000		-		0.000	0.000	0.400	-
Next Generation Secure Time Transfer	C/FFP	Classified : Not Specified	0.434	0.500	Jul 2017	0.273	Mar 2018	0.500	Mar 2019	-		0.500	0.565	2.272	-
1.8 meter infrared camera development	C/FFP	Classified : Not Specified	0.000	0.000		0.000		1.000	Jun 2019	-		1.000	4.249	5.249	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

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
Primary Hardware Development (Site Prep)	TBD	NASA/GSFC : HI	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Primary Hardware Development (Antenna Receiver Electronics)	C/FFP	NASA : GSFC	1.000	0.000		0.000		0.000		-		0.000	0.000	1.000	-
1.8 meter Telescope Enclosure	C/FFP	NAVFAC SW : Not Specified	0.000	0.000		1.800	Jun 2018	0.000		-		0.000	0.000	1.800	-
Advanced Time and Frequency Tranfer Upgrade	C/FFP	Classified : Not Specified	0.000	0.000		0.000		0.500	Mar 2019	-		0.500	0.600	1.100	-
Optical Lattice Clocks	C/FFP	Classified : Not Specified	0.000	0.000		0.000		0.305	Mar 2019	-		0.305	0.600	0.905	-
		Subtotal	7.501	3.330		3.941		2.454		-		2.454	6.014	23.240	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
Development Support (All PTA - Labor) 1	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.347	0.103	Dec 2016	0.138	Dec 2017	0.173	Dec 2018	-		0.173	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 2	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.347	0.103	Mar 2017	0.138	Mar 2018	0.173	Mar 2019	-		0.173	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 3	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.347	0.103	Jun 2017	0.138	Jun 2018	0.173	Jun 2019	-		0.173	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 4	Allot	U.S. Naval Observatory (Civilian	0.347	0.103	Jul 2017	0.138	Jul 2018	0.173	Jul 2019	-		0.173	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2344 / *Precise Time and Astrometry*	

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
		Labor) : Washington, DC													
Software Development (EOP Automation)	C/FFP	U.S. Naval Observatory (Civilian Labor) : Washington, DC	1.024	0.356	Jun 2017	0.256	Jun 2018	0.611	Jun 2019	-		0.611	0.000	2.247	-
Travel 1	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.022	0.010	Dec 2016	0.005	Oct 2017	0.000		-		0.000	0.000	0.037	-
Travel 2	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.022	0.010	Jan 2017	0.005	Jan 2018	0.000		-		0.000	0.000	0.037	-
Travel 3	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.023	0.010	Apr 2017	0.005	Apr 2018	0.000		-		0.000	0.000	0.038	-
Travel 4	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.023	0.010	Jul 2017	0.005	Jul 2018	0.000		-		0.000	0.000	0.038	-
VLBI2010 Testing and Integration	MIPR	NASA : GSFC	0.444	0.461	Jun 2017	0.000		0.000		-		0.000	0.000	0.905	-
Software Development (SW Correlator GUI)	C/FFP	U.S. Naval Observatory : Washington, DC	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Astrometric Development	C/FFP	U.S. Naval Observatory : Washington, DC	0.242	0.245	Jul 2017	0.253	Jul 2018	0.240	Jul 2019	-		0.240	0.000	0.980	-
EOP Optimal Estimation	C/FFP	NASA : GSFC	0.000	0.000		0.000		0.125	Feb 2019	-		0.125	0.500	0.625	-
Foreign GNSS	C/FFP	Classified : Not Specified	0.000	0.000		0.000		0.125	Feb 2019	-		0.125	0.500	0.625	-
SLAC Software Upgrade	TBD	Not Specified : Not Specified	0.000	0.000		0.168	Jan 2018	0.309	Mar 2019	-		0.309	0.690	1.167	-
SIBR Placeholder	TBD	Not Specified : Not Specified	0.000	0.000		0.000		0.000	Jan 2019	-		0.000	0.000	0.000	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

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
		Subtotal	3.188	1.514		1.249		2.102		-		2.102	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	10.689	4.844		5.190		4.556		-		4.556	Continuing	Continuing	N/A

Remarks

Decrease between FY18 and FY19 reduces research and development efforts to enhance the DoD Precise Time and Time Interval (PTTI) infrastructure within the Critical Time Dissemination (CTD) project. The specific impacts are classified; however, the risk to these important Time and Frequency (T&F) nodes across the DoD not receiving this technical refresh and upgrade will be severely increased by lack of programmed transitions from these RDTEN activities.

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

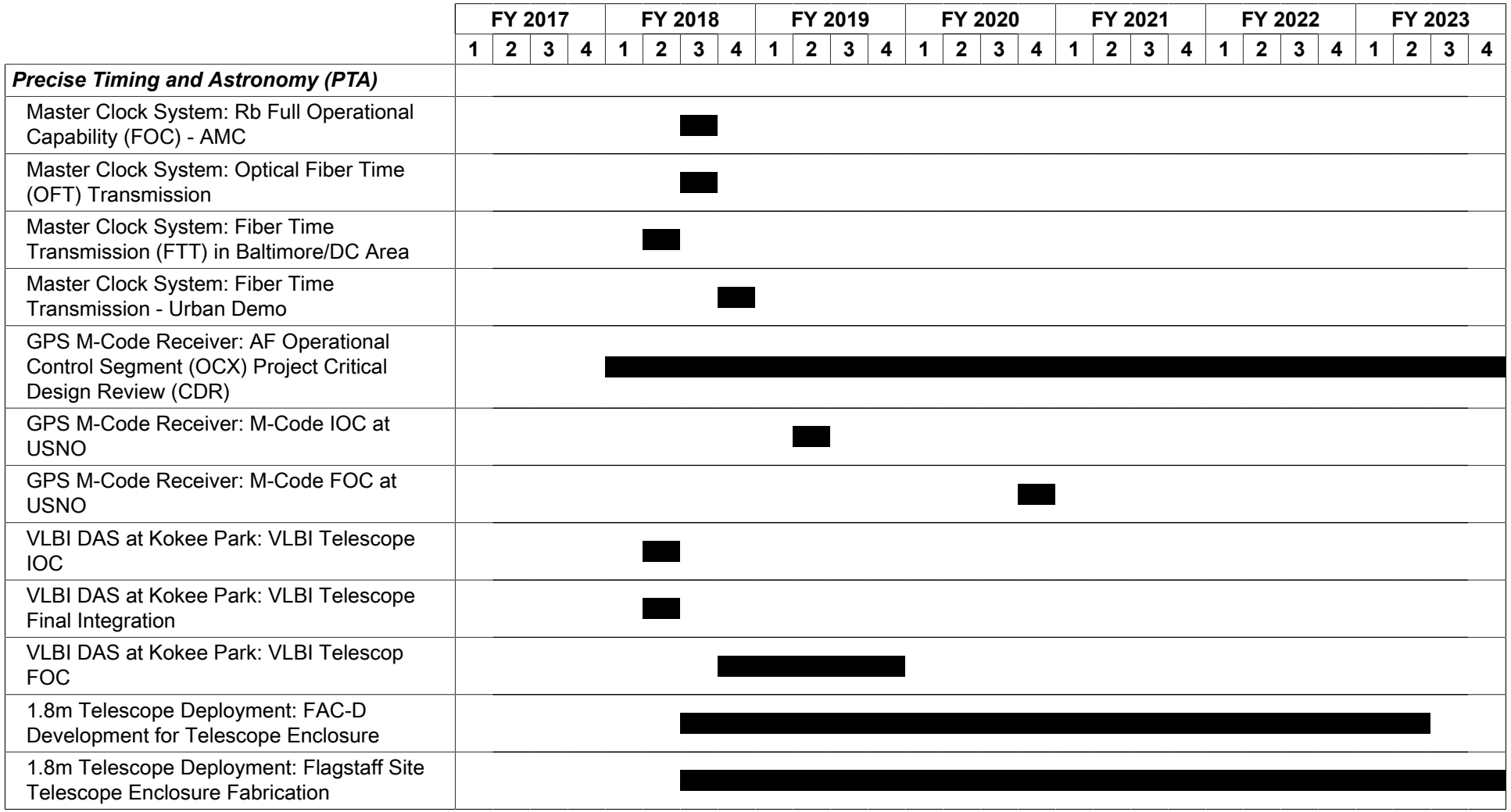


Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2344 / *Precise Time and Astrometry*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Precise Timing and Astronomy (PTA)				
Master Clock System: Rb Full Operational Capability (FOC) - AMC	3	2018	3	2018
Master Clock System: Optical Fiber Time (OFT) Transmission	3	2018	3	2018
Master Clock System: Fiber Time Transmission (FTT) in Baltimore/DC Area	2	2018	2	2018
Master Clock System: Fiber Time Transmission - Urban Demo	4	2018	4	2018
GPS M-Code Receiver: AF Operational Control Segment (OCX) Project Critical Design Review (CDR)	1	2018	4	2023
GPS M-Code Receiver: M-Code IOC at USNO	2	2019	2	2019
GPS M-Code Receiver: M-Code FOC at USNO	4	2020	4	2020
VLBI DAS at Kokee Park: VLBI Telescope IOC	2	2018	2	2018
VLBI DAS at Kokee Park: VLBI Telescope Final Integration	2	2018	2	2018
VLBI DAS at Kokee Park: VLBI Telescop FOC	4	2018	4	2019
1.8m Telescope Deployment: FAC-D Development for Telescope Enclosure	3	2018	2	2023
1.8m Telescope Deployment: Flagstaff Site Telescope Enclosure Fabrication	3	2018	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2363 / *Remote Sensing Capability Development*	

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
2363: *Remote Sensing Capability Development*	7.355	3.773	3.959	0.324	-	0.324	0.327	0.328	0.328	0.000	0.000	16.394
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

$5.642M of FY19 funding was realigned from Program Element (PE) 0603207N Project Unit 2363 into PE 0604218N Air Ocean Equipment Engineering Project Unit 2363 Remote Sensing Capability Development as a result of a Budget Activity (BA) reclassification.

A. Mission Description and Budget Item Justification

Remote Sensing Capability Development characterizes the ocean environment using a variety of remote sensing techniques that provide that capability to discriminate atypical oceanographic phenomena from the natural environment that will greatly improve undersea dominance capabilities. The Naval Oceanographic Office will employ oceanographic data to refine and extend environmental characterization of the phenomena and disseminate data to the Fleet.

FY 2019 request provides for continued target data collection, enhancements on algorithms and continue to integrate algorithms for access over the network.

FY19 funds are to develop and deliver algorithms in support of the Remote Sensing Capability Development (RSCD) project and will support Fleet Anti-Submarine Warfare (ASW) and Mine Warfare (MIW) missions.
Remote Sensing Capability Development characterizes ocean environment using a variety of remote sensing techniques that provide that capability to discriminate atypical oceanographic phenomena from the natural environment that will greatly improve undersea dominance capabilities. The Naval Oceanographic Office will employ oceanographic data to refine and extend environmental characterization of the phenomena and disseminate data to the Fleet.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Remote Sensing Capability Development	3.563	3.899	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2018 Plans: Continue data collection in various weather and sea states to broaden the range of environmental conditions and reduce uncertainty in environmental prediction. Continue software algorithm performance analysis. Continue software algorithm enhancements to automatically detect oceanographic phenomena. Continue software algorithm enhancements and modifications to support transition to a new architecture. Continue to implement the algorithm performance assessment strategy as well as the test and evaluation plans. Document software algorithm test reports. Conduct algorithm Integration Decision. Continue to integrate algorithms for access over					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
the network. Continue development of training to provide the user community education on using the different tools and applications. Coordinate Task, Collect, Process, Exploit, Disseminate (TCPED) process amongst inter-agencies to support Navy Missions. ***FY 2019 Base Plans:*** N/A ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** $5.642M of FY19 funding was realigned from Program Element (PE) 0603207N Project Unit 2363 into 0604218N Air Ocean Equipment Engineering Project 2363 Remote Sensing Capability Development as a result of a Budget Activity (BA) reclassification.					
Title: Remote Sensing Capability Dev. ***Articles:*** ***Description:*** Collect remote sensing and ground truth data in various weather and sea states to broaden the range of environmental conditions and reduce uncertainty in environmental prediction. Develop and enhance software algorithms to automatically detect oceanographic phenomena. Integrate algorithms for access over the network. Enhance existing toolsets to provide users robust applications to assist in their daily tasks. Develop training to provide the user community education on using the different tools and applications. (Details held at a higher classification) ***FY 2018 Plans:*** Continue efforts to coordinate the TCPED process across DoD and civilian government agencies to support Navy Missions. Supported transition of SEAHORSE algorithms to operations. ***FY 2019 Base Plans:*** Increase investment in new technology that allows for an accelerated pace to detect oceanographic phenomena of ocean science transitions in the interest of national security for Task Force Ocean. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:***	0.210 -	0.060 -	0.324 -	0.000 -	0.324 -

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Funding increased from FY2018 (PE 0603207N) to FY2019 to expand scope of surface ship detection algorithms for SEAHORSE/Remote Sensing Capability Development based on emerging threats.					
Accomplishments/Planned Programs Subtotals	3.773	3.959	0.324	0.000	0.324

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Remote Sensing Capability Development is being managed as a Program Executive Office (PEO) Project, via a Project Definition Document (PDD) construct for acquisition rigor and oversight.

Remote Sensing Capability Development is being managed as a PEO Project leveraging the Rapid Development and Deployment (RDD) construct for rigor and discipline.

E. Performance Metrics

Available in the Project's Requirements Definition Package (RDP).

Classified performance metrics are available in the Project's Requirements Definition Package (RDP) approved 14 July 2015

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2363 / *Remote Sensing Capability Development*	

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
Remote Sensing Capability Development Data Collection	C/FFP	SAIC : Virginia	1.284	0.497	Feb 2017	0.521	Feb 2018	0.000		-		0.000	0.000	2.302	-
Remote Sensing Capability Development Data Collection	WR	NRL : Washington, DC	1.212	0.730	Nov 2016	0.944	Nov 2017	0.000		-		0.000	0.000	2.886	-
Remote Sensing Capability Development Data Collection	C/FFP	Raytheon : MA	1.070	0.000	Apr 2017	0.000		0.000		-		0.000	0.000	1.070	-
Remote Sensing Capability Development Data Collection	WR	NUWC : Keyport, WA	0.232	0.000		0.000		0.000		-		0.000	0.000	0.232	-
Remote Sensing Capability Development Data Collection	C/FFP	Cubic : San Diego, CA	0.000	1.041	Apr 2017	1.068	Apr 2018	0.000		-		0.000	0.000	2.109	-
REMOTE SENSING CAPABILITY DEVELOPMENT DATA COLLECTION	Various	VARIOUS : VARIOUS	0.000	0.210	Jan 2017	0.060	Jan 2018	0.324	Jan 2019	-		0.324	5.176	5.770	-
		Subtotal	3.798	2.478		2.593		0.324		-		0.324	5.176	14.369	N/A

Remarks

Due to a change in contract strategy funds were sent to Cubic vice Raytheon beginning in FY17.

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
Remote Sensing Capability Development Data Collection	WR	SSC PAC : San Diego, CA	0.472	0.495	Feb 2017	0.536	Mar 2018	0.000		-		0.000	0.000	1.503	-
		Subtotal	0.472	0.495		0.536		0.000		-		0.000	0.000	1.503	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 2363 / *Remote Sensing Capability Development*	

Test and Evaluation ($ 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
Remote Sensing Capability Development Data Collection	WR	SSC PAC : San Diego, CA	1.122	0.800	Feb 2017	0.830	Mar 2018	0.000		-		0.000	0.000	2.752	-
Remote Sensing Capability Development Data Collection	WR	SSC Pacific : SAN DIEGO, CA	1.081	0.000		0.000		0.000		-		0.000	0.375	1.456	-
		Subtotal	2.203	0.800		0.830		0.000		-		0.000	0.375	4.208	N/A

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
Remote Sensing Capability Development Data Collection	C/FP	BAH : Virginia	0.345	0.000		0.000		0.000		-		0.000	0.000	0.345	-
Remote Sensing Capability Development Data Collection	C/FP	BAH : VA	0.537	0.000		0.000		0.000		-		0.000	0.374	0.911	-
		Subtotal	0.882	0.000		0.000		0.000		-		0.000	0.374	1.256	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	7.355	3.773		3.959		0.324		-		0.324	5.925	21.336	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

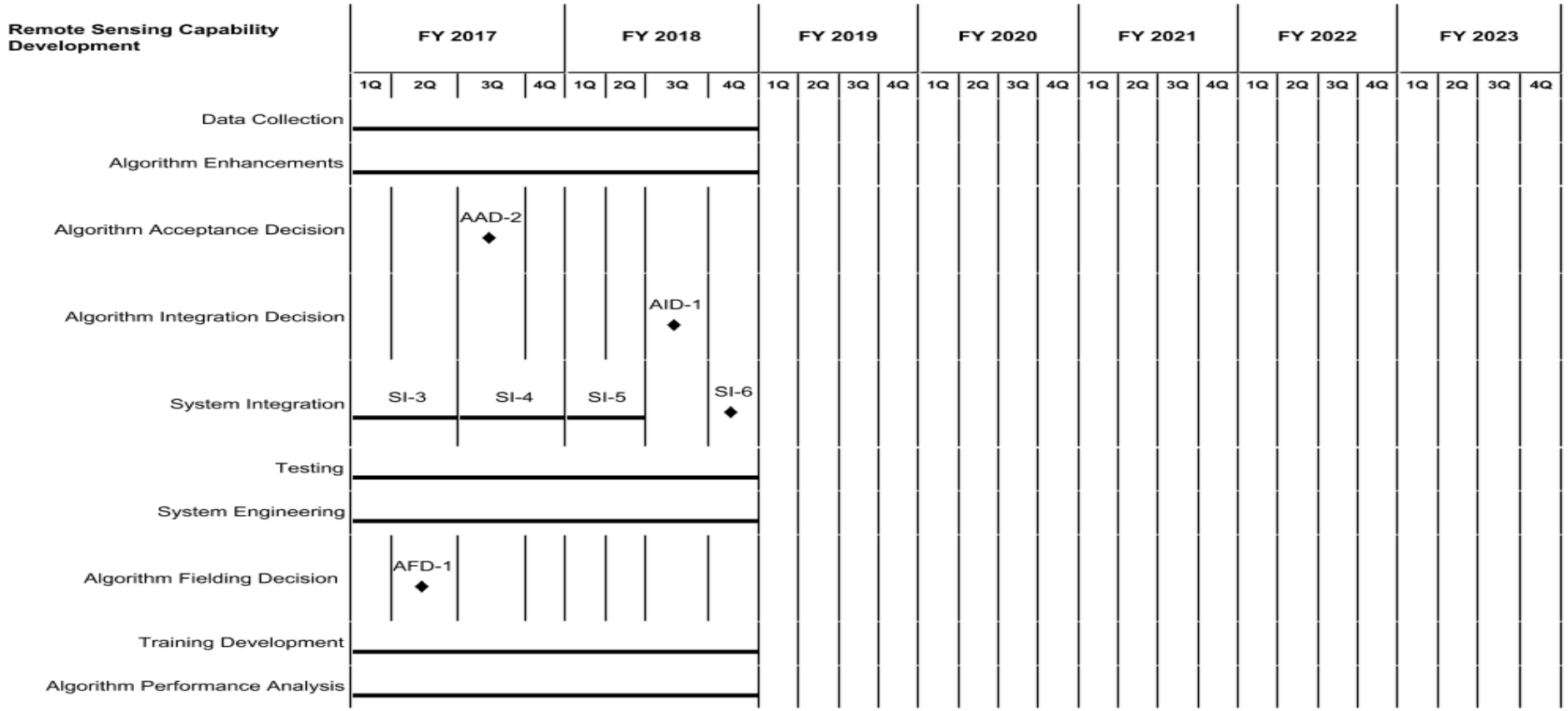


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Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 2363 / *Remote Sensing Capability Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Remote Sensing Capability Development				
Data Collection:	1	2017	4	2018
Algorithm Enhancements:	1	2017	4	2018
Algorithm Acceptance Decision: Algorithm Acceptance Decision 2	3	2017	3	2017
Algorithm Integration Decision: Algorithm Integration Decision 1	3	2018	3	2018
System Integration: System Integration 3	1	2017	2	2017
System Integration: System Integration 4	3	2017	4	2017
System Integration: System Integration 5	1	2018	2	2018
System Integration: System Integration 6	4	2018	4	2018
Testing:	1	2017	4	2018
System Engineering:	1	2017	4	2018
Algorithm Fielding Decision: Algorithm Fielding Decision 1	2	2017	2	2017
Training Development:	1	2017	4	2018
Algorithm Performance Analysis:	1	2017	4	2018
Remote Sensing Capability Dev.				
Data Collection:: Schedule Detail	1	2017	2	2020
Algorithm Development:: Schedule Detail	1	2017	4	2017
Application Development:: Schedule Detail	1	2017	4	2018
System Integration:: Schedule Detail	3	2017	4	2019
Testing:: Schedule Detail	1	2017	4	2020
System Engineering:: Schedule Detail	1	2017	4	2020
Training Development:: Schedule Detail	1	2017	4	2018

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 3207 / *Fleet Synthetic Training*	

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
3207: *Fleet Synthetic Training*	1.466	0.933	0.253	0.266	-	0.266	0.283	0.305	0.326	0.332	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Fleet Synthetic Training (FST) provides Naval Forces with an enhanced in-port training capability. Integrating embedded shipboard training devices, aircraft and submarine simulators into an interoperable network with joint, coalition and interagency partners will provide more effective training for our deploying naval forces.

A key factor in achieving this new way of training our Naval Forces is to ensure that the required training is based on realistic characterizations of the physical environment. This project develops and delivers software that characterizes the ocean and atmospheric environments; adjusts to meet fleet-required training scenarios; allows synthetic training to be conducted in areas of planned and contingency operations; and, provides sufficient detail to simulate the real-world conditions of the physical environment in those areas of interest.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Fleet Synthetic Training	0.933	0.253	0.266	0.000	0.266
Articles:	-	-	-	-	-
Description: Ballistic Missile Defense (BMD) Fleet Synthetic Training (FST) at sea effort will provide the capability to conduct integrated Live, Virtual and Constructive (LVC) single or multi-ship exercises with ships at sea using the Navy Continuous Training Environment (NCTE). This capability will support BMD mission area Fleet training and mission rehearsal in theater, allow ships to participate in Combatant Command (COCOM) mandated BMD exercises while pier-side or underway, as well as enhance BMD training objective accomplishment in current Fleet Readiness Training Plan (FRTP) underway training events such as Composite Training Unit Exercises (COMPTUEX) and Joint Task Force Exercises (JTFEX). The NCTE and FST directly support Fleet training readiness, strike group and BMD platform deployment certifications.					
FY 2018 Plans: *Develop Machine-to-Machine (M2M) capability for Environmental Data Cube Support System (EDCSS) interface in support of environmental product generation. *Research possible Fleet Synthetic Training (FST) integration into advanced Training (Integrated team trainers, warfighting development center support, etc.) *Research/Implement live virtual constructive capability leveraging virtual testbed and Full Motion Video/Joint Semi-Automatic Forces/Next Generation Threat System research.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
*Develop support for Electromagnetic Spectrum Maneuver Warfare (EMMW) leveraging Full Motion Video/Joint Semi-Automatic Forces/Next Generation Threat System research. ***FY 2019 Base Plans:*** *Research Fleet Synthetic Training (FST) integration into advanced Training (Integrated team trainers, warfighting development center support, etc.) *Research/Implement live virtual constructive capability leveraging virtual testbed and Full Motion Video/Joint Semi-Automatic Forces/Next Generation Threat System research. *Develop support for Electromagnetic Spectrum Maneuver Warfare (EMMW) leveraging Full Motion Video/Joint Semi-Automatic Forces/Next Generation Threat System research. *Research/Develop use of FST for Basic/Integrated phase certification of Strike Group Oceanography Teams. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Increase FY18 and FY19 supports cost of advance technology to support Ballistic Missile Defense Fleet Synthetic Training to provide integrated live, virtual and constructive single or multi-ship exercises.					
Accomplishments/Planned Programs Subtotals	0.933	0.253	0.266	0.000	0.266

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

The included technology developments are primarily in-house with contractor participation through existing vehicles.

E. Performance Metrics

1) The Navy will produce meteorological and oceanographic environmental databases for all NCTE exercise areas. Will implement, test, and integrate with Joint Semi Automated Forces (JSAF) and other federates in accordance with requirements.

2) The Navy will complete data and architecture integration, including information assurance compliance for provision of synthetic meteorological and oceanographic data to the NCTE. Data and products will be available via NEP-Oc, DVD and/or Machine-to-Machine (M2M) during planning and execution of FST events.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

3) The Navy will produce products based on synthetic ocean environment and synthetic satellite/radar imagery based on meteorological environmental data for all NCTE exercise areas. Products are utilized in planning and execution of FST events.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 3207 / *Fleet Synthetic Training*	

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
Development Support	WR	AER : VA	0.258	0.300	Jan 2017	0.083	Jan 2018	0.000		-		0.000	Continuing	Continuing	Continuing
Software Development	WR	Not Specified : Not Specified	0.070	0.142	Jan 2017	0.041	Jan 2018	0.000		-		0.000	Continuing	Continuing	Continuing
Configuration Management	WR	AER : VA	0.269	0.100	Jan 2017	0.039	Jan 2018	0.000		-		0.000	0.000	0.408	-
Studies and Analysis	Various	AER : VA	0.369	0.100	Apr 2017	0.039	Apr 2018	0.000		-		0.000	0.000	0.508	-
Award Fees	WR	NAWC TSD (Orlando, FL) : Not Specified	0.057	0.036	Jan 2017	0.012	Jan 2018	0.000		-		0.000	0.000	0.105	-
Technical Data	WR	Not Specified : Not Specified	0.119	0.000		0.000		0.000		-		0.000	0.000	0.119	-
		Subtotal	1.142	0.678		0.214		0.000		-		0.000	Continuing	Continuing	N/A

Test and Evaluation ($ 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
Operational Test & Evaluation	WR	AER : VA	0.171	0.150	Jan 2017	0.000		0.000		-		0.000	0.000	0.321	-
Development Test and Evaluation	WR	AER : VA	0.153	0.105	Jan 2017	0.039	Jan 2018	0.266	Jan 2019	-		0.266	0.000	0.563	-
		Subtotal	0.324	0.255		0.039		0.266		-		0.266	0.000	0.884	N/A

	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
Project Cost Totals	1.466	0.933		0.253		0.266		-		0.266	Continuing	Continuing	N/A

Remarks

Increase FY18 and FY19 supports cost of advance technology to support Ballistic Missile Defense Fleet Synthetic Training to provide integrated live, virtual and constructive single or multi-ship exercises.

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

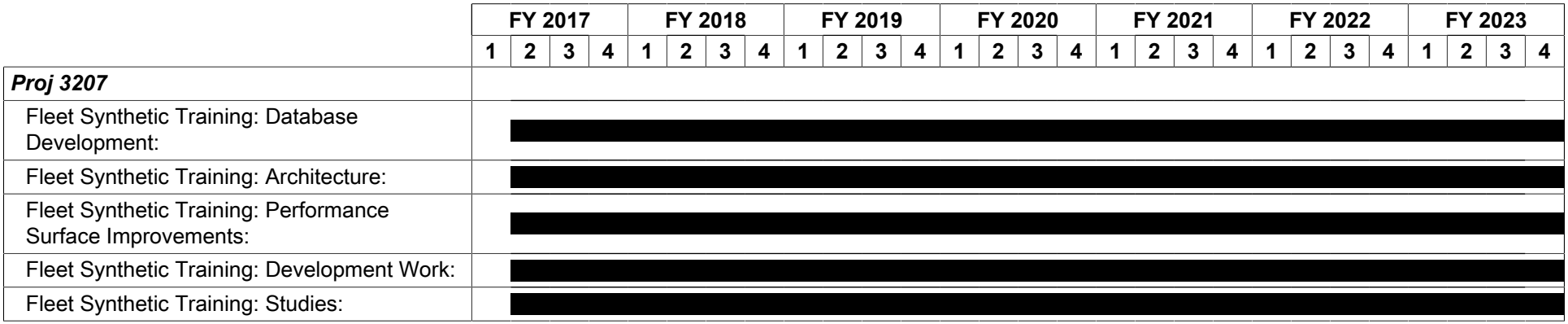

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3207 / *Fleet Synthetic Training*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3207				
Fleet Synthetic Training: Database Development:	2	2017	4	2023
Fleet Synthetic Training: Architecture:	2	2017	4	2023
Fleet Synthetic Training: Performance Surface Improvements:	2	2017	4	2023
Fleet Synthetic Training: Development Work:	2	2017	4	2023
Fleet Synthetic Training: Studies:	2	2017	4	2023

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 3404 / *Tactical Environmental Support*	

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
3404: *Tactical Environmental Support*	0.000	0.000	0.327	2.595	-	2.595	2.616	2.643	2.671	2.685	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Tactical Environmental Support Project (3404) enables the future warfighter to leverage environmental data gathered, assimilated and predicted under Projects 2341 (METOC Collections) and 2342 (METOC processing) by incorporating them into warfighting technological, net-centric applications that shape the way in which commanders engage the enemy, take full advantage of environmental conditions (and their impacts on systems and sensors) and complete the mission in the most efficient manner feasible. These software decision support tools complement the capabilities found in the NITES-Next Program of Record, and provide platform, sensor, communications, and weapon systems performance assessments for littoral and deep-strike warfighters. The following warfighting disciplines benefit directly from these METOC Exploitation capabilities: (1) Undersea Warfare (USW), Anti-Submarine Warfare (ASW), Mine Warfare (MIW), Amphibious Warfare (AMW), Anti-Surface Warfare (ASUW), Anti-Air Warfare, (AAW), Strike Warfare (STW), Expeditionary Warfare (EXW), Electronic Warfare (EW), Information Operations (IO), Intelligence Operations (INT), Non-Combat Operations (NCO), Command, Control, Communication (CCC), and Naval Special Warfare (NSW).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Tactical Environmental Support	0.000	0.327	2.595	0.000	2.595
Articles:	-	-	-	-	-
Description: The Tactical Environmental Support Project (3404) enables the future warfighter to leverage environmental data gathered, assimilated and predicted under Projects 2341 (METOC Collections) and 2342 (METOC processing) by incorporating them into warfighting technological, net-centric applications that shape the way in which commanders engage the enemy, take full advantage of environmental conditions (and their impacts on systems and sensors) and complete the mission in the most efficient manner feasible. These software decision support tools complement the capabilities found in the NITES-Next POR, and provide platform, sensor, communications, and weapon systems performance assessments for littoral and deep-strike warfighters. The following warfighting disciplines benefit directly from these METOC Exploitation capabilities: (1) Undersea Warfare (USW), Anti-Submarine Warfare (ASW), Mine Warfare (MIW), Amphibious Warfare (AMW), Anti-Surface Warfare (ASUW), Anti-Air Warfare, (AAW), Strike Warfare (STW), Expeditionary Warfare (EXW), Electronic Warfare (EW), Information Operations (IO), Intelligence Operations (INT), Non-Combat Operations (NCO), Command, Control, Communication (CCC), and Naval Special Warfare (NSW). Accomplishments and plans described below are examples for each effort category.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
FY 2018 Plans: - Continue: Provide a new ashore (reach back) radar/radio frequency (RF) and electro-optical (EO) performance products system that is modular, extensible, and high fidelity environmental model-driven that can serve as a replacement for the current tactical decision aids (TDAs) for RF: AREPS (Advanced Refractive Effects Prediction System), and EO: TAWS (Target Acquisition Weapons Software). - Continue: Enhance TrueView/Builder to maximize impact on and relevance to Navy and Marine Corps operations; make it fully compatible with Navy and Marine Corps operational computer systems and networks. - Continue: Leverage The Scalable Tactical Acoustic Propagation Loss Engine (STAPLE) Transitions project to support on-going transition of OAML model and database improvements into STAPLE in order to provide a common core element to a large number of Fleet ASW tactical and high fidelity training systems. - Continue: Improve Parabolic Equation (PE) modeling of passive sonar performance modeling within the TOPSIDE mission planner for regional ASW modeling; improve the physics and utility of the RAM/Seahawk model to extend to higher frequencies. - Continue: Evaluate and develop algorithms that leverage optical remote sensing data from Sentinel-3A, JPSS-1 VIIRS, Sentinel-3B and work toward transition of algorithms. - Continue: Improve the Naval Research Laboratory Atmospheric Acoustic Propagation (NRLAAP) system by developing new multi-vehicle simulation capabilities, incorporating the effects of propagation and ambient noise uncertainty/variability into probability of detection calculations, and improving the efficiency of the model calculations by incorporating advances from the NRL base program "Atmospheric environmental acoustic features for reduction of performance prediction time". - Continue: Work toward EPMA improvements, including: (1) New services to modernize MIW databases for imagery; (2) Refresh of environmental workflows for Bathymetry, Salinity, Temperature, Optics, and Currents; (3) Integration with new Mine Contact Database; (4) Define requirements for integration with Net-Centric Sensor Analysis for Mine Warfare (NSAM), NAVSEA Surface Mine Warfare Program (PMS-495), Naval Surface Warfare Center - Panama City Division (NSWC-PCD); (5) Demonstrate interoperability with latest NSAM service architecture. - Continue: Provide automated mission-relevant water sampling plans with joint optimization of varied observing systems: gliders, profiling floats, shipboard, satellite, buoy, air-deployed, etc. - Continue: Improvement and validation of the Navy Surface Layer Atmospheric Model (NAVSLaM), based on evaluation of recent applied research results and the availability of experimental datasets and produce a sample near-surface Cn2 (turbulence) climatology database for evaluation purposes.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Begin: Improve Builder software to include Bragg Line analysis, upgrades to the Ionospheric model and upgrades to output metadata.					
FY 2019 Base Plans: - Complete: Provide a new ashore (reach back) radar/radio frequency (RF) and electro-optical (EO) performance products system that is modular, extensible, and high fidelity environmental model-driven that can serve as a replacement for the current tactical decision aids (TDAs) for RF: AREPS (Advanced Refractive Effects Prediction System), and EO: TAWS (Target Acquisition Weapons Software). - Continue: Improve Builder software to include Bragg Line analysis, upgrades to the Ionospheric model and upgrades to output metadata. - Complete: Enhance TrueView/Builder to maximize impact on and relevance to Navy and Marine Corps operations; make it fully compatible with Navy and Marine Corps operational computer systems and networks. - Complete: Leverage The Scalable Tactical Acoustic Propagation Loss Engine (STAPLE) Transitions project to support on-going transition of OAML model and database improvements into STAPLE in order to provide a common core element to a large number of Fleet ASW tactical and high fidelity training systems. - Complete: Improve Parabolic Equation (PE) modeling of passive sonar performance modeling within the TOPSIDE mission planner for regional ASW modeling; improve the physics and utility of the RAM/Seahawk model to extend to higher frequencies. - Complete: Evaluate and develop algorithms that leverage optical remote sensing data from Sentinel-3A, JPSS-1 VIIRS, Sentinel-3B and work toward transition of algorithms. - Complete: Improve the Naval Research Laboratory Atmospheric Acoustic Propagation (NRLAAP) system by developing new multi-vehicle simulation capabilities, incorporating the effects of propagation and ambient noise uncertainty/variability into probability of detection calculations, and improving the efficiency of the model calculations by incorporating advances from the NRL base program "Atmospheric environmental acoustic features for reduction of performance prediction time". - Complete: Work toward EPMA improvements, including: (1) New services to modernize MIW databases for imagery; (2) Refresh of environmental workflows for Bathymetry, Salinity, Temperature, Optics, and Currents; (3) Integration with new Mine Contact Database; (4) Define requirements for integration with Net-Centric Sensor Analysis for Mine Warfare (NSAM), PMS-495, NSWC-PCD; (5) Demonstrate interoperability with latest NSAM service architecture. - Complete: Provide automated mission-relevant water sampling plans with joint optimization of varied observing systems: gliders, profiling floats, shipboard, satellite, buoy, air-deployed, etc.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Complete: Improvement and validation of the Navy Surface Layer Atmospheric Model (NAVSLaM), based on evaluation of recent applied research results and the availability of experimental datasets and produce a sample near-surface Cn2 (turbulence) climatology database for evaluation purposes. - Initiate: Leverage lessons learned from NAVSLaM to create a holistic approach to atmospheric boundary larger turbulence observation, data-basing and modeling, as they pertains to Navy tactical problems. - Initiate: Enhancements to newly fielded RF and EO capability that incorporates Fleet user feedback and tactical lessons learned. - Initiate: Explore synergies with other DoD ocean observation system initiatives in order to rapidly advance and scale-up Navy ocean observation systems, data exfiltration, data assimilation and forward modeling capabilities. - Initiate: Fully explore artificial intelligence (AI) and machine learning aspects of EPMA, to include optimization within private cloud and "big data analytics" architectures. Incorporate "mirrored" test and evaluation computational environments when fielding new EPMA capabilities. - Initiate: Develop technologies that will improve NAVAIR's ability to quickly integrate newly developed NRLAAP capabilities. - Initiate: Explore options in terms of long-term, state-of-the-art maintenance of and improvements to PE and ASW modeling. - Initiate: Explore means of integrating STAPLE with newly developed cloud-based OAML software distribution capability. - Initiate: Make additional modifications to TrueView/Builder in order to meet new Fleet operational and Cyber requirements in an agile manner. - Initiate: Leverage lessons learned from remote sensing data algorithms for use in SmallSats and other newly emerging remote sensing technologies. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Funding Increases from FY2018 to FY2019 is due to realignment of resources within PE 0603207N Project Unit/LI 2341 METOC Data Acquisition for follow-on efforts that will more fully transition tactical environmental technologies into Fleet operations, as well as address operational lessons learned from fielding of recently introduced technologies. This feedback mechanism enables agility, thus accelerating the improvement of capabilities that provide a distinct tactical advantage to the Fleet and Marine Corps.					
Accomplishments/Planned Programs Subtotals	0.000	0.327	2.595	0.000	2.595

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Tactical Environmental Support Project to develop, demonstrate and validate products and decision aids to understand and predict the impact of the environment on military operations.

E. Performance Metrics

Goal: Develop techniques and tools to transform traditional METOC predicted variables into more directly tactially relevant variables, and allow METOC personnel and others to understand the impact of the environment on sensors, communications, and weapons. Focus areas include, but are not limited to, electromagnetic maneuver warfare, electro-optical impacts (of environment on sensors and weapons systems), and anstisubmarine warfare. Metric -- Tasks will address no less than 75% of applicable capability gaps and requirements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 3404 / *Tactical Environmental Support*	

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
METOC Tactical Environmental Support	WR	NRL : Washington, DC	0.000	0.000		0.145	Nov 2017	2.283	Nov 2018	-		2.283	0.000	2.428	-
METOC Tactical Environmental Support	WR	NRL : Monterey, CD Stennis Space Center,MS	0.000	0.000		0.182	Nov 2017	0.312	Nov 2018	-		0.312	Continuing	Continuing	Continuing
METOC Tactical Environmental Support-Staple Transitions	WR	NSWC Carderock : West Bethesda, MD	0.000	0.000		0.000	Nov 2017	0.000		-		0.000	2.500	2.500	-
METOC Tactical Environmental Support	C/FFP	Various : Various	0.000	0.000		0.000	Nov 2017	0.000		-		0.000	0.075	0.075	-
		Subtotal	0.000	0.000		0.327		2.595		-		2.595	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	0.000	0.000		0.327		2.595		-		2.595	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

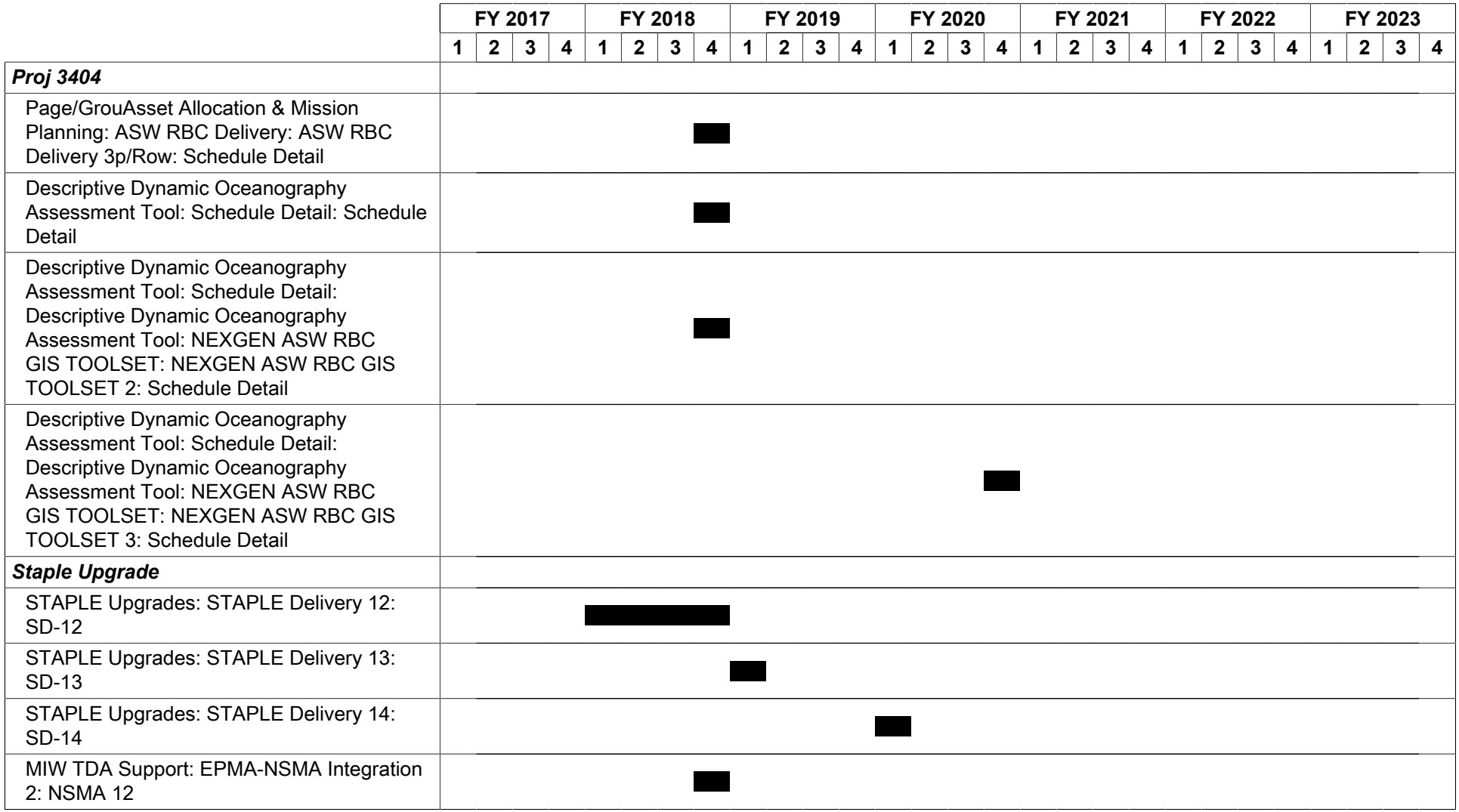

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

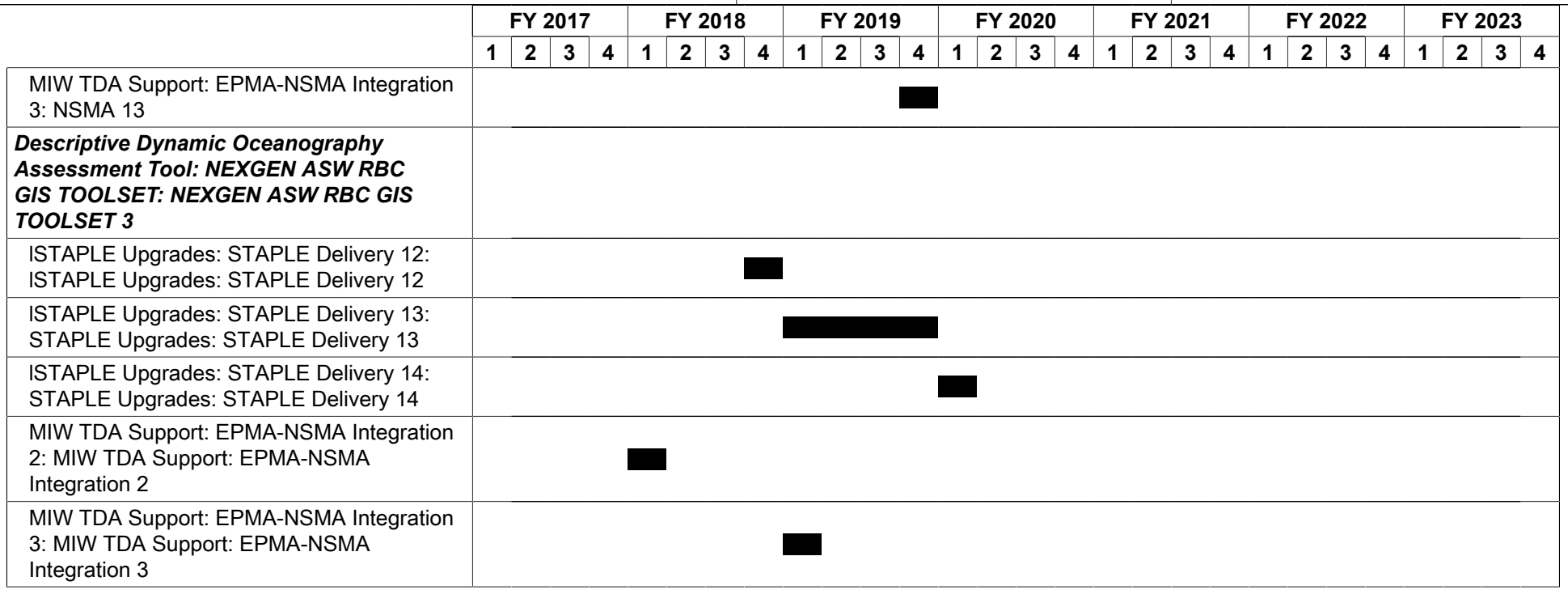

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3404				
Page/GrouAsset Allocation & Mission Planning: ASW RBC Delivery: ASW RBC Delivery 3p/Row: Schedule Detail	4	2018	4	2018
Descriptive Dynamic Oceanography Assessment Tool: Schedule Detail: Schedule Detail	4	2018	4	2018
Descriptive Dynamic Oceanography Assessment Tool: Schedule Detail: Descriptive Dynamic Oceanography Assessment Tool: NEXGEN ASW RBC GIS TOOLSET: NEXGEN ASW RBC GIS TOOLSET 2: Schedule Detail	4	2018	4	2018
Descriptive Dynamic Oceanography Assessment Tool: Schedule Detail: Descriptive Dynamic Oceanography Assessment Tool: NEXGEN ASW RBC GIS TOOLSET: NEXGEN ASW RBC GIS TOOLSET 3: Schedule Detail	4	2020	4	2020
Staple Upgrade				
STAPLE Upgrades: STAPLE Delivery 12: SD-12	1	2018	4	2018
STAPLE Upgrades: STAPLE Delivery 13: SD-13	1	2019	1	2019
STAPLE Upgrades: STAPLE Delivery 14: SD-14	1	2020	1	2020
MIW TDA Support: EPMA-NSMA Integration 2: NSMA 12	4	2018	4	2018
MIW TDA Support: EPMA-NSMA Integration 3: NSMA 13	4	2019	4	2019
Descriptive Dynamic Oceanography Assessment Tool: NEXGEN ASW RBC GIS TOOLSET: NEXGEN ASW RBC GIS TOOLSET 3				
ISTAPLE Upgrades: STAPLE Delivery 12: ISTAPLE Upgrades: STAPLE Delivery 12	4	2018	4	2018
ISTAPLE Upgrades: STAPLE Delivery 13: STAPLE Upgrades: STAPLE Delivery 13	1	2019	4	2019
ISTAPLE Upgrades: STAPLE Delivery 14: STAPLE Upgrades: STAPLE Delivery 14	1	2020	1	2020
MIW TDA Support: EPMA-NSMA Integration 2: MIW TDA Support: EPMA-NSMA Integration 2	1	2018	1	2018

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3404 / *Tactical Environmental Support*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
MIW TDA Support: EPMA-NSMA Integration 3: MIW TDA Support: EPMA-NSMA Integration 3	1	2019	1	2019

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 3405 / *Decision Support Products & Dissemination*	

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
3405: *Decision Support Products & Dissemination*	0.000	0.000	0.327	1.094	-	1.094	1.115	1.144	1.171	1.186	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Decision Support Products & Dissemination efforts enable the future warfighter to leverage environmental data gathered, assimilated, predicted and exploited by optimizing data formatting, compression, packaging, depiction, data-basing and transfer methodologies that permit the rapid dissemination of actionable battlespace environmental (METOC) information over tactical and reach-back networks. This project ensures warfighters, commanders and those who support them are fully synchronized in terms of environmental data products shared among a multitude of platforms, systems and common operating pictures (COPs). METOC information is highly dynamic. Just as time synchronization is essential to navigation principles, timely METOC knowledge and information are vital to battlespace environmental exploitation, placing the warfighter and support elements in spatial and temporal synchronization, and at a collective advantage, in terms of the current and predicted states of the ocean and atmosphere.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Decision Support Products & Dissemination	0.000	0.327	1.094	0.000	1.094
Articles:	-	-	-	-	-
Description: The Decision Support Products and Dissemination Project (3405) enables the future warfighter to leverage environmental data gathered, assimilated, predicted and exploited under Projects 2341 (METOC Collections), 2342 (METOC processing) and 3404 (METOC exploitation) by optimizing data formatting, compression, packaging, depiction, data-basing and transfer methodologies that permit the rapid dissemination of actionable battlespace environmental (METOC) information over tactical and reach-back networks. This project ensures warfighters, commanders and those who support them are fully synchronized in terms of environmental data products shared among a multitude of platforms, systems and common operating pictures (COPs). METOC information is highly dynamic. Just as time synchronization is essential to navigation principles, timely METOC knowledge and information synchronization is vital to battlespace environmental exploitation, placing the warfighter and all of those who support him on the "same sheet of music" and at a collective advantage, in terms of the current and predicted states of the ocean and atmosphere. Accomplishments and plans described below are examples for each effort category. ***FY 2018 Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
- Continue: Mature the A3PET capabilities already demonstrated in the prototype; provide an intuitive, interactive user interface, and provide a service application programming interface (API) for potential programmatic use by backend components in the future. - Continue: Provide acoustically consistent oceanographic confidence estimates based on current continuous ocean model/data comparisons for the Navy's operational ocean and acoustics communities. - Initiate: Evaluate global ocean analyses and forecasts from different national/international centers, with respect to both hydrographic and acoustic properties. - Initiate: Develop ship routing and base preparedness algorithms so that they can be employed on the following systems: the Automated Tropical Cyclone Forecast System (ATCF), the Joint METOC Viewer (JMV), and the Advanced Weather Interactive Processing System Version II (AWIPS II). ***FY 2019 Base Plans:*** - Continue: Evaluate global ocean analyses and forecasts from different national/international centers, with respect to both hydrographic and acoustic properties. - Continue: Develop ship routing and base preparedness algorithms so that they can be employed on the following systems: the Automated Tropical Cyclone Forecast System (ATCF), the Joint METOC Viewer (JMV), and the Advanced Weather Interactive Processing System Version II (AWIPS II). - Complete: Provide acoustically consistent oceanographic confidence estimates based on current continuous ocean model/data comparisons for the Navy's operational ocean and acoustics communities. - Complete: Mature the Advanced Air ASW Planning abs Evaluation Tool (A3PET) capabilities already demonstrated in the prototype; provide an intuitive, interactive user interface, and provide a service application programming interface (API) for potential programmatic use by backend components in the future. - Initiate: Explore the use of oceanographic confidence estimates derived from model/data comparisons to improve Navy ocean and acoustic models and tactical decision aids. - Initiate: Leverage lessons learned from ocean analysis and forecast evaluations in order to improve databases, data assimilation techniques and ocean and acoustic models in a more synergistic way. - Initiate: Leverage lessons learned from A3PET to create a holistic approach to real-time ASW mission planning and re-tasking by exploring machine learning, high-performance computing, cloud computing and "big data analytics" aspects of the ASW mission planning and associated ocean environment problem. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Funding Increases from FY2018 to FY2019 due to realignment of resources from Project Unit (PU)/LI 2342 METOC Data Acquisition which will result in follow-on efforts that more fully address the needs of Fleet and Marine Corps decision makers, to include technologies that fully integrate state-of-the-art and tactically-relevant atmospheric and ocean modeling capabilities as well as state-of-the-art information technologies such as cloud-based and high-performance computing, as well as "big data analytics" and machine learning.					
Accomplishments/Planned Programs Subtotals	0.000	0.327	1.094	0.000	1.094

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Acquisition, management and contracting strategies are to support the Decision Support Products & Dissemination Project to develop, demonstrate and validate products and decision aids to provide environmentally based recommendations to commanders at the Strategic, Operational, and Tactical levels of military operations.

E. Performance Metrics

Goal: Develop techniques and tools to provide tactially relevant METOC based advice to military commanders. Focus areas include, but are not limited to, electromagnetic maneuver warfare, electro-optical impacts (of environment on sensors and weapons systems), and anstisubmarine warfare. Metric -- Tasks will address no less than 75% of applicable capability gaps and requirements.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / *Air/Ocean Tactical Applications*	Project (Number/Name) 3405 / *Decision Support Products & Dissemination*	

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
METOC Tactical Environmental Support	WR	NRL : Washington DC	0.000	0.000		0.111	Nov 2017	0.232	Nov 2018	-		0.232	0.000	0.343	-
METOC Tactical Environmental Support	WR	NRL : Monterey, CA; Dtennis Space Center, MS	0.000	0.000		0.100	Nov 2017	0.100	Nov 2018	-		0.100	Continuing	Continuing	Continuing
METOC Tactical Environmental Support	C/FFP	Various : Various	0.000	0.000		0.116	Nov 2017	0.762	Nov 2018	-		0.762	0.000	0.878	-
		Subtotal	0.000	0.000		0.327		1.094		-		1.094	Continuing	Continuing	N/A

	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
Project Cost Totals	0.000	0.000		0.327		1.094		-		1.094	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

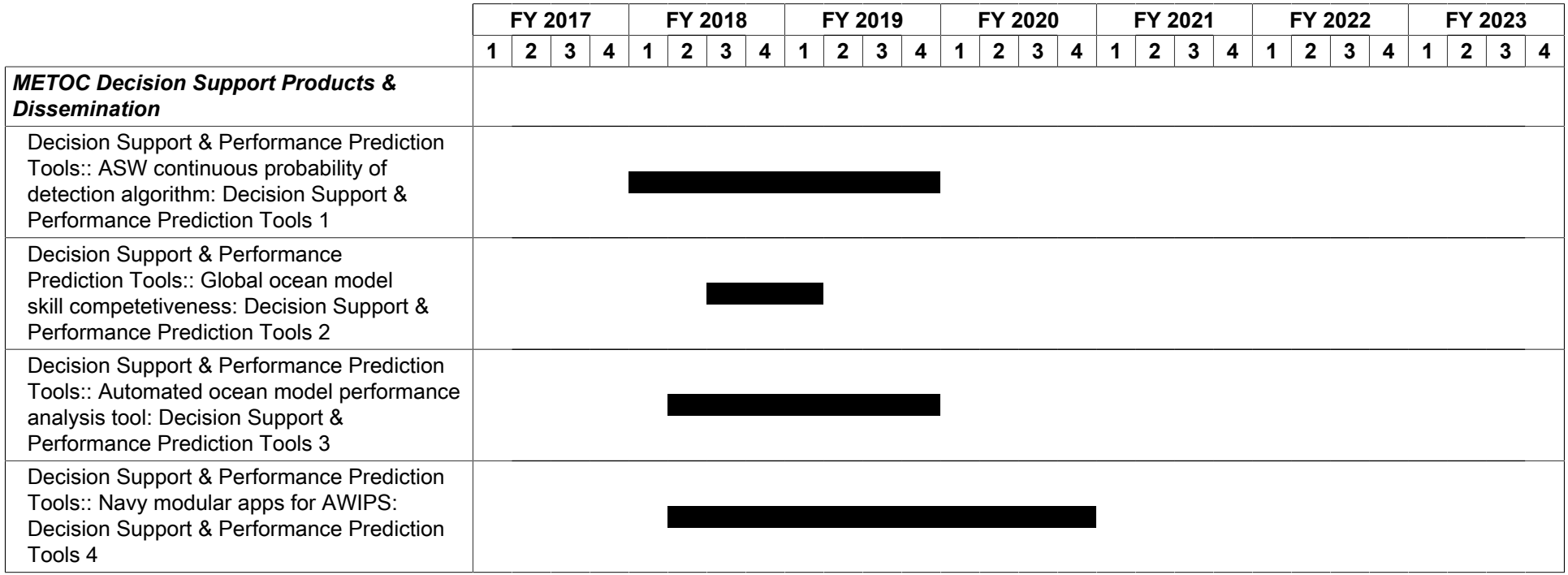

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603207N / *Air/Ocean Tactical Applications*	**Project (Number/Name)** 3405 / *Decision Support Products & Dissemination*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
METOC Decision Support Products & Dissemination				
Decision Support & Performance Prediction Tools:: ASW continuous probability of detection algorithm: Decision Support & Performance Prediction Tools 1	1	2018	4	2019
Decision Support & Performance Prediction Tools:: Global ocean model skill competetiveness: Decision Support & Performance Prediction Tools 2	3	2018	1	2019
Decision Support & Performance Prediction Tools:: Automated ocean model performance analysis tool: Decision Support & Performance Prediction Tools 3	2	2018	4	2019
Decision Support & Performance Prediction Tools:: Navy modular apps for AWIPS: Decision Support & Performance Prediction Tools 4	2	2018	4	2020