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

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
Total Program Element	507.074	39.670	37.832	48.536	-	48.536	49.686	49.734	45.864	46.818	Continuing	Continuing
2341: <i>METOC Data Acquisition</i>	161.559	2.487	3.763	4.437	-	4.437	5.467	5.316	5.341	5.447	Continuing	Continuing
2342: <i>METOC Data Assimilation and Mod</i>	202.060	12.890	16.360	20.165	-	20.165	21.497	22.369	22.721	23.198	Continuing	Continuing
2343: <i>Tactical METOC Applications</i>	135.448	8.942	9.260	13.473	-	13.473	15.437	15.261	15.443	15.765	Continuing	Continuing
2344.: <i>Precise Time and Astrometry</i>	6.825	8.217	4.977	5.636	-	5.636	5.229	4.745	0.313	0.319	Continuing	Continuing
2363.: <i>Remote Sensing Capability Development</i>	0.000	4.949	2.479	3.855	-	3.855	1.023	0.988	0.970	0.991	Continuing	Continuing
3207: <i>Fleet Synthetic Training</i>	1.182	2.185	0.993	0.970	-	0.970	1.033	1.055	1.076	1.098	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Air Ocean 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 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.

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Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>
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Major emphasis areas include the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) and the METOC Future Mission Capabilities (FMC), the METOC Space-Based Sensing Capabilities, the Precise Timing and Astrometry, the Fleet Synthetic Training, the Tactical Oceanographic Capabilities for Under Sea Warfare, the Earth System Prediction Capability projects, and the Remote Sensing Capability Development.

B. Program Change Summary (\$ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	40.429	41.832	50.430	-	50.430
Current President's Budget	39.670	37.832	48.536	-	48.536
Total Adjustments	-0.759	-4.000	-1.894	-	-1.894
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-4.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.284	0.000			
• SBIR/STTR Transfer	-1.044	0.000			
• Program Adjustments	0.000	0.000	1.800	-	1.800
• Rate/Misc Adjustments	0.001	0.000	-3.694	-	-3.694

Change Summary Explanation

Decrease in Air Ocean Tactical Applications (AOTA) by \$2.1M as required for the Department of the Navy to comply with the Bipartisan Budget Act of 2015.

The FY 2016 funding request was reduced by \$3.6 million to account for the availability of prior year execution balances.

Technical - Increase in funding in FY16 - FY19 for Precise Time and Astrometry (PTA) program efforts.

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

2) The schedule for NITES-Next is updated to reflect a 12 month delay to Fleet Capability Release-3 (FCR-3) Build Decision.

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy										Date: February 2016		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 2341 / <i>METOC Data Acquisition</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
2341: <i>METOC Data Acquisition</i>	161.559	2.487	3.763	4.437	-	4.437	5.467	5.316	5.341	5.447	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The major thrust of the Meteorology and Oceanography (METOC) Data Acquisition Project is to provide future mission capabilities to warfighters that will allow them to detect and monitor the conditions of the physical environment throughout the entire battlespace. New sensor technologies (including unmanned vehicles, tactical sensor exploitation, in-situ sensors) identified as the most promising candidates 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 and products to operational and tactical commanders. METOC data requirements have likewise evolved as the emphasis on naval warfare has evolved from blue water operations to the littoral and deep strike battlespace. The littoral and deep strike regions typically have dynamic and complex oceanographic and atmospheric conditions. The need to accurately characterize these conditions is more crucial than ever 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, and satellite remote sensing are necessary but not sufficient to support these warfare areas in 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 both 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 areas include the METOC Future Mission Capabilities (FMC) and the Tactical Oceanographic Capabilities project.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC)	2.188	3.463	4.230	0.000	4.230
Articles:	-	-	-	-	-
FY 2015 Accomplishments: Continued advanced component and prototype development efforts associated with acquiring environmental data and develop advanced techniques for data measurement and survey techniques that capture measurement uncertainties in order to provide warfare commanders with an accurate assessment of uncertainty in sensor performance prediction products and services. Continued to develop technologies that use tactical detection systems where applicable to characterize undersea and atmospheric environment in the battlespace. Developed					

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2341 / <i>METOC Data Acquisition</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>and demonstrated in-situ sampling techniques to support adaptive and advance measurement technologies. Developed tools and techniques to support forecaster's processing, analysis and performance assessment processes.</p> <p>FY 2016 Plans: Continue advanced component and prototype development efforts associated with acquiring environmental data. Develop advanced techniques for data measurement and survey techniques that capture measurement uncertainties in order to provide warfare commanders with an accurate assessment of uncertainty in sensor performance prediction products and services. Continue to develop technologies to characterize undersea and atmospheric environment in the battlespace. Continue to develop and demonstrate in-situ sampling techniques to support adaptive and advance measurement technologies. Continue to develop tools and techniques to support forecaster's processing, analysis and performance assessment processes. Develop tools to assess reach-back and on scene data fusion to support improved METOC decision support infrastructure.</p> <p>FY 2017 Base Plans: Developed and demonstrated in-situ sampling techniques to support adaptive and advance measurement technologies. Developed techniques to improve delivery of GI&S within Navy METOC product production centers and throughout the fleet user base. Continue development of METOC systems engineering plans, requirements, standards, studies, and other documentation supporting integration of these products. Develop advanced techniques for data measurement and survey techniques that capture measurement uncertainties in order to provide warfare commanders with an accurate assessment of uncertainty in sensor performance prediction products and services. Develop tools to assess reach-back and on scene data fusion to support improved METOC decision support infrastructure.</p> <p>FY 2017 OCO Plans: N/A</p>					
<p>Title: Tactical Oceanography Capabilities (TOC) / Undersea Warfare (USW)</p> <p align="right">Articles:</p>	0.299 -	0.300 -	0.207 -	0.000 -	0.207 -
<p>FY 2015 Accomplishments: Continued to transition sonar through-the-sensor (TTS) collection methodologies, data assimilation, models, algorithms and databases used by the Naval Oceanographic Office (NAVO) to calculate accurate acoustic transition loss (TL) and characterize environmental parameters that affect TL into U.S. Navy anti-submarine warfare (ASW) tactical decision aids (TDAs). Continued to develop capabilities to rapidly calculate acoustic TL</p>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
values within tactical timeframes to include environmental uncertainty quantification of those values for both active and passive sonar systems.					
FY 2016 Plans: Continue to transition models, algorithms and databases used to calculate accurate acoustic TL and characterize environmental parameters that affect TL into U.S. Navy ASW TDAs. Continue to develop capabilities to rapidly calculate acoustic TL values within tactical timeframes to include environmental uncertainty quantification of those values for both active and passive sonar systems with emphasis on developing an active radial province capability.					
FY 2017 Base Plans: Continue to transition models, algorithms and databases that calculate accurate acoustic transmission loss (TL) and characterize environmental parameters that affect TL. Developed TL calculation implementations to be used in the Navy's Anti-Submarine Warfare (ASW) Tactical Decision Aids (TDAs) and sonar trainers. Continued to develop capabilities to rapidly calculate acoustic TL values within tactical timeframes to include environmental uncertainty quantification of those values. Develop capabilities to rapidly calculate acoustic TL values within tactical timeframes to include environmental uncertainty quantification of those values for both active and passive sonar systems with emphasis on developing an active radial province capability.					
FY 2017 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	2.487	3.763	4.437	0.000	4.437

C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
• RDTEN/0604218N/2345: <i>FLEET METOC EQUIPMENT</i>	1.200	3.379	2.222	-	2.222	2.411	2.438	2.456	2.505	Continuing	Continuing
• RDTEN/0603207N/2342: <i>METOC DATA ASSIMILATION AND MOD</i>	4.891	8.168	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
• RDTEN/0604218N/2346: <i>METOC SENSOR ENGINEERING</i>	0.926	1.136	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

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Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2341 / <i>METOC Data Acquisition</i>

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 in order to improve the accuracy of global and regional scale meteorological and oceanographic forecast models. Advanced sensor component, data collection, and meteorological, oceanographic and hydrographic survey technique development tasks are directed by Resource Sponsor, with input from external Systems Commands and/or Type Commanders, in response to validated capability gaps or operational fleet requirements. 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 6.2 - 6.3 S&T work. Metric -- Tasks will address no less than 75% of applicable capability gaps and requirements.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)						Project (Number/Name)					
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications						2341 / METOC Data Acquisition					
Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Future Mission Capabilities	WR	NRL : Washington, DC	73.390	1.669	Nov 2014	2.636	Nov 2015	3.406	Nov 2016	-		3.406	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	WR	SSC PAC : California	22.033	0.300	Nov 2014	0.730	Nov 2015	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	0.666	0.137	Dec 2014	0.185	Nov 2015	0.205	Nov 2016	-		0.205	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	APPLIED SCIENCE ASSOCIATED : RHODE ISLAND	0.000	0.000		0.000		0.226	Dec 2016	-		0.226	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC : Virginia	1.400	0.022	Jan 2015	0.059	Jan 2016	0.300	Dec 2016	-		0.300	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	CSC : Virginia	0.400	0.031	Jan 2015	0.000		0.300	Dec 2016	-		0.300	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/CPFF	GDIT : Virginia	0.000	0.138	Mar 2015	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Subtotal			157.591	2.297		3.610		4.437		-		4.437	-	-	-
Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	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	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications				2341 / METOC Data Acquisition							
Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
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	0.000	0.162	Nov 2014	0.115	Jan 2016	0.000		-		0.000	0.000	0.277	-
METOC Future Mission Capabilities	C/CPFF	PSS/BAH : California	0.000	0.028	Dec 2014	0.038	Dec 2015	0.000		-		0.000	0.000	0.066	-
Subtotal			3.272	0.190		0.153		0.000		-		0.000	0.000	3.615	-
Test and Evaluation (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	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	-
Management Services (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	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	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy								Date: February 2016			
Appropriation/Budget Activity 1319 / 4			R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 2341 / <i>METOC Data Acquisition</i>				
	Prior Years	FY 2015	FY 2016		FY 2017 Base	FY 2017 OCO	FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract	
Project Cost Totals	161.559	2.487	3.763		4.437	-	4.437	-	-	-	

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2341 / <i>METOC Data Acquisition</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>METOC Future Mission Capabilities (FMC)</i>				
Ocean & Atmos Data Acq & Processing:	1	2015	4	2016
In-situ Data Sampling:	1	2015	4	2018
Geospatial Information and Services (GI&S) Delivery Technologies:	1	2016	4	2019
Assess Reach-back and On Scene Data Fusion: Schedule Detail	1	2016	4	2020

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Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
2342: <i>METOC Data Assimilation and Mod</i>	202.060	12.890	16.360	20.165	-	20.165	21.497	22.369	22.721	23.198	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Meteorological and Oceanographic (METOC) Data Assimilation Project is a multi-faceted project that provides future mission capabilities for warfighters to characterize the physical environment within their battlespace. This project includes: 1) development, demonstration and validation of software associated with atmospheric and oceanographic data assimilation forecast models and database management systems for use in both mainframe and tactical scale computers. Included are numerical oceanographic and atmospheric models for the Large Scale Computers at the Navy Fleet Numerical Meteorology and Oceanography Center (FNMOC), Monterey, CA and the Naval Oceanographic Office (NAVO), Stennis Space Center, MS. These models, combined with a global communications network for data acquisition and distribution, form a prediction system which provides METOC data and products necessary to support naval operations worldwide in virtually every mission area; 2) other software models, which focus on ocean thermal structure and circulation, and surf and tide prediction; 3) software to process and manage satellite remotely-sensed environmental data at Oceanography Centers ashore and on ships equipped with the AN/SMQ-11 satellite receiver/recorder; 4) future METOC and environmental satellite data readiness and risk reduction preparations to develop hardware and software that will allow ground stations to receive, ingest and exploit satellite data including payload sensor data from the National Polar Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP), the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) Polar Systems' Meteorological Operational satellites A & B (METOP-A & B), Joint Polar Satellite System (JPSS), and Defense Meteorological Satellite Program (DMSP). This software allows for the integration and tactical application of significant oceanographic and atmospheric data derived from satellite-borne sensors. Satellite and unmanned sensor data, combined with manned platform data are foundational to a robust numerical weather and oceanographic modeling capability that predicts battlespace conditions impacting fleet and adversary weapon and sensor performance. Included are software and algorithms for the processing of sensor measurements, conversion of raw signal data to geophysical information, analysis schemes encompassing Artificial Intelligence and Expert Systems, and other satellite data applications and field validation of end products; and, 5) a family of acoustic system performance models beginning with active system models and databases in the low-, mid-, and high-frequency regimes and culminating with high fidelity simulation products. As weapons and sensors become more sophisticated and complex, the marine environment has an increasingly significant impact on system performance. Operational limitations induced by the ocean and atmosphere must be understood, and the resulting constraints on mission effectiveness and system employment minimized. Hence, the operating forces require more accurate worldwide forecasts of METOC conditions with increased temporal and spatial resolution. An additional challenge is posed by the emergence of new satellite sensor data. In order to fully exploit this dynamic and massive volume of data, modern Data Base Management Systems are required, and must be tailored for individual computer configurations at both FNMOC and NAVO. Improved representation of smaller-scale phenomena, particularly in the littoral, is also an important consideration. Intelligence Preparation of the Environment Sensor R&D to meet Chief of Naval Operations and Commander, Fleet Forces Command requirements for remote autonomous, clandestine, littoral battlespace sensing in near shore areas in support of Sea Shield & Sea Basing. Major emphasis areas include the METOC Future Mission Capabilities (FMC), the METOC Space-Based Sensing Capabilities, and the Tactical Oceanographic Capabilities / Under Sea Warfare projects (TOC/USW). Recent focuses have included continued advanced software component development and prototype efforts associated with advanced data assimilation into environmental prediction systems (to include development of tactical decision aids and asset allocation tools software), the continued development of advanced oceanographic and atmospheric prediction systems software and architectures to

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provide improved forecasts and estimates of product accuracies, continued development of improved data fusion techniques, data quality control technologies and accelerate the automation prediction processes, and the development of data assimilation and fusion software technologies for tactical radars, remote sensing and undersea sensor systems. Continue research and development of data processing and data assimilation algorithms for the Joint Polar Satellite System-1 (JPSS-1), Free-Flyer, GOES-S, EarthCARE, and OceanSat launch. Continue to Develop Meteorological and Oceanographic (METOC) Decision Support & Prediction Tools to improve Electromagnetic and Electro-optical (EM/EO) system performance. Funding from Project Element 0305160N, Line Item 0524 has been realigned to the 2342 Line Item: Meteorology and Oceanography (METOC) Space-Based Sensing Capabilities project provides for Navy participation in the Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/Imager and Special Sensor Microwave Imager Sounder calibration/validation efforts in support of the fleet operational requirements. The passive microwave instrument carried on DMSP provides global oceanic and atmospheric data of direct operational relevance, including sea surface wind speed, sea ice, and precipitation. The METOC Space-Based Sensing Capabilities project ensures the naval service's operational requirements are satisfied primarily through demonstration of technologies for inclusion on operational constellations such as DMSP, the Joint Polar Satellite System (JPSS) and the National Oceanic and Atmospheric Administration's Geostationary Operational Environmental Satellites (GOES). These efforts fulfill naval service unique requirements that are not funded within the DMSP, JPSS or GOES programs, and are in accordance with current inter-agency agreements. The TREES Speed to Fleet project is an advanced electromagnetic propagation model for Electronic Warfare. 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.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Meteorological and Oceanographic (METOC) Future Mission Capabilities (FMC)	2.475	3.872	4.408	0.000	4.408
Articles:	-	-	-	-	-
FY 2015 Accomplishments: Continued to development of advanced METOC prediction systems and architectures to provide improved forecasts and estimates of product accuracies. Continued the development of improved data fusion and assimilation techniques, data quality control technologies and accelerate the automation of prediction processes using data from tactical sensors, remote sensing and undersea sensor systems. Continued to develop METOC and GI&S fusion algorithms and demonstration of capabilities. Developed METOC Decision Support & Prediction Tools to improve Electromagnetic and Electro-optical (EM/EO) systems performance.					
FY 2016 Plans: Continue development of advanced METOC prediction systems and architectures to provide improved forecasts and estimates of product accuracies. Continue development of improved data fusion and assimilation techniques, data quality control technologies and accelerate the automation of prediction processes using data from tactical sensors, remote sensing and undersea sensor systems. Continue to develop METOC fusion algorithms and demonstrate capabilities. Continue to develop METOC Decision Support & Prediction Tools to					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>improve EM/EO system performance. Accelerate the development of the higher resolution global and small scale ocean forecasting systems with 4 dimensional variational data assimilation. Develop and demonstrate a tropospheric environmental modeling capability to support long range EM propagation (in FY17 this effort moved to R2A Chief of Naval Operations Speed to Fleet Initiative).</p> <p>FY 2017 Base Plans: Development of advanced METOC prediction systems and architectures to provide improved forecasts and estimates of product accuracies. Continue development of improved data fusion and assimilation techniques, data quality control technologies and accelerate the automation of prediction processes using data from tactical sensors, remote sensing and undersea sensor systems. Develop METOC and GI&S fusion algorithms and demonstrate capabilities. Develop METOC Decision Support & Prediction Tools to improve Electromagnetic and Electro-optical (EM/EO) systems performance. Accelerate the development of the higher resolution global and small scale ocean forecasting systems with four-dimensional variation (4DVAR) data assimilation.</p> <p>FY 2017 OCO Plans: N/A</p>					
<p>Title: Meteorological and Oceanographic (METOC) Space-Based Sensing Capabilities</p> <p align="right">Articles:</p> <p>FY 2015 Accomplishments: Prepared to ingest data from earth observing satellite systems, specifically Sentinel launches. Began research and development of data processing and data assimilation algorithms for the Geostationary Operational Environmental Satellite R-Series (GOES-R) launch.</p> <p>FY 2016 Plans: Preparation to ingest data from earth observing satellite systems, Geostationary Operational Environmental Satellite R-Series (GOES-R), and Global Change Observation Mission (GCOM) W-2 sensors. Begin research and development of data processing and data assimilation algorithms for the Joint Polar Satellite System-1 (JPSS-1), GOES-S, Earthcare, and OceanSat-3 launches scheduled in FY2017.</p> <p>FY 2017 Base Plans: Continue performance assessment on National Polar-orbiting Operational Environmental Satellite System Preparatory Project (NPP) and Defense Meteorological Satellite Program (DMSP) satellite sensor suites. Furthering assessment of planned Joint Polar Satellite System (JPSS) sensors and assessment of other national, commercial, and foreign earth observing satellite system's sensor data for use in Navy Atmospheric</p>	0.642	2.278	3.544	0.000	3.544
	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy			Date: February 2016		
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)					
and Oceanographic Prediction Models. Develop performance assessment of planned national earth observing satellite system's sensor data Sentinel 3a and 3b launch for use in Navy Atmospheric and Oceanographic Prediction Models. Develop assessment of planned environmental satellite sensor launches such as Geostationary Operational Environmental Satellite R-Series (GOES-R) and Global Change Observation Mission (GCOM) W-2 scheduled in FY16.					
FY 2017 OCO Plans: N/A					
Title: Tactical Oceanographic Capabilities (TOC) / Undersea Warfare (USW)					
FY 2015 Accomplishments: Continued to develop the underlying acoustic and environmental software components of Navy decision tools that assist Undersea Warfare (USW) warfighters to optimally deploy assets equipped with acoustic sensors and to take advantage of prevailing environmental conditions. Verify/Verified, validated and transitioned this software technology through the Oceanographic and Atmospheric Master Library (OAML). Continued population/upgrade of oceanographic, acoustic and geoacoustic databases in Combatant Commanders' (COCOM) areas of interest. Continued developing Maritime Patrol Aircraft and submarine-based TTS technologies to collect and transmit environmental data for use by NAVOCEANO to predict ASW sensor performance. Transitioned software algorithms that capture and communicate variability and uncertainty contained in the output of underlying model and data base components of ASW TDAs. Continued to develop and transition the environmental software components of MIW TDAs in use by the U.S. Navy's MIW Forces and Naval NOe personnel supporting them. Provided technical support to the NAVOCEANO in updating geoacoustic bottom loss & scatter data bases for sonar performance predictions. Continued to design and develop a geospatially-enabled global ocean observing system database through the Ocean Observing System (OOS) designed to characterize national and international ocean observatories locations, sensor grid capabilities and mitigations to address potential U.S. submarine security vulnerabilities. Conducted additional proof-of-concept at-sea demonstration of emerging Unmanned Undersea Vehicle (UUV) and Unmanned Surface Vehicle (USV) technologies designed to collect environmental data based on feedback received on FY14 at-sea demonstration results.					
FY 2016 Plans: Continue to develop the underlying acoustic and environmental software components of Navy decision tools that assist Undersea Warfare (USW) warfighters to optimally deploy assets equipped with acoustic sensors and to take advantage of prevailing environmental conditions. Verify, validate and transition this software					
	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
	1.774	2.018	2.393	0.000	2.393
	Articles:	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>technology through the Oceanographic and Atmospheric Master Library (OAML). Continue population/upgrade of oceanographic, acoustic and geoacoustic databases in COCOM areas of interest. Complete development of Maritime Patrol & Reconnaissance Aircraft (MPRA) and submarine-based Through-the-Sensor (TTS) technologies to collect and transmit environmental data for use by Naval Oceanographic Office (NAVOCEANO) to predict Anti-Submarine Warfare (ASW) sensor performance. Transition, to include Reachback Cells (RBCs), software algorithms that capture and communicate variability and uncertainty contained in the output of underlying model and data base components of ASW Tactical Decision Aids (TDAs). Restart efforts to increase access speed of acoustic surface scattering and loss modules for ASW applications. Continue to develop and transition the environmental software components of Mine Warfare (MIW) TDAs in use by the U.S. Navy's MIW Forces and Naval Oceanography enterprise (NOe) personnel supporting them. Complete development and transition of a global observing database designed through the Ocean Observing System to characterize national and international ocean observatory locations, sensor grid capabilities and mitigations to address potential U.S. submarine security vulnerabilities.</p> <p>FY 2017 Base Plans:</p> <ul style="list-style-type: none"> - Furthering to develop the underlying acoustic and environmental software components of Navy decision tools that assist Undersea Warfare (USW) warfighters to optimally deploy assets equipped with acoustic sensors and to take advantage of prevailing environmental conditions. Verified, validated and transitioned this software technology through the Oceanographic and Atmospheric Master Library (OAML). - Furthering to refine and validate USW-related performance surface and decision support software applications for use afloat and at ASW RBCs to determine appropriate tactical Courses of Action (COAs) in ASW. - Furthering population/upgrade of oceanographic, acoustic and geo-acoustic databases in COCOM areas of interest. Began developing Maritime Patrol & Reconnaissance Aircraft (MPRA) and submarine-based Through-the-Sensor (TTS) technologies to collect and transmit environmental data for use by Naval Oceanographic Office (NAVOCEANO) to predict Anti- Submarine Warfare (ASW) sensor performance. - Transition software algorithms that capture and communicate variability and uncertainty contained in the output of underlying model and database components of ASW Tactical Decision Aids (TDAs). - Expand capabilities and increased access speed of acoustic surface scattering and loss modules. - Furthering development of software-based methodologies that characterize and forecast bio-acoustic volume attenuation and scatter functions as observed by the Navy's active hull-mounted sonar systems. - Furthering to develop and transition the environmental software components of Mine Warfare (MIW) TDAs in use by the U.S. Navy's MIW Forces and Naval Oceanography enterprise (NOe) personnel supporting them. Provided technical support to the NAVOCEANO in updating geo-acoustic bottom loss & scatter data bases for 					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>sonar performance predictions. Began to design, develop, demonstrate and transition a geospatially-enabled global ocean observing system database through the Ocean Observing System (OOS) designed to characterize national and international ocean observatories locations, sensor grid capabilities and mitigations to address potential U.S. submarine security vulnerabilities.</p> <ul style="list-style-type: none"> - Conduct proof-of-concept at-sea demonstrations of emerging Unmanned Undersea Vehicle (UUV) and Unmanned Surface Vehicle (USV) technologies designed to collect environmental data. - Restart efforts to increase access speed of acoustic surface scattering and loss modules for ASW applications. <p>Continue to develop and transition the environmental software components of Mine Warfare (MIW) TDAs in use by the U.S. Navy's MIW Forces and Naval Oceanography enterprise (NOe) personnel supporting them. Conduct additional proof-of-concept at-sea demonstrations of emerging Unmanned Undersea Vehicle (UUV) and Unmanned Surface Vehicle (USV) technologies designed to collect environmental data based on feedback received on FY14 at-sea demonstration results.</p> <p>FY 2017 OCO Plans: N/A</p>					
<p>Title: Chief of Naval Operations Speed to Fleet Initiative</p> <p align="right">Articles:</p> <p>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 is a two year effort that 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).</p> <p>FY 2015 Accomplishments: N/A</p> <p>FY 2016 Plans: N/A</p> <p>FY 2017 Base Plans: Initiate two-year effort to quickly transition new Advanced Propagation Model (APM) capability to the U.S. Fleet.</p> <p>FY 2017 OCO Plans:</p>	0.000	0.000	1.058	0.000	1.058
	-	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
N/A					
<p>Title: Earth System Prediction Capability (ESPC)</p> <p align="right">Articles:</p> <p>Description: Funding increased from FY 2016 to FY 2017 due to an increased effort to develop an extended range, probabilistic ensemble from the deterministic prototype system completed in 2016. This increase will be applied to an ensemble by design effort that is needed to extend decision support guidance to longer lead times required for transit route optimization, global military logistics, and exercise and contingency operational planning and response.</p> <p>FY 2015 Accomplishments:</p> <ul style="list-style-type: none"> - Continued to develop a greatly more efficient computational architecture to allow for real-time operational prediction. - Continued science workshops and benchmark testing. - Continued efforts towards advanced skillful environmental forecasts and decision guidance (relative to averaged climatology) to improve from the operational capability, currently 7-10 days, to 30 days and longer. - Continued the Navy component to the National R&D initiative for Environmental Prediction across the major U.S. National Operational Prediction Centers at Navy, NOAA, NASA, and DOE. - Completed a National common environmental computing architecture to improve cross-Agency collaboration. - Completed common environmental model architecture and standards and prediction demonstration plans. - Initiated improved scalability and computational performance of a fully coupled global atmosphere / wave / ocean / land / ice prediction system providing daily predictions out to 10 days and weekly predictions out to 30 days. - Initiated improved DoD decision support for 30-180 Day lead times. <p>FY 2016 Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY2015, less those noted as complete. - Continue science workshops and benchmark testing. - Continue efforts towards advanced skillful environmental forecasts and decision guidance (relative to averaged climatology) to improve from the operational capability, currently 7-10 days, to 30 days and longer. - Continue the Navy component to the National R&D initiative for Environmental Prediction across the major U.S. National Operational Prediction Centers at Navy, NOAA, NASA, NSF and DOE. 	7.999	8.192	8.762	0.000	8.762
	-	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<ul style="list-style-type: none"> - Continue improved scalability and computational performance of a fully coupled global atmosphere / wave / ocean / land / sea ice prediction system providing daily predictions out to 16 days and weekly predictions out to 30-90 days. - Continue improved DoD decision support for 30-180 Day lead times. - Complete development of a greatly more efficient computational architecture to allow for real-time operational prediction. - Initiate high resolution and high fidelity Regional Arctic Prediction System development for improved decision support to maritime operations for 0-7 days as well as monthly and seasonal outlooks. - Initiate improvements to automated ship routing guidance for safety and energy efficiency at 0-7 day lead times. <p>FY 2017 Base Plans:</p> <ul style="list-style-type: none"> - Continue all efforts from FY2016, less those noted as complete. - Continue science workshops and benchmark testing. - Continue efforts towards advanced skillful environmental forecasts and decision guidance (relative to averaged climatology) to improve from the operational capability, currently 7-10 days, to 45 days and longer. - Continue to develop the Navy component to the National R&D initiative for Environmental Prediction across the major U.S. National Operational Prediction Centers at Navy, NOAA, NASA, NSF and DOE. - Continue improved scalability and computational performance of a fully coupled global atmosphere / wave / ocean / land /sea ice prediction system providing daily predictions out to 16 days and weekly predictions out to 30-90 days. - Continue improved DoD decision support for 30-180 Day lead times. - Continue high resolution and high fidelity Regional Arctic Prediction System development for improved decision support to maritime operations for 0-7 days as well as monthly and seasonal outlooks. - Complete initial prototype system, with data cycling and post-model processing for pre-operations evaluation. - Initiate an Ensemble by design coupled global ocean-atmospheric system for probabilities and risk assessments at longer lead times based on the Navy ESPC deterministic architecture. - Initiate advanced improvements to automated ship routing guidance for safety and energy efficiency from a 7 day maximum to a 14 day maximum lead time. <p>FY 2017 OCO Plans: N/A</p>					
Accomplishments/Planned Programs Subtotals	12.890	16.360	20.165	0.000	20.165

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C. Other Program Funding Summary (\$ in Millions)

Line Item	FY 2015	FY 2016	FY 2017	FY 2017	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	Cost To	
			Base	OCO	Total					Complete	Total Cost
• RD TEN/0604218N/2345: <i>FLEET METOC EQUIPMENT</i>	1.200	3.379	0.354	-	0.354	0.491	0.480	0.458	0.467	Continuing	Continuing
• RD TEN/0603207N/2341: <i>METOC DATA ACQUISITION</i>	2.487	3.763	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing
• RD TEN/0604218N/2346: <i>METOC SENSOR ENGINEERING</i>	0.926	1.136	0.000	-	0.000	0.000	9.933	0.000	0.000	Continuing	Continuing
• RD TEN/0305160N/0524: NAVY <i>METOC SUPPORT (SPACE)</i>	0.356	0.599	0.000	-	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

Remarks

D. Acquisition Strategy

Acquisition, management and contracting strategies to support the Meteorological & Oceanography (METOC) Data Assimilation Project which is a multi-faceted program which includes: 1) development, demonstration and validation of software associated with atmospheric and oceanographic data assimilation forecast models and database management systems for use in both mainframe and tactical scale computers; 2) other software models, which focus on ocean thermal structure and circulation, and surf and tide prediction; 3) software to process and manage satellite remotely-sensed environmental data at Oceanography Centers ashore and on ships equipped with the AN/SMQ-11 satellite receiver/recorder; and, 4) a family of acoustic system performance models beginning with active system models and databases in the low-, mid-, and high-frequency regimes and culminating with high fidelity simulation products. Acquisition, management and contracting strategies to support the Navy Earth System Prediction Capability Project, a multi-faceted program which includes: 1) development, demonstration and validation of atmospheric, sea ice and oceanographic data assimilation techniques, forecast models, database management systems, and associated software for use in teraflop to petaflop scale computers; 2) other models, which focus on decision products and quantifying thresholds, forecast uncertainty, and risk for Navy and DoD resource and mission planning using non-Navy models as input; 3) techniques to improve computational and data dissemination efficiency for environmental information dominance. Space based Meteorology and Oceanography (METOC) requirements: particular sensors or data sources with unique naval service mission needs are targeted to accelerate acquisition or ensure threshold accomplishment of Joint or converged national program plans. The Joint Polar Satellite System (JPSS) program will collect global microwave radiometry and sounding data to produce microwave imagery and other meteorological and oceanographic data. Conical Microwave Imager Sounder (CMIS) can be viewed as the follow-on instrument to the Special Sensor Microwave (SSM) instruments Navy developed for the Defense Meteorological Satellite Program. These CMIS sensors will be acquired as part of the JPSS architecture which supports these Navy requirements in the future. Maintenance of rigorous sensor calibration and data validation for operational SSM instruments continues along with algorithm development in support of fleet applications. The Advanced Altimeter technologies will improve radar altimeter resolution and aerial coverage to support Navy requirements for sea surface topography measurement in the littorals.

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.

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<p>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.</p> <p>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 skill levels comparable to any international peer competitor for 0-30 day global operational planning.</p> <p>Metrics: Long term trends show a globally averaged gain of skill of 1 day per decade of RDT&E investment, i.e. today's 5-day forecast is as accurate as the 3-day forecast available in the early 1990's. This program will implement new technological approaches to improve 7-14 day predictions to the level of current 5-7 day forecasts and will seek to provide quantifiable skill above long term seasonal averages for 14-90 day lead times for mission planning.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)						Project (Number/Name)					
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications						2342 / METOC Data Assimilation and Mod					
Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
METOC Future Mission Capabilities	WR	NRL : Washington DC	119.107	2.298	Nov 2014	2.926	Nov 2015	3.626	Nov 2016	-		3.626	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	11.627	0.642	Nov 2014	2.278	Nov 2015	2.545	Nov 2016	-		2.545	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	WR	NRL : Washington, DC	7.288	0.529	Nov 2014	0.523	Nov 2015	1.140	Nov 2016	-		1.140	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	University of Texas : TX	0.800	0.208	Apr 2015	0.155	Apr 2016	0.000		-		0.000	0.000	1.163	-
Tactical Oceanography Capabilities / Undersea Warfare	WR	NSWC Carderock : West Bethesda, MD	1.635	0.005	Nov 2014	0.000		0.450	Nov 2016	-		0.450	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	0.630	0.050	Dec 2014	0.050	Dec 2015	0.120	Dec 2016	-		0.120	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Johns Hopkins University : MD	0.310	0.000		0.030	Dec 2015	0.091	Dec 2016	-		0.091	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC/QNA : Various	1.490	0.115	Jan 2015	0.000		0.354	Nov 2016	-		0.354	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC/QNA : Various	1.575	0.149	Feb 2015	0.758	Jan 2016	0.614	Dec 2016	-		0.614	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Penn State University : Pennsylvania	0.000	0.050	Dec 2014	0.075	Dec 2015	0.000		-		0.000	0.000	0.125	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)					Project (Number/Name)						
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications					2342 / METOC Data Assimilation and Mod						
Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Tactical Oceanography Capabilities / Undersea Warfare	WR	SSC LANT : North Charleston	0.000	0.025	Nov 2014	0.025	Nov 2015	0.000		-		0.000	0.000	0.050	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SPA : Virginia	0.000	0.175	Dec 2014	0.200	Dec 2015	0.000		-		0.000	0.000	0.375	-
METOC SUPPORT SPACE-SOFTWARE DEVELOPMENT	WR	NRL : WASHINGTON DC	0.000	0.000		0.000		0.515	Nov 2016	-		0.515	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	METRON : Virginia	0.000	0.000		0.385	Dec 2015	0.000		-		0.000	0.000	0.385	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Vencore : Virginia	0.000	0.000		0.239	Nov 2015	0.000		-		0.000	0.000	0.239	-
Earth Systems Prediction Capability (ONR)	WR	NRL : Washington DC	5.883	5.000	Oct 2014	5.000	Oct 2015	7.431	Nov 2016	-		7.431	Continuing	Continuing	Continuing
ESPC	Various	Various : Various	1.365	1.949	Oct 2014	2.692	Oct 2015	1.661	Nov 2016	-		1.661	Continuing	Continuing	Continuing
CHIEF OF NAVAL OPERATIONS SPEED TO FLEET INITIATIVE	WR	NRL : WASHINGTON DC	0.000	0.000		0.000		0.850	Nov 2016	-		0.850	1.130	1.980	-
Subtotal			198.327	11.195		15.336		19.397		-		19.397	-	-	-
Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	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	-
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	C/FP	SAIC : Virginia	0.473	0.000		0.000		0.000		-		0.000	0.000	0.473	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications				2342 / METOC Data Assimilation and Mod							
Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC : Virginia	0.000	0.461	Feb 2015	0.173	Feb 2016	0.000		-		0.000	0.000	0.634	-
METOC Future Mission Capabilities	C/FP	SAIC : VIRGINIA	0.000	0.000		0.000		0.115	Nov 2016	-		0.115	Continuing	Continuing	Continuing
METOC SUPPORT SPACE-PROGRAM SUPPORT	WR	SSC PACIFIC : SAN DIEGO, CA	0.000	0.000		0.000		0.090	Nov 2016	-		0.090	Continuing	Continuing	Continuing
Program Support and Subject Matter Expertise	Various	UW-APL : Seattle, WA	0.200	1.050	Oct 2014	0.500	Oct 2015	0.000		-		0.000	0.000	1.750	-
Subtotal			1.468	1.511		0.673		0.205		-		0.205	-	-	-
Management Services (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	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	-
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	0.825	0.156	Nov 2014	0.163	Nov 2015	0.171	Nov 2016	-		0.171	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	PSS/BAH : San Diego, CA	0.000	0.028	Dec 2014	0.188	Dec 2015	0.000		-		0.000	0.000	0.216	-
METOC Space-Based Sensing Capabilities	C/FP	BAH : VIRGINIA	0.000	0.000		0.000		0.142	Nov 2016	-		0.142	Continuing	Continuing	Continuing
METOC Space-Based Sensing Capabilities	WR	SSC PAC : SAN DIEGO, CA	0.000	0.000		0.000		0.213	Nov 2016	-		0.213	Continuing	Continuing	Continuing
METOC Acquisition Management	C/CPFF	PSS/BAH : SAN DIEGO, CA	0.000	0.000		0.000		0.037	Nov 2016	-		0.037	Continuing	Continuing	Continuing
Subtotal			2.265	0.184		0.351		0.563		-		0.563	-	-	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy								Date: February 2016					
Appropriation/Budget Activity 1319 / 4				R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>					
	Prior Years	FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	202.060	12.890		16.360		20.165		-		20.165	-	-	-

Remarks

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>
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METOC Future Mission Capabilities (FMC)	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
METOC FMC																												
Data Assimilation Into Coupled Prediction Systems																												
Develop Oceanographic and Atmospheric Forecast Models																												
Oceanographic and Atmospheric Forecast Model Data Assimilation																												
Decision Support & Performance Prediction Tools																												
Accelerate Development of Ocean Forecast Systems																												
Develop/Demonstrate a Tropospheric Modeling Capability																												

2017OSD - 0603207N - 2342

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>
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METOC Space-Based Sensing Capabilities	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021							
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q				
NPP/JPSS Dev. NPP/JPSS Data Algorithms																																
GOES Dev. GOES Algorithms					GOES-R Launch																											
GCOM Dev. GCOM																																
Sentinel Dev. Sentinel Data Algorithms																																
EarthCare Dev. EarthCARE Data Algorithms																																
Cosmic DEV Cosmic Data Algorithms																																
METEOSAT DEV METEOSAT Data Algorithms																																
METOP DEV METOP Data Algorithms																																
Jason Dev Jason Algorithm																																
GEO-KOMPISA DEV GEO-KOMPSAT Data Algorithms																																
DMSP DEV DMSP Data Algorithms																																
INSAT DEV INST Data Algorithms																																
OceanSat Dev. OceanSat Data Algorithms																																

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

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
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Tactical Oceanographic Capabilities (TOC) / Undersea Warfare (USW)	FY 2015				FY 2016				FY 2017	FY 2018	FY 2019	FY 2020	FY 2021			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Asset Allocation & Mission Planning																
ASW RBC Delivery																
ASW RBC Delivery								ASW RBC Delivery ▲								
Acoustic Model Upgrades																
CASS/ASPM/NSPE Upgrades																
CASS/ASPM/NSPE Upgrades								CASS/ASPM/NSPE Upgrade ▲								
Descriptive Dynamic Oceanography Assessment Tool																
NEXGen ASW RBC GIS Toolset																
STAPLE Upgrades																
STAPLE Delivery 9				STAPLE Delivery 9 ▲												
STAPLE Delivery 10								STAPLE Delivery 10 ▲								
Bioacoustic Volume Attenuation and Scatter Efforts																
Documentation Delivery																
Documentation Delivery								Documentation Delivery ▲								
SME Support to NAVOCEANO Bottom Loss Database Upgrades																
HFBL Horizontal Variability 1																
HFBL Horizontal Variability 1																
SUS Replacement Technology																
SUS Replacement Technology																
HFBL Horizontal Variability 2								HFBL Horizontal Variability 2 ▲								
MIW TDA Support																
TODS Components 3																
TODS Components 3																
NEXGEN MIW				NEXGEN MIW ▲												
NEXGEN MIW																
EPMA-NSMA Integration								EPMA-NSMA Integration ▲								
EPMA-NSMA Integration																
Ocean Observing System Security Group Database																

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>
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Navy METOC Support (SPACE)	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Navy METOC Support (SPACE): Schedule Detail	<div style="border: 1px solid black; width: 100%; height: 100%;"></div>																											

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
METOC Future Mission Capabilities (FMC)				
METOC FMC: Data Assimilation Into Coupled Prediction Systems:	1	2015	4	2020
METOC FMC: Develop Oceanographic and Atmospheric Forecast Models:	1	2015	4	2020
METOC FMC: Oceanographic and Atmospheric Forecast Model Data Assimilation:	1	2015	4	2017
METOC FMC: Decision Support & Performance Prediction Tools:	1	2015	4	2020
METOC FMC: Accelerate Development of Ocean Forecast Systems:	1	2016	4	2018
METOC FMC: Develop/Demonstrate a Tropospheric Modeling Capability:	1	2016	4	2016
METOC Space-Based Sensing Capabilities				
NPP/JPSS: Dev. NPP/JPSS Data Algorithms: FY16-FY20	1	2016	4	2020
NPP/JPSS: Dev. NPP/JPSS Data Algorithms: JPSS-1 Launch	3	2017	3	2017
GOES: Dev. GOES Algorithms: GOES-R Launch	1	2016	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	2016	1	2020
GCOM: Dev. GCOM: GCOM-W2 Launch	3	2016	3	2016
GCOM: Dev. GCOM: GCOM-W3 Launch	3	2020	3	2020
Sentinel: Dev. Sentinel Data Algorithms:	1	2015	4	2015
Sentinel: Dev. Sentinel Data Algorithms: Sentinel 3A Launch	3	2015	3	2015
Sentinel: Dev. Sentinel Data Algorithms: Sentinel 3B Launch	3	2015	3	2015
EarthCare: Dev. EarthCARE Data Algorithms: EarthCARE Launch	3	2017	3	2017
EarthCare: Dev. EarthCARE Data Algorithms: Schedule Detail	1	2016	4	2020
Cosmic: DEV Cosmic Data Algorithms: Schedule Detail	1	2016	4	2020

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
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
METOP: DEV METOP Data Algorithms: METOP-C Launch	3	2018	3	2018
Jason: Dev Jason Algorithm: FY16-FY20	1	2016	4	2020
Jason: Dev Jason Algorithm: JASON-CS A Launch	1	2018	1	2018
GEO-KOMPASA: DEV GEO-KOMPSAT Data Algorithms: GEO-KOMPSAT 2A Launch	1	2018	1	2018
GEO-KOMPASA: DEV GEO-KOMPSAT Data Algorithms: GEO-KOMPSAT 2B Launch	4	2018	4	2018
GEO-KOMPASA: 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:	1	2016	4	2016
OceanSat: Dev. OceanSat Data Algorithms: OceanSat 3 Launch	3	2017	3	2017
<i>Tactical Oceanographic Capabilities (TOC) / Undersea Warfare (USW)</i>				
Asset Allocation & Mission Planning:	1	2016	4	2016
Asset Allocation & Mission Planning: ASW RBC Delivery: ASW RBC Delivery	4	2016	4	2016
Asset Allocation & Mission Planning: ASW RBC Delivery: ASW RBC Delivery 2	4	2017	4	2017
Asset Allocation & Mission Planning: ASW RBC Delivery: ASW RBC Delivery 3	4	2018	4	2018
Acoustic Model Upgrades: CASS/ASPM/NSPE Upgrades: CASS/ASPM/NSPE Upgrades	1	2016	1	2016
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

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
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
STAPLE Upgrades:	1	2015	4	2016
STAPLE Upgrades: STAPLE Delivery 9	4	2015	4	2015
STAPLE Upgrades: STAPLE Delivery 10	4	2016	4	2016
STAPLE Upgrades: STAPLE Delivery 11	4	2017	4	2017
STAPLE Upgrades: STAPLE Delivery 12	4	2018	4	2018
STAPLE Upgrades: STAPLE Delivery 13	4	2019	4	2019
STAPLE Upgrades: STAPLE Delivery 14	4	2020	4	2020
STAPLE Upgrades: Bioacoustic Volume Attenuation and Scatter Efforts:	1	2016	4	2016
STAPLE Upgrades: Bioacoustic Volume Attenuation and Scatter Efforts: Documentation Delivery	4	2016	4	2016
SME Support to NAVOCEANO Bottom Loss Database Upgrades:	1	2015	4	2016
SME Support to NAVOCEANO Bottom Loss Database Upgrades: HFBL Horizontal Variability 1	1	2015	1	2015
SME Support to NAVOCEANO Bottom Loss Database Upgrades: HFBL Horizontal Variability 2	4	2016	4	2016
SME Support to NAVOCEANO Bottom Loss Database Upgrades: SUS Replacement Technology	3	2015	3	2015

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
MIW TDA Support:	1	2015	4	2016
MIW TDA Support: EPMA-NSMA Integration	4	2016	4	2016
MIW TDA Support: TODS Components	4	2015	4	2015
MIW TDA Support: NEXGEN MIW Environmental Application	4	2015	4	2015
MIW TDA Support: EPMA-NSMA Integration 2	4	2018	4	2018
MIW TDA Support: EPMA-NSMA Integration 3	4	2019	4	2019
Ocean Observing System Security Group Database:	1	2015	4	2016
Ocean Observing System Security Group Database: OOSSG Database Delivery #1	4	2015	4	2015
Ocean Observing System Security Group Database: OOSSG Database Delivery #2	4	2016	4	2016
Active & Passive Model-Data V&V:	1	2015	4	2016
Active & Passive Model-Data V&V: Active ASW R&A 1	4	2015	4	2015
Active & Passive Model-Data V&V: Active ASW R&A 2	4	2016	4	2016
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:	1	2015	4	2016
Through-the-Sensor Data Collection: P-8A Poseidon Data Collection 2	3	2015	3	2015
Through-the-Sensor Data Collection: P-8A Poseidon Data Collection 3	4	2016	4	2016
Through-the-Sensor Data Collection: SSN Data Collection 2	4	2015	4	2015
Through-the-Sensor Data Collection: SSN Data Collection 3	3	2016	3	2016
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

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy			Date: February 2016	
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2342 / <i>METOC Data Assimilation and Mod</i>		
	Start		End	
Events by Sub Project	Quarter	Year	Quarter	Year
Through-the-Sensor Data Collection: SSN Data Collection 7	4	2020	4	2020
UUV-USV At-Sea Experimentation:	1	2015	4	2015
UUV-USV At-Sea Experimentation: Sea Test 2	3	2015	3	2015
UUV-USV At-Sea Experimentation: Sea Test 3	4	2017	4	2017
<i>Metoc Data Assimilation and Mod Future Mission Capabilities (ESPC)</i>				
ESPC Coupled Data Assimilation into Environmental Prediction:	1	2015	4	2018
ESPC Development Global Coupled Environmental Models:	1	2015	4	2018
ESPC Advanced Computational Architectures: Schedule Detail	1	2015	1	2018
ESPC Demonstrate Extended Range Prediction: Schedule Detail	1	2015	1	2018
Global Coupled Prediction System Development: Schedule Detail	2	2015	3	2018
Operation Implementation and Validation: Schedule Detail	2	2015	4	2019
Coupled Global Ensemble Prediction System: Schedule Detail	2	2015	3	2020
Next Generation Dynamic Cores: Schedule Detail	3	2015	2	2020
Computational Efficiency of Earth System: Schedule Detail	3	2015	2	2020
Advanced Observational Data Analysis and long Range Forecasting (ACAF): Schedule Detail	4	2015	4	2019
Regional Artic Prediction System: Schedule Detail	1	2015	2	2020
National ESPC Interagency Coordinated Development: Schedule Detail	1	2016	4	2020
Global Coupled Data Assimilation: Schedule Detail	1	2017	4	2020
<i>Navy METOC Support (SPACE)</i>				
Navy METOC Support (SPACE): Schedule Detail: Schedule Detail	1	2017	1	2020

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy										Date: February 2016		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 2343 / <i>Tactical METOC Applications</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
2343: <i>Tactical METOC Applications</i>	135.448	8.942	9.260	13.473	-	13.473	15.437	15.261	15.443	15.765	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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 governments 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) METOC Decision Aids (MDAs) and, 2) Operational Effects Decision Aids (OEDAs). MDAs 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 then use the MDA 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, AMW ingress and egress points, and for other warfare considerations. MDAs 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). MDAs and OEDAs also use data obtained through direct interfaces to Navy combat systems. A current emphasis area of the project is cyber secure capabilities 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.

FY 2017 request provides for NITES-Next to finalize the acquisition documentation, award a task order, begin the development efforts and plan for test events for Fleet Capability Release (FCR-3). NITES-Next will begin planning the initial FCR-4 development efforts and contract actions.

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy			Date: February 2016			
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2343 / <i>Tactical METOC Applications</i>				
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)						
		FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Naval Integrated Tactical Environmental System Next Generation (NITES-Next)		8.942	9.260	13.473	0.000	13.473
Articles:		-	-	-	-	-
FY 2015 Accomplishments: Conducted Operational Test Readiness Review (OTRR) with the System Engineering Technical Review (SETR) board, and the Milestone Decision Authority (MDA). Conducted Initial Operational Test and Evaluation (IOT&E) in support of FCR-1 Fielding Decision (FD). Complete Independent Logistics Assessment (ILA) for FCR-1. Obtained Authority to Operate (ATO) for FCR-1. Conducted FCR-1 FD with the MDA and achieved Initial Operational Capability (IOC). Conducted the SETR Build Technical Review (BTR) in support of FCR-2. Conducted the Build Decision (BD) for FCR-2. Continued developing, integrating, and testing FCR-2 software. Began documentation, and preparation (including Requirements Definition Package (RDP), Technology Readiness Assessment (TRA) Addendum 2, Cost Analysis Requirements Description (CARD), Acquisition Strategy (AS), and Acquisition Program Baseline (APB)) for FCR-3. Began planning for contract actions in support of FCR-3. Continued planning contract in support of FCR-3. Planned for SIT and, SQT, UA, and DT&E for FCR-2.						
FY 2016 Plans: NITES-Next will conduct the SIT#1, SIT #2, SQT, UA, and DT&E for FCR-2. Participate in the Consolidated Afloat Network and Enterprise Services (CANES) Application Integration (AI) SIT event. The program will update the Navy Training System Plan (NTSP) and ILA for FCR-2. NITES-Next will continue development, integration, and test for FCR-2 software with follow-on contract. The program will conduct and seek a FCR-2 FD with the MDA. Receive the ATO for FCR-2. The program will plan the FCR-3 development activities. NITES-Next will conduct the Fielding Technical Review (FTR) for FCR-2. Plan and prepare for integration into the Navy Tactical Cloud Reference Implementation (NCRRI).						
FY 2017 Base Plans: NITES-Next will incorporate new, robust Department of Defense (DoD)/Department of Navy (DoN) cybersecurity standards in the design of FCR-3 software and finalize the documentation (including RDP, TRA Addendum 2, CARD, Program Life Cycle Cost Estimate (PLCCE), AS, and APB) for the FCR-3 BD. NITES-Next will award a task order for the development of FCR-3. NITES-Next will prepare for FCR-3 BTR, prepare for FCR-3 BD, and begin to develop FCR-3 software that is anti-tamper proof and releasable to our allies to enhance our interoperability with their information warfare systems. NITES-Next will plan for SIT, SQT, UA, and DT&E for						

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2343 / <i>Tactical METOC Applications</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
FCR-3. Continue integration into the Navy Tactical Cloud Reference Implementation (NTCRI). The program will plan the initial FCR-4 development activities and begin planning for contract actions in support of FCR-4. FY 2017 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	8.942	9.260	13.473	0.000	13.473

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

The Naval Integrated Tactical Environmental System Next Generation (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 NITES-Next program's acquisition and contracting strategies. The DoN's requirements for the 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)).

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

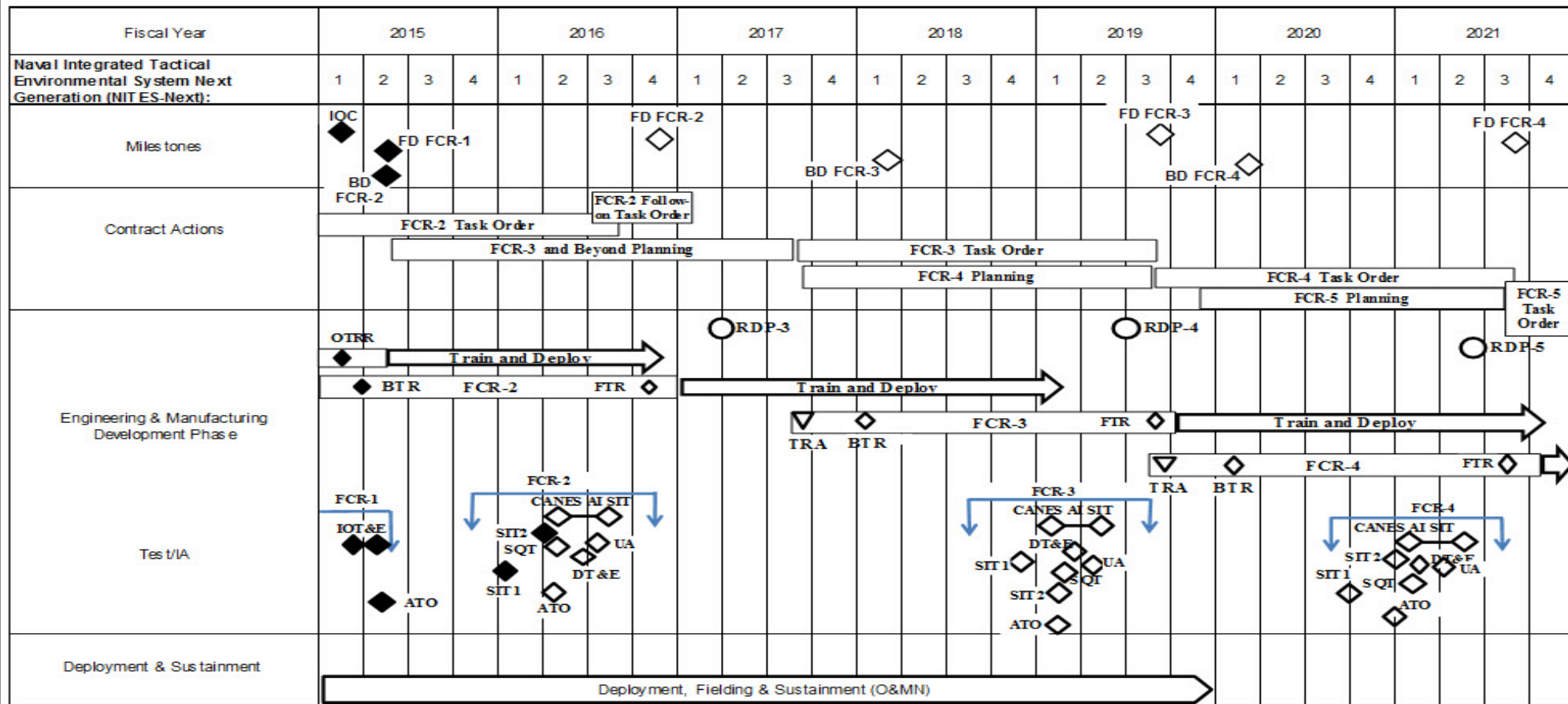
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2343 / <i>Tactical METOC Applications</i>
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Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
NITES/NITES-Next	Various	Various : Various	111.017	0.000		0.000		0.000		-		0.000	0.000	111.017	-
NITES-Next	WR	SSC Pacific : San Diego, CA	12.209	3.818	Jan 2015	1.381	Dec 2015	4.533	Nov 2016	-		4.533	Continuing	Continuing	Continuing
NITES-Next	C/FP	SAIC : Virginia	3.986	1.445	Jan 2015	2.046	Dec 2015	2.472	Dec 2016	-		2.472	Continuing	Continuing	Continuing
NITES-Next	WR	SSC Atlantic : South Carolina	0.200	0.000		0.009	Oct 2015	0.007	Oct 2016	-		0.007	0.000	0.216	-
NITES-Next/ SW	C/FP	GDIT : Virginia	3.000	1.120	Apr 2015	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
NITES-Next	WR	SSC Pac : San Diego, CA	0.000	0.000		2.481	Feb 2016	0.000		-		0.000	Continuing	Continuing	Continuing
NITES-Next / Eng	C/IDIQ	Unknown : Unknown	0.000	0.000		1.500	Mar 2016	0.000		-		0.000	0.000	1.500	-
NITES-Next / Engineering	C/IDIQ	Unknown : Unknown	0.000	0.000		0.150	Jul 2016	4.500	Jan 2017	-		4.500	0.000	4.650	-
NITES-Next/SW	C/IDIQ	Unknown : Unknown	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
NITES-Next	C/BA	PS&E : Washington	0.000	0.207	Jan 2015	0.000		0.000		-		0.000	0.000	0.207	-
NITES-Next	C/BA	COTF : Virginia	0.000	0.121	Nov 2014	0.000		0.000		-		0.000	0.000	0.121	-
Subtotal			130.412	6.711		7.567		11.512		-		11.512	-	-	-

Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Support Cost	C/CPIF	IPD : Various	0.595	0.000		0.000		0.000		-		0.000	0.000	0.595	-
NITES-Next	C/FP	SAIC : Virginia	2.735	1.530	Jan 2015	0.984	Dec 2015	1.191	Nov 2016	-		1.191	Continuing	Continuing	Continuing
NITES-Next	C/FP	NAVAIR : Maryland	0.125	0.000		0.000		0.000		-		0.000	0.000	0.125	-
Subtotal			3.455	1.530		0.984		1.191		-		1.191	-	-	-

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Exhibit R-4, RDT&E Schedule Profile: PB 2017 Navy	Date: February 2016
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 = Operational Test Readiness Review. RDP = Requirements Definition Package. FCR = Fleet Capability Release. TRA = Technology Readiness Assessment. BD = Build Decision. FD = Fielding Decision. LFD = Limited Fielding Decision. IOC = Initial Operational Capability. IATO = Interim Authority to Operate. ATO = Authority to Operate. UA = User Assessment. BTR = Build Technical Review. Field Technical Review = 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.

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2343 / <i>Tactical METOC Applications</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Naval Integrated Tactical Environmental System Next Generation (NITES-Next)</i>				
Milestones: Build Decision Fleet Capability Release - 2	2	2015	2	2015
Milestones: Initial Operational Capability	1	2015	1	2015
Milestones: Fielding Decision Fleet Capability Release - 1	2	2015	2	2015
Milestones: Build Decision Fleet Capability Release - 3	1	2018	1	2018
Milestones: Fielding Decision Fleet Capability Release - 2	4	2016	4	2016
Milestones: Build Decision Fleet Capability Release - 4	1	2020	1	2020
Milestones: Fielding Decision Fleet Capability Release - 3	3	2019	3	2019
Milestones: Fielding Decision Fleet Capability Release - 4	3	2021	3	2021
Contract Actions: FCR-2 Task Order	1	2015	3	2016
Contract Actions: FCR-3 Task Order	3	2017	3	2019
Contract Actions: FCR-3-Beyond Planning	2	2015	3	2017
Contract Actions: FCR-4 Task Order	3	2019	3	2021
Contract Actions: FCR-4 Planning	3	2017	3	2019
Contract Actions: FCR-5 Planning	4	2019	3	2021
Contract Actions: FCR-5 Task Order	3	2021	4	2021
Engineering & Manufacturing Development Phase: Fleet Capability Release - 1 / Train and Deploy	1	2015	4	2016
Engineering & Manufacturing Development Phase: Fleet Capability Release - 2 / Train Deploy	1	2015	1	2019
Engineering & Manufacturing Development Phase: Fleet Capability Release - 3 / Train Deploy	3	2017	4	2021

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy			Date: February 2016	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)	Project (Number/Name)		
1319 / 4	PE 0603207N / <i>Air/Ocean Tactical Applications</i>	2343 / <i>Tactical METOC Applications</i>		
Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Engineering & Manufacturing Development Phase: Fleet Capability Release - 4 / Train and Deploy	3	2019	4	2021
Engineering & Manufacturing Development Phase: Requirements Definition Package - 3	2	2017	2	2017
Engineering & Manufacturing Development Phase: Requirements Definition Package - 4	3	2019	3	2019
Engineering & Manufacturing Development Phase: Requirements Definition Package - 5	2	2021	2	2021
Engineering & Manufacturing Development Phase: Build Technical Review FCR-2	1	2015	1	2015
Engineering & Manufacturing Development Phase: Build Technical Review FCR-3	1	2018	1	2018
Engineering & Manufacturing Development Phase: Build Technical Review FCR-4	1	2020	1	2020
Engineering & Manufacturing Development Phase: Technology Readiness Assessment - 3	3	2017	3	2017
Engineering & Manufacturing Development Phase: Technology Readiness Assessment - 4	3	2019	3	2019
Engineering & Manufacturing Development Phase: Field Technical Review FCR-2	4	2016	4	2016
Engineering & Manufacturing Development Phase: Field Technical Review FCR-3	3	2019	3	2019
Engineering & Manufacturing Development Phase: Field Technical Review FCR-4	3	2021	3	2021
Engineering & Manufacturing Development Phase: Operational Test Readiness Review FCR-1	1	2015	1	2015
Test/IA: Fleet Capability Release - 1	1	2015	2	2015
Test/IA: Fleet Capability Release - 2	4	2015	4	2016
Test/IA: Fleet Capability Release - 3	3	2018	3	2019
Test/IA: Fleet Capability Release - 4	3	2020	3	2021
Test/IA: System Integration Test - 1 (FCR-2)	1	2016	1	2016
Test/IA: System Integration Test - 2 (FCR-2)	2	2016	2	2016
Test/IA: System Integration Test - 1 (FCR-3)	4	2018	4	2018

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2343 / <i>Tactical METOC Applications</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Test/IA: System Integration Test - 2 (FCR-3)	1	2019	1	2019
Test/IA: System Integration Test - 1 (FCR-4)	3	2020	3	2020
Test/IA: System Integration Test - 2 (FCR4)	1	2021	1	2021
Test/IA: Initial Operational Test and Evaluation 1	1	2015	1	2015
Test/IA: Initial Operational Test and Evaluation 2	2	2015	2	2015
Test/IA: Authority to Operate FCR-1	2	2015	2	2015
Test/IA: Authority to Operate FCR-2	2	2016	2	2016
Test/IA: Authority to Operate FCR-3	1	2019	1	2019
Test/IA: Authority to Operate FCR-4	1	2021	1	2021
Test/IA: System Qualification Test FCR-2	2	2016	2	2016
Test/IA: System Qualification Test FCR-3	1	2019	1	2019
Test/IA: System Qualification Test FCR-4	1	2021	1	2021
Test/IA: Developmental Test Fleet Capability Release - FCR-2	2	2016	2	2016
Test/IA: Developmental Test Fleet Capability Release - FCR-3	1	2019	1	2019
Test/IA: Developmental Test Fleet Capability Release - FCR-4	1	2021	1	2021
Test/IA: User Assessment FCR-2	3	2016	3	2016
Test/IA: User Assessment FCR-3	2	2019	2	2019
Test/IA: User Assessment FCR-4	2	2021	2	2021
Test/IA: CANES AI SIT FCR-2	2	2016	3	2016
Test/IA: CANES AI SIT FCR-3	1	2019	2	2019
Test/IA: CANES AI SIT FCR-4	1	2021	2	2021
Test/IA: Deployment and Sustainment: Deployment, fielding and Sustainment (OMN)	1	2015	4	2019

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy										Date: February 2016		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 2344. / <i>Precise Time and Astrometry</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
2344.: <i>Precise Time and Astrometry</i>	6.825	8.217	4.977	5.636	-	5.636	5.229	4.745	0.313	0.319	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 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 (CJCSI 6130.01D, encl J, of 13 Apr 2007), 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. The Navy is also responsible for providing astronomical data for military and NTM navigation, positioning, and guidance capabilities that are space-based.

The PTA research and development efforts are focused on several areas relating to timing and time transfer: (1) Development of Rubidium Fountain Atomic Clocks and development of improved GPS Timing Receivers in order to meet the precise timing requirements for the GPS III system; (2) Research & development of the capability of distributing timing signals via Optical fiber lines, as an alternative and backup to GPS time distribution; and (3) Research & development into Optical Clock technology, which is expected to be required for future DoD systems. The PTA research and development effort is also focused on the following areas related to Earth Orientation Parameter (EOP) determination: (1) Upgrade of the Very Long Baseline Interferometry (VLBI) data acquisition system / radio telescope at Kokee Park HI; (2) Development of a Software (SW) Correlator for processing of VLBI data, necessary for the generation of Earth Orientation Parameter (EOP) data; (3) Development of the capability for electronic transmission of the VLBI data from remote VLBI sites to the USNO correlator. The new SW Correlator and the eVLBI infrastructure upgrades are necessary in order to support daily updates of EOP data required by GPS III; (4) Development of an automated end-to-end EOP processing system, which combines input from multiple data sets (e.g. VLBI data, GPS orbit data, and laser ranging data, etc.). This process is currently very labor intensive and costly. Automation is necessary to meet future DoD and GPS requirements; and (5) Modifications to the EOP system for compatibility with the new international standard -'VLBI2010'. Starting in FY15, the PTA research and development for astrometry will focus on improvements to the USNO Navy Precision Optical Interferometer (NPOI) at Flagstaff, AZ. It is necessary for maintenance of the Celestial Reference Frame (CRF). Four 1.8m telescopes will be added to the array in order to extend and expand the number of stars in the catalog to fainter stars of 9th magnitude.

The Critical Time Dissemination (CTD) aspect of the PTA program develops enhanced methods of distributing and verifying precise time back to the Master Clock, UTC (USNO). The development aspect of this project has four parts: (1) Development of a mobile time link; (2) Refinement of and modernization of the Hydrogen Maser and

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2344. / <i>Precise Time and Astrometry</i>
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Auxiliary Offset Generator (AOG); (3) Customize a timing system to develop a Site Verification System; and (4) Produce a fiber link system to transfer the Master Clock down long-haul fiber.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>Title: Precise Timing and Astronomy</p> <p align="right">Articles:</p> <p>Description: 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.</p> <p>FY 2015 Accomplishments:</p> <ul style="list-style-type: none"> *Final Operating Capability (FOC) for Rb Fountains at USNO Alternate Master Clock facility *Continue Optical Fiber timing link activities *Continue Critical Time Dissemination Activities *PDR for Earth Orientation Parameter (EOP) Automation *Install Kokee Park radio telescope *Begin Navy Precision Optical Interferometer (NPOI)/1.8m construction activities (relocate roads, install concrete piers, fabricate & install domes, electrical services) <p>FY 2016 Plans:</p> <ul style="list-style-type: none"> *Demo Optical Fiber timing link in fiber network *Lab demonstration of optical clock prototype *Continue Critical Time Dissemination Activities *Continue work on EOP automation *IOC for Kokee Park radio telescope * Continue NPOI/1.8m construction activities (relocate roads, install concrete piers, fabricate & install domes, electrical services) <p>FY 2017 Base Plans:</p> <ul style="list-style-type: none"> *Optical clock prototype Improvements *Continue Critical Time Dissemination Activities *Continue work on EOP automation *Increased NPOI enhancements *Create a control system and procure the adaptive optics *IOC for Kokee Park radio telescope 	8.217	4.977	5.636	0.000	5.636
	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2344. / <i>Precise Time and Astrometry</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
*Continue NPOI/1.8m construction activities (relocate roads, install concrete piers, fabricate & install domes, electrical services) FY 2017 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	8.217	4.977	5.636	0.000	5.636

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 (OPN-funded) 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) Antenna will be installed at Kokee Park, HI.
- (3) Rb Fountain System will reach FOC at AMC in FY17.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)						Project (Number/Name)					
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications						2344. / Precise Time and Astrometry					
Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	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	2.172	Oct 2015	0.482	Mar 2017	0.993	Mar 2017	-		0.993	0.000	3.647	-
Primary Hardware Development (NPOI) 1.8m Telescope (2)	SS/FFP	AZ Embedded System : Not Specified	0.000	0.000		0.200	Oct 2016	0.000		-		0.000	0.000	0.200	-
Ancillary Hardware Development 1	Various	U.S. Naval Observatory : Washington, DC	0.057	0.030	Oct 2015	0.020	Jan 2016	0.120	Oct 2016	-		0.120	0.000	0.227	-
Ancillary Hardware Development 2	Various	U.S. Naval Observatory : Washington, DC	0.057	0.030	Oct 2015	0.020	Oct 2016	0.120	Jan 2017	-		0.120	0.000	0.227	-
Ancillary Hardware Development 3	Various	U.S. Naval Observatory : Washington, DC	0.094	0.030	Apr 2016	0.021	Nov 2016	0.101	Apr 2017	-		0.101	0.000	0.246	-
Ancillary Hardware Development 4	Various	U.S. Naval Observatory : Washington, DC	0.000	0.030	Jan 2015	0.021	Nov 2016	0.100	Jul 2017	-		0.100	0.000	0.151	-
Primary Hardware Development for CTD (System Integration)	C/FP	Classified : Not Specified	1.644	0.600	Dec 2015	0.600	Dec 2015	0.600	Dec 2016	-		0.600	0.000	3.444	-
Primary Hardware Development for CTD (RF Interface)	MIPR	Classified : Not Specified	1.580	1.500	Dec 2015	1.000	Dec 2015	1.000	Dec 2016	-		1.000	0.000	5.080	-
Primary Hardware Development for CTD (Line Interface)	MIPR	Classified : Not Specified	1.775	2.483	Mar 2016	0.963	Mar 2017	1.000	Mar 2017	-		1.000	0.000	6.221	-
Primary Hardware Development for CTD (Reference Upgrade)	C/FFP	Symmetricom : San Jose, CA	0.200	0.200	Jun 2016	0.100	Jun 2017	0.342	Jun 2017	-		0.342	0.000	0.842	-
Two Way Satellite Time Transfer Modernization	TBD	TBD : Not Specified	0.000	0.000		0.000		0.000	Jun 2017	-		0.000	0.000	0.000	-
Subtotal			5.407	7.075		3.427		4.376		-		4.376	0.000	20.285	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications				2344. / Precise Time and Astrometry							
Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	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	0.195	0.152	Oct 2015	0.103	Oct 2016	0.100	Oct 2016	-		0.100	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 2	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.195	0.152	Jan 2016	0.103	Jan 2017	0.100	Jan 2017	-		0.100	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 3	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.195	0.152	Apr 2016	0.103	Apr 2017	0.100	Apr 2017	-		0.100	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 4	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.195	0.152	Jul 2016	0.103	Jul 2017	0.100	Jul 2017	-		0.100	Continuing	Continuing	Continuing
Software Development (EOP Automation)	C/FFP	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.568	0.050	Jun 2016	0.440	Jun 2017	0.356	May 2017	-		0.356	0.000	1.414	-
Travel 1	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.017	0.010	Dec 2015	0.005	Oct 2016	0.005	Oct 2016	-		0.005	0.000	0.037	-
Travel 2	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.017	0.010	Jan 2016	0.005	Jan 2017	0.005	Jan 2017	-		0.005	0.000	0.037	-
Travel 3	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.018	0.010	Apr 2015	0.005	Apr 2016	0.005	Apr 2017	-		0.005	0.000	0.038	-
Travel 4	Allot	U.S. Naval Observatory (Civilian Travel) : Varies	0.018	0.010	Jul 2016	0.005	Jul 2017	0.005	Jul 2017	-		0.005	0.000	0.038	-
VLBI2010 Testing and Integration	MIPR	NASA : GSFC	0.000	0.444	Jan 2016	0.678	Jan 2017	0.484	Jan 2017	-		0.484	0.000	1.606	-

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

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
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Precise Timing and Astronomy (PTA)	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021											
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q								
Master Clock System	Rb IOC M/S C																																			
	OFT Xmsn ▲	Rb IOC AMC ▲							Rb FOC AMC ▲					Rb FOC MC ▲																						
GPS M-Code Receiver	AF OCX CDR																																			
Electronic Very Long Base-Line (eVLBL) / Software Correlator Development	eVLBL Ops																																			
VLBI DAS at Kokee Park																																				
EOP Automation																																				
NPOI 1.8m Telescopes																																				
Two Way Satellite Time Transfer Modernization																																				

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

Appropriation/Budget Activity	R-1 Program Element (Number/Name)	Project (Number/Name)
1319 / 4	PE 0603207N / <i>Air/Ocean Tactical Applications</i>	2344. / <i>Precise Time and Astrometry</i>

				TWSTT												
<p>2017OSD - 0603207N - 2344.L60</p>																

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2344. / <i>Precise Time and Astrometry</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Precise Timing and Astronomy (PTA)</i>				
Master Clock System: Rubidium (Rb) Fountain Initial Operational Capability (IOC) - Milestone C (Master Clock -MC)	1	2015	4	2016
Master Clock System: IOC for Rb Fountain Clocks at Alternate Master Clock (AMC)	2	2015	2	2015
Master Clock System: Rb Full Operational Capability (FOC) - AMC	4	2016	4	2016
Master Clock System: Rb FOC - AMC	2	2016	2	2016
Master Clock System: Optical Fiber Time (OFT) Transmission	1	2015	1	2015
Master Clock System: Fiber Time Transmission (FTT) in Baltimore/DC Area	2	2016	2	2016
Master Clock System: Fiber Time Transmission - Urban Demo	4	2017	4	2017
GPS M-Code Receiver: AF Operational Control Segment (OCX) Project Critical Design Review (CDR)	1	2015	4	2019
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
Electronic Very Long Base-Line (eVLBL) / Software Correlator Development: Wide Band eVBLI Operations Start	1	2015	1	2018
Electronic Very Long Base-Line (eVLBL) / Software Correlator Development: CDR Software COR	1	2015	4	2015
Electronic Very Long Base-Line (eVLBL) / Software Correlator Development: IOC - Software COR	2	2015	2	2015
Electronic Very Long Base-Line (eVLBL) / Software Correlator Development: FOC - SW COR Upgrade	4	2015	4	2015
VLBI DAS at Kokee Park: Design VLBI 2010 System	1	2015	1	2015
VLBI DAS at Kokee Park: Antenna Procurement Contract	1	2015	1	2015
VLBI DAS at Kokee Park: Kokee Park Site Preparation	1	2015	3	2015

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2344. / <i>Precise Time and Astrometry</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
VLBI DAS at Kokee Park: IOC	4	2016	4	2016
VLBI DAS at Kokee Park: FOC	4	2017	4	2017
EOP Automation: Preliminary Design Review (PDR)	1	2015	1	2015
EOP Automation: IOC	2	2017	2	2017
EOP Automation: FOC	3	2018	3	2018
NPOI 1.8m Telescopes: Dome structures and electrical installed	3	2017	3	2017
Two Way Satellite Time Transfer Modernization: Develop TWSTT Modem	1	2016	1	2016

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy										Date: February 2016		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 2363. / <i>Remote Sensing Capability Development</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
2363.: <i>Remote Sensing Capability Development</i>	0.000	4.949	2.479	3.855	-	3.855	1.023	0.988	0.970	0.991	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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 2017 request provides for continued target data collection, enhancements on algorithms and continue to integrate algorithms for access over the network. Remote Sensing Capability Development characterized 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.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Remote Sensing Capability Development	3.967	1.819	3.636	0.000	3.636
Articles:	-	-	-	-	-
FY 2015 Accomplishments: Collected 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. Developed the Requirements Definition Package (RDP). Enhanced software algorithms to automatically detect oceanographic phenomena. Integrated algorithms for access over the network. Enhanced existing toolsets to provide users robust applications to assist in their daily tasks. Initiated development of training to provide the user community education on using the different tools and applications.					
FY 2016 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 enhancements to automatically detect oceanographic phenomena. Conduct algorithm Acceptance Decision. Continue to integrate algorithms for access over the network. Conduct Algorithm Transition Board. Continue evolving development of training to					

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2363. / <i>Remote Sensing Capability Development</i>

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>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. Provide Navy leadership status on emerging capabilities.</p> <p>FY 2017 Base Plans: Develop data collection strategy and collections process. Continue data collection in various weather and sea states to broaden the range of environmental conditions and reduce uncertainty in environmental prediction. Conduct software algorithm performance analysis. Continue software algorithm enhancements to automatically detect oceanographic phenomena and modifications to support transition to a new architecture. Develop and implement the algorithm performance assessment strategy and test and evaluation plans. Document software algorithm test reports. Conduct algorithm Acceptance Decision. Continue to integrate algorithms for access over the network. Conduct algorithm Fielding Decision. Continue development of training to provide the user community education on using the different tools and applications. Coordinate TCPED process amongst inter-agencies to support Navy Missions. Provide Navy leadership status on emerging capabilities. Award contract for Development and Integration efforts.</p> <p>FY 2017 OCO Plans: N/A</p>					
<p>Title: Remote Sensing Capability Dev.</p> <p align="right">Articles:</p> <p>FY 2015 Accomplishments: N/A</p> <p>FY 2016 Plans: N/A</p> <p>FY 2017 Base Plans: - Continue all efforts of FY 2016 less those noted as completed above. - Coordinate TCPED process across DoD and civilian government agencies to support Navy Missions.</p> <p>FY 2017 OCO Plans: N/A</p>	0.982	0.660	0.219	0.000	0.219
	-	-	-	-	-
Accomplishments/Planned Programs Subtotals	4.949	2.479	3.855	0.000	3.855

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2363. / <i>Remote Sensing Capability Development</i>
C. Other Program Funding Summary (\$ in Millions) N/A		
Remarks		
D. Acquisition Strategy Remote Sensing Capability Development is being managed as a 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		

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

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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Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Remote Sensing Capability Development Data Collection	C/FFP	SAIC : Virginia	0.000	1.284	Jul 2015	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Remote Sensing Capability Development Data Collection	WR	NRL : Washington, DC	0.000	0.841	Mar 2015	0.387	Jan 2016	0.773	Jan 2017	-		0.773	0.000	2.001	-
Remote Sensing Capability Development Data Collection	C/FFP	Raytheon : MA	0.000	0.566	Jul 2015	0.521	Dec 2015	1.041	Dec 2016	-		1.041	0.000	2.128	-
Remote Sensing Capability Development Data Collection	WR	NUWC : Not Specified	0.000	0.000		0.248	Jan 2016	0.496	Jan 2017	-		0.496	0.000	0.744	-
REMOTE SENSING CAPABILITY DEVELOPMENT DATA COLLECTION	Various	VARIOUS : VARIOUS	0.000	0.000		0.000		0.219	Jan 2017	-		0.219	5.176	5.395	-
Subtotal			0.000	2.691		1.156		2.529		-		2.529	-	-	-

Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Remote Sensing Capability Development Data Collection	WR	SSC PAC : San Diego, CA	0.000	0.219	Dec 2014	0.253	Mar 2016	0.506	Mar 2017	-		0.506	0.000	0.978	-
Subtotal			0.000	0.219		0.253		0.506		-		0.506	0.000	0.978	-

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2363. / <i>Remote Sensing Capability Development</i>
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Test and Evaluation (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Remote Sensing Capability Development Data Collection	WR	SSC PAC : San Diego, CA	0.000	0.712	Dec 2014	0.410	Jan 2016	0.820	Jan 2017	-		0.820	0.000	1.942	-
Remote Sensing Capability Development Data Collection	WR	SSC Pacific : SAN DIEGO, CA	0.000	0.480	Dec 2014	0.625	Oct 2015	0.000		-		0.000	0.375	1.480	-
Subtotal			0.000	1.192		1.035		0.820		-		0.820	0.375	3.422	-

Management Services (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Remote Sensing Capability Development Data Collection	C/FP	BAH : Virginia	0.000	0.345	Jul 2015	0.000		0.000		-		0.000	0.000	0.345	-
Remote Sensing Capability Development Data Collection	C/FP	BAH : VIRGINIA	0.000	0.502	Feb 2015	0.035	Dec 2015	0.000		-		0.000	0.374	0.911	-
Subtotal			0.000	0.847		0.035		0.000		-		0.000	0.374	1.256	-

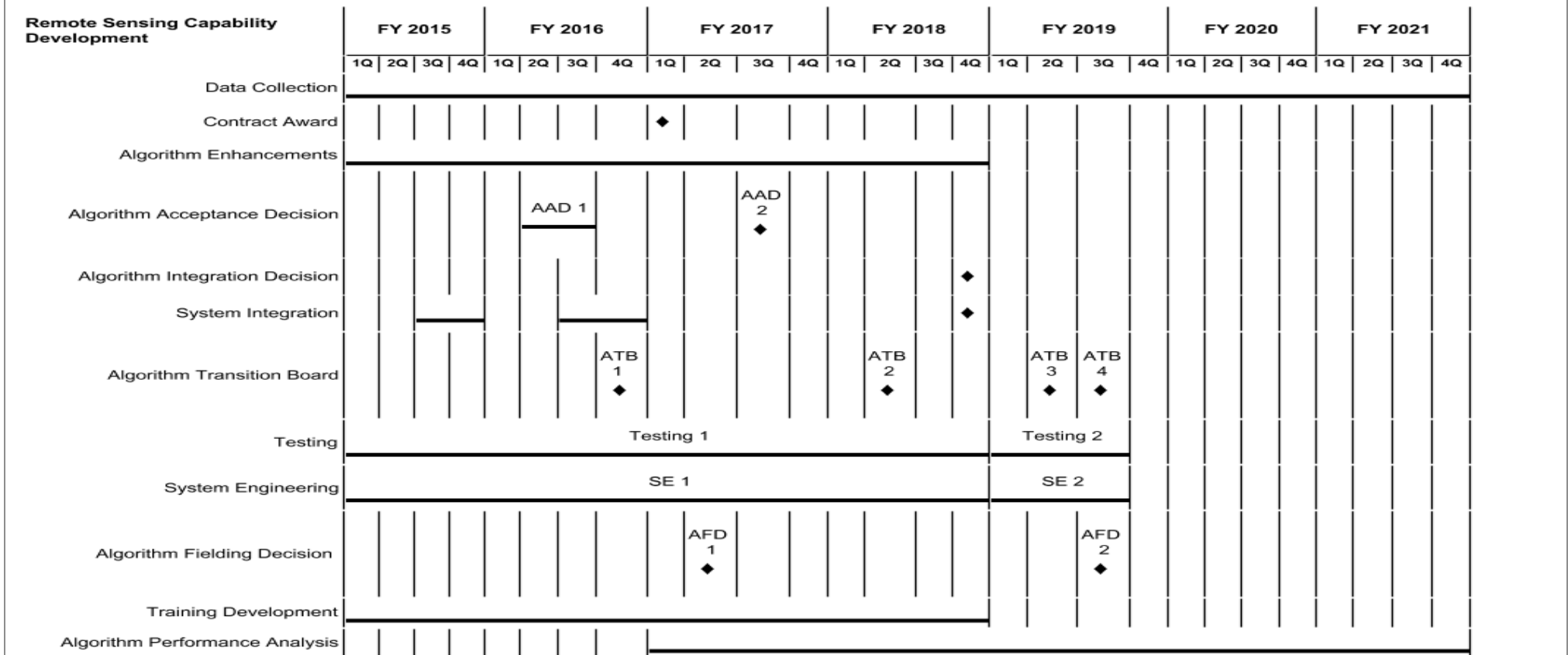
			Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			0.000	4.949	2.479	3.855	-	3.855	-	-	-

Remarks

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

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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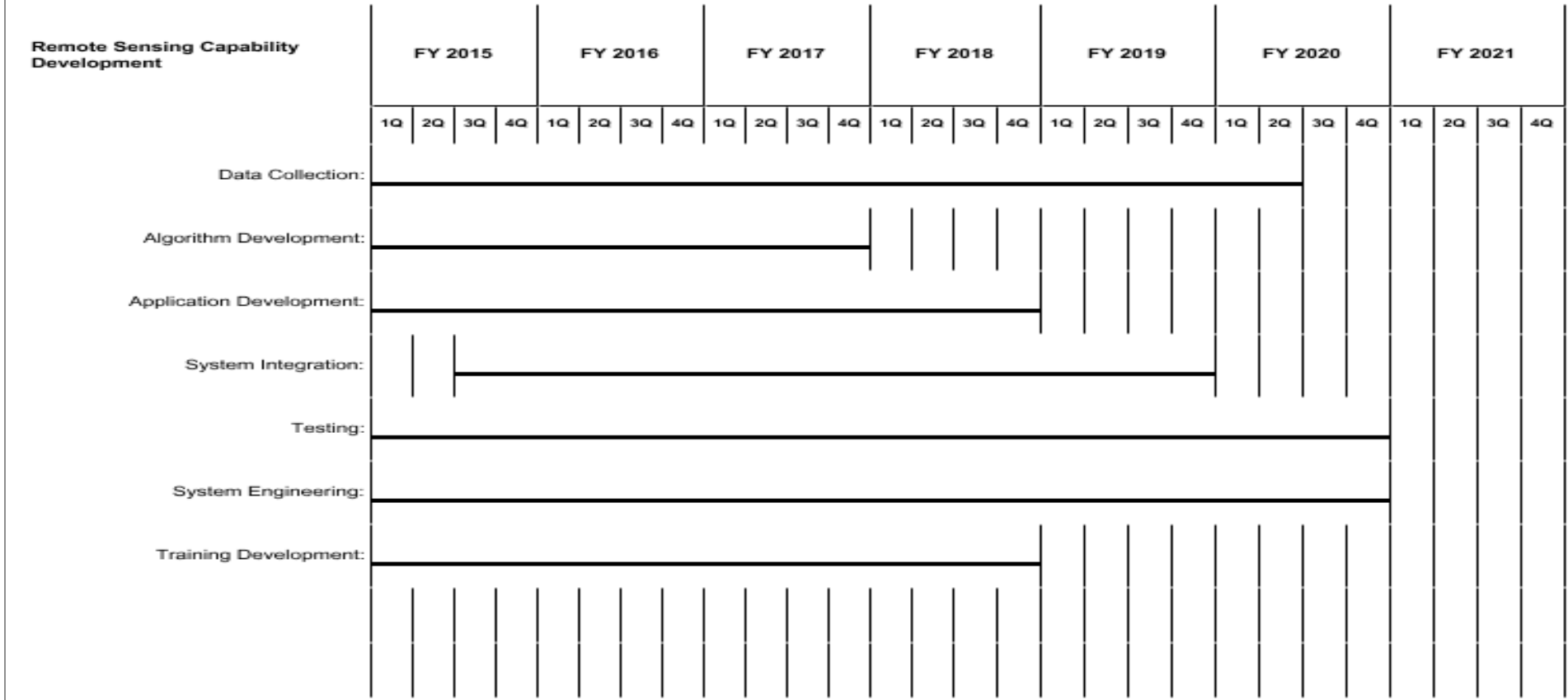
Exhibit R-4, RDT&E Schedule Profile: PB 2017 Navy

Date: February 2016

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 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2363. / <i>Remote Sensing Capability Development</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Remote Sensing Capability Development</i>				
Data Collection:	1	2015	4	2021
Contract Award:	1	2017	1	2017
Algorithm Enhancements:	1	2015	4	2018
Algorithm Acceptance Decision: Algorithm Acceptance Decision 1	2	2016	3	2016
Algorithm Acceptance Decision: Algorithm Acceptance Decision 2	3	2017	3	2017
Algorithm Integration Decision:	4	2018	4	2018
System Integration: System Integration 1	3	2015	4	2015
System Integration: System Integration 2	3	2016	4	2016
System Integration: System Integration 3	4	2018	4	2018
Algorithm Transition Board: Algorithm Transition Board 1	4	2016	4	2016
Algorithm Transition Board: Algorithm Transition Board 2	2	2018	2	2018
Algorithm Transition Board: Algorithm Transition Board 3	2	2019	2	2019
Algorithm Transition Board: Algorithm Transition Board 4	3	2019	3	2019
Testing: Testing 1	1	2015	4	2018
Testing: Testing 2	1	2019	3	2019
System Engineering: System Engineering 1	1	2015	4	2018
System Engineering: System Engineering 2	1	2019	3	2019
Algorithm Fielding Decision: Algorithm Fielding Decision 1	2	2017	2	2017
Algorithm Fielding Decision: Algorithm Fielding Decision 2	3	2019	3	2019
Training Development:	1	2015	4	2018
Algorithm Performance Analysis:	1	2017	4	2021

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

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 2363. / <i>Remote Sensing Capability Development</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Remote Sensing Capability Dev.</i>				
Data Collection:: Schedule Detail	1	2015	2	2020
Algorithm Development:: Schedule Detail	1	2015	4	2017
Application Development:: Schedule Detail	1	2015	4	2018
System Integration:: Schedule Detail	3	2015	4	2019
Testing:: Schedule Detail	1	2015	4	2020
System Engineering:: Schedule Detail	1	2015	4	2020
Training Development:: Schedule Detail	1	2015	4	2018

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 3207 / <i>Fleet Synthetic Training</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
3207: <i>Fleet Synthetic Training</i>	1.182	2.185	0.993	0.970	-	0.970	1.033	1.055	1.076	1.098	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.

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 pierside or underway, as well as enhance BMD training objective accomplishment in current Fleet Requirements 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.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Fleet Synthetic Training	0.579	0.993	0.970	0.000	0.970
Articles:	-	-	-	-	-
Description: Develop and deliver 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.					
Accomplishments include development of Meteorological and Oceanographic (METOC) environmental databases for total of 10 of 14 Navy Continuous Training Environment (NCTE) exercise areas. Conducted data and architecture testing between Commander, Navy Information Dominance Forces Command (NAVIDFOR) data and the Environmental Data Cube Support system (EDCSS). Integrated environmental database hosting					

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy	Date: February 2016
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Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 3207 / <i>Fleet Synthetic Training</i>
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
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at the Naval Oceanographic Office. Developed capability to realistically simulate bathythermograph data collection based on synthetic ocean environment for total of 6 of 14 NCTE areas. Enhanced realism of training environment by providing synthetic satellite/radar imagery based on synthetic environmental data. Made improvements in generating acoustic performance products used by Anti-Submarine Warfare (ASW) white cell and ASW commander staff. Conducted verification and validation of acoustic performance products.

United States Fleet Forces Command and Commander Pacific Fleet jointly signed out the Fleet Live, Virtual, and Constructive (LVC) Training Capability Requirement on 31 Jan 2013. The document states that an integrated LVC Training Environment is essential for future force readiness. As such, physical environment efforts are required to be undertaken to meet the desired LVC end state of a seamless training environment that enables robust, realistic, and cost effective training by integrating live, virtual, and constructive training systems to support the effective and efficient generation of maritime forces in support of Combatant Commander requirements.

Specifically, Live, Virtual, and Constructive simulations each have unique requirements for METOC representation, as well as their Concept of Operations (CONOPS) for its use. The EDCSS is capable of providing a single integrated METOC representation to each simulation in a manner and format uniquely suited to that platform. In addition, EDCSS is source agnostic and can provide such representations from historical reference scenarios or live operational METOC data sources. These capabilities of EDCSS have been previously developed, however their use within LVC federations, most notable NCTE, continues to be defined and as such the final technical approach, deployment and validation must still be accomplished.

FY 2015 Accomplishments:

- * Complete full integration of EDCSS production capability at NWDC.
- * Complete COAMPS-OS Modeling on Demand. IOC estimated in Q2 FY15.
- * Continue work on FMV support.
- * Convert 17 year HYbrid Coordinate Ocean Model (HYCOM) database to a mineable format.

FY 2016 Plans:

- * Research/implement live virtual constructive capability.
- * Develop support for Electromagnetic Spectrum Maneuver Warfare (EMMW) and FMV.

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy			Date: February 2016			
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 3207 / <i>Fleet Synthetic Training</i>				
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)						
		FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>* Develop Machine-to-Machine (M2M) capability for EDCSS interface in support of environmental product generation.</p> <p>FY 2017 Base Plans:</p> <p>* Research/Implement live virtual constructive capability leveraging virtual testbed and FMV/JSAF/NGTS research.</p> <p>* Develop support for Electromagnetic Spectrum Maneuver Warfare (EMMW) leveraging FMV/JSAF/NGTS research.</p> <p>* Develop Machine-to-Machine (M2M) capability for EDCSS interface in support of environmental product generation.</p> <p>* Research EDCSS Cloud architecture (COOP capability and potential for shipboard integration).</p> <p>FY 2017 OCO Plans: N/A</p>						
Title: Ballistic Missile Defense (BMD) Fleet Synthetic Training (FST) at Sea		1.606	0.000	0.000	0.000	0.000
		Articles:	-	-	-	-
<p>Description: Develop a distributed training capability to provide simulation data via a satellite network to the ship underway to stimulate the combat systems and operators. Coordinate efforts with NAVSEA, SPAWAR, and NAVAIR.</p> <p>FY 2015 Accomplishments:</p> <p>* Finalize development, test, certification and demonstration of the capability.</p> <p>* Test and certification of the capability will be conducted FY 2015.</p> <p>FY 2016 Plans: N/A</p> <p>FY 2017 Base Plans: N/A</p> <p>FY 2017 OCO Plans: N/A</p>						
Accomplishments/Planned Programs Subtotals		2.185	0.993	0.970	0.000	0.970

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 3207 / <i>Fleet Synthetic Training</i>
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) NAVIDFOR will produce meteorological and oceanographic environmental databases for all Navy Continuous Training Environment (NCTE) exercise areas. Will implement, test, and integrate with JSAF and other federates in accordance with requirements. 2) NAVIDFOR will complete data and architecture integration, including information assurance compliance for provision of synthetic Meteorological and Oceanographic Command (METOC) 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. 3) NAVIDFOR 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. 4) NWDC, in FY15 will finalize development, test, certify, and demonstrate capability for BMD FST at sea.		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016				
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)								
1319 / 4				PE 0603207N / Air/Ocean Tactical Applications				3207 / Fleet Synthetic Training								
Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total				
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract	
Primary Hardware Development	WR	NAWC TSD : Orlando, FL	0.248	0.000		0.000		0.000		-		0.000	0.248	0.496	-	
Subtotal			0.248	0.000		0.000		0.000		-		0.000	0.248	0.496	-	
Support (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total				
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract	
Development Support	WR	NRL / AER : MS / CA / VA	0.230	0.000		0.142	Nov 2015	0.229	Nov 2016	-		0.229	Continuing	Continuing	Continuing	
Software Development	SS/CPFF	AER / GEOCENT : VA / MS	0.640	0.000		0.200	Jan 2016	0.250	Nov 2016	-		0.250	Continuing	Continuing	Continuing	
Configuration Management	WR	AER / GEOCENT : VA / MS	0.064	0.000		0.000		0.230	Nov 2016	-		0.230	0.000	0.294	-	
Studies and Analysis	Various	Various : Various	0.000	0.579	May 2015	0.440	May 2016	0.000		-		0.000	0.000	1.019	-	
TCSS Development	WR	NAWC TSD : Orlando, FL	0.000	0.150	Nov 2014	0.000		0.000		-		0.000	0.000	0.150	-	
Technology Development	C/CPFF	Alion Science & Technology : Norfolk, VA	0.000	1.456	Dec 2014	0.000		0.000		-		0.000	0.000	1.456	-	
Technical Data	WR	NRL : MS	0.000	0.000		0.021	May 2016	0.000		-		0.000	0.000	0.021	-	
Subtotal			0.934	2.185		0.803		0.709		-		0.709	-	-	-	
Test and Evaluation (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total				
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract	
Development Test and Evaluation	WR	NRL : Monterey, CA	0.000	0.000		0.190	Dec 2015	0.261	Dec 2016	-		0.261	0.000	0.451	-	
Subtotal			0.000	0.000		0.190		0.261		-		0.261	0.000	0.451	-	

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy								Date: February 2016					
Appropriation/Budget Activity 1319 / 4				R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>				Project (Number/Name) 3207 / <i>Fleet Synthetic Training</i>					
	Prior Years	FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	1.182	2.185		0.993		0.970		-		0.970	-	-	-

Remarks

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603207N / <i>Air/Ocean Tactical Applications</i>	Project (Number/Name) 3207 / <i>Fleet Synthetic Training</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 3207				
Fleet Synthetic Training: Database Development:	4	2015	4	2021
Fleet Synthetic Training: Architecture:	4	2015	4	2021
Fleet Synthetic Training: Performance Surface Improvements:	2	2015	4	2021
Fleet Synthetic Training: Development Work:	4	2015	4	2021
Fleet Synthetic Training: Studies:	1	2016	4	2021
Fleet Synthetic Training: Configuration Management:	4	2015	4	2021
Ballistic Missile Defense (BMD) FST at Sea: Development:	1	2015	1	2015
Ballistic Missile Defense (BMD) FST at Sea: Testing:	1	2015	2	2015
Ballistic Missile Defense (BMD) FST at Sea: Certification:	3	2015	4	2015
Ballistic Missile Defense (BMD) FST at Sea: Technology Demonstration:	4	2015	4	2015