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**Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy / BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>
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COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	579.541	58.758	40.653	41.765	-	41.765	43.647	41.794	41.556	41.585	Continuing	Continuing
2341: <i>METOC Data Acquisition</i>	196.490	8.806	8.979	7.935	-	7.935	7.962	7.616	7.774	7.942	Continuing	Continuing
2342: <i>METOC Data Assimilation and Mod</i>	349.964	18.607	18.640	20.428	-	20.428	21.400	20.899	20.873	20.477	Continuing	Continuing
2344: <i>Precise Time and Astrometry</i>	18.665	6.818	8.689	6.254	-	6.254	7.911	6.583	6.056	6.146	Continuing	Continuing
3207: <i>Fleet Synthetic Training</i>	0.000	0.002	0.000	3.101	-	3.101	2.186	2.439	2.510	2.584	Continuing	Continuing
3404: <i>Tactical Environmental Support</i>	9.793	3.073	3.100	2.811	-	2.811	2.908	2.956	3.016	3.081	Continuing	Continuing
3405: <i>Decision Support Products &amp; Dissemination</i>	4.629	1.180	1.245	1.236	-	1.236	1.280	1.301	1.327	1.355	Continuing	Continuing
9999: <i>Congressional Adds</i>	0.000	20.272	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	20.272

**A. Mission Description and Budget Item Justification**

Understanding and accurately predicting the maritime environment is a naval warfighting advantage. Effective meteorological and oceanographic modeling depends upon a network of advanced, reliable sensors below, on and above the world's oceans. Combined with state-of-the-art computational infrastructure, the Navy-Marine Corps Meteorological and Oceanographic (METOC) team delivers 24/7 observations, precise forecasts and operational recommendation to commanders. The Air Tactical Applications (AOTA) Program Element (PE) is aligned with the Navy's maritime strategy to enhance future METOC mission capabilities 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 PE 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

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<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy / BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>
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Global Command and Control System and specific unit-level combat systems. This PE 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.

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

Advanced Component Development and Prototypes (ACD&P) efforts necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment are funded in this PE. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 6 (system/subsystem model or prototype demonstration in a relevant environment) and TRL 7 (system prototype demonstration in an operational environment).

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
Previous President's Budget	60.737	40.653	37.814	-	37.814
Current President's Budget	58.758	40.653	41.765	-	41.765
Total Adjustments	-1.979	0.000	3.951	-	3.951
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.979	0.000			
• Program Adjustments	0.000	0.000	3.854	-	3.854
• Rate/Misc Adjustments	0.000	0.000	0.097	-	0.097

**Congressional Add Details (\$ in Millions, and Includes General Reductions)**

**Project:** 9999: *Congressional Adds*

    Congressional Add: *Infrared optimized telescope*

    Congressional Add: *Maritime unattended sensors*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	<b>FY 2023</b>	<b>FY 2024</b>
	2.896	0.000
	17.376	0.000
	20.272	0.000
	20.272	0.000

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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2025 Navy **Date:** March 2024

**Appropriation/Budget Activity**  
1319: *Research, Development, Test & Evaluation, Navy / BA 4: Advanced Component Development & Prototypes (ACD&P)*

**R-1 Program Element (Number/Name)**  
PE 0603207N / *Air/Ocean Tactical Applications*

**Change Summary Explanation**

Funding: FY25 increase is primarily associated with 1) PTA Network 2.0 and 2) Information Warfare Integration Live Virtual Constructive 2.3.  
Technical: No significant change.

Schedule: No significant change

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy										<b>Date:</b> March 2024		
<b>Appropriation/Budget Activity</b> 1319 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>				<b>Project (Number/Name)</b> 2341 / <i>METOC Data Acquisition</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>FY 2029</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
2341: <i>METOC Data Acquisition</i>	196.490	8.806	8.979	7.935	-	7.935	7.962	7.616	7.774	7.942	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

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

This project: 1) provides the means to rapidly and automatically acquire a broad array of METOC data using off-board and on-board sensors; 2) provides an on-scene assessment capability for the tactical commander; 3) provides the tactical commander with real-time METOC data and products for operational use; 4) demonstrates and validates the use of tactical workstations and desktop computers for processing and display of METOC data and products; 5) demonstrates and validates techniques which employ data compression, connectivity and interface technologies to obtain, store, process, distribute and display these METOC data and products; 6) develops new charting and bathymetric survey techniques necessary to reduce hazards to navigation and improve forecast accuracy.

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<b>Title:</b> Meteorological and Oceanographic (METOC) Data Acquisition	8.806	8.979	7.935	0.000	7.935
<b>Articles:</b>	-	-	-	-	-
<b>Description:</b> Efforts falling within the Meteorology and Oceanography (METOC) Collections Project provide future scientific and technological warfighting capabilities that detect and continuously monitor environmental (atmospheric, sea surface, oceanographic and seabed) conditions throughout the battlespace. The Navy's mission continues to require focus on blue-water operations, littoral and deep-strike (inland) battlespaces. Each of these operating areas (and the transitions between them) has its own dynamic and complex environmental characteristics and behaviors that require modifying METOC Collections and associated sensing strategies and methodologies. Without reliable characterization of ocean and atmosphere in these operating areas, the Navy risks ineffective allocation and employment of warfighters and weapon systems, and the sensors that					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2341 / <i>METOC Data Acquisition</i>

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p>fully enable them. Fleet Naval METOC has updated the definition and structure of the METOC program along the lines of operational mission needs. This update focuses on the operational characteristics of Tasking, Collection, Processing, Exploitation, and Dissemination (TCPED) of METOC data and information. Identified efforts supporting METOC are realigned to projects and activities that align to the TCPED updated program structure.</p> <p><b>FY 2024 Plans:</b></p> <ul style="list-style-type: none"> <li>- Continue evaluation and integration of sea surface composition and structure by remote and inverted (or "through-the- sensor" means. Validate electro-optical, acoustic and synthetic aperture radar observations in an operational settings and as suitable for improved ocean model conditions, from wave state through bathymetry.</li> <li>- Continue integration of acoustic oceanographic data and model components as to tactical decision aids.</li> <li>- Continue to improve the Navy Coupled Ocean Data Assimilation-Forward (NCODAf) ocean observation collection and assimilation system, to include operationalizing the capability to ingest physical ocean observations beyond traditional static vertical soundings.</li> <li>- Continue development, validation and operationalization of software that enables Navy numerical weather and ocean prediction models to ingest and quality control observations from new and emergent satellites, including commercial and partner nation instruments.</li> <li>- Continue to update and expand applications of refractivity from radio (RFR) projects, including extraction of atmospheric information from radar clutter.</li> <li>- Continue to develop, validate and integrate processes for inclusion of quantified atmospheric aerosol data into 1) calibration and correction algorithms for satellite retrieval of other environmental parameters, and into 2) tactical data aids supporting multiple weapons, sensors and decision systems.</li> <li>- Continue efforts in data compression and delivery. Specific efforts include evaluation and integration of single-value decomposition applications to forecast model output, application of automation-based compression techniques. Objective is to enable delivery of timely and relevant environmental information to communications-limited assets.</li> </ul>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2341 / <i>METOC Data Acquisition</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p>- Initiate validation and maturation of Ionospheric data collection and application programming interfaces important to forecasting the capabilities and limitations of long range communications.</p> <p>- Initiate advanced remote sensing retrievals of earth system characteristics, including using current and upcoming Satellite Based Environmental Monitoring (SBEM) frequencies available in optical, infrared and microwave spectral bands with a common processing software between sensors and applications.</p> <p><b>FY 2025 Base Plans:</b></p> <p>-Continue evaluation integration and transition of sea surface composition and structure by remote and inverted (or "through-the- sensor" means. Specific efforts will include validation of electro-optical, acoustic and synthetic aperture radar observations in an operational settings. The objective is to increase the number, resolution and variation of observations to significantly improve tactical decision aid initialization.</p> <p>-Continue integration of acoustic oceanographic data and model components as to tactical decision aids. Specific efforts include validating data quality for acceptance into the Ocean and Atmospheric Master Library. Objective is to expand and improve the authorized suite of tactical decision aid-supporting databases and model.</p> <p>-Continue to mature the Navy Coupled Ocean Data Assimilation-Forward (NCODAf) ocean observation collection and assimilation system. Specific efforts include adding the ability to ingest multiple observation types. Objective is an enhanced ocean tactical acoustic environmental awareness for assets with limited communications.</p> <p>-Continue development, validation and operationalization of advanced software components that enable Navy numerical weather and ocean prediction models to ingest and quality control observations from recently available satellites, including commercial and partner nation instruments. Specific efforts include adapting to sensors on several US and ESA satellites launching in 2024-2025. Objective is an increased quantity and quality of observations leading to improved forecast model performance.</p> <p>-Continue to mature and expand applications of refractivity from radio (RFR) projects, including extraction of atmospheric information from radar clutter. Specific efforts include the analysis of data collected from operational platforms in 2024-2025. Objective is development of regional models that effectively predict refractive conditions leading to improved communications and sensor employment planning.</p>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
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**B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)**

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
-Continue to develop, validate and integrate processes for inclusion of quantified atmospheric aerosol data into 1) calibration and correction algorithms for satellite retrieval of other environmental parameters, and into 2) tactical data aids supporting multiple weapons, sensors and decision systems. Specific efforts include developing the ability to provide recommendations for emergent energetic devices Objective is increasing the accuracy of sensor and weapons performance predictions.					
-Continue efforts in data compression and delivery. Specific efforts include evaluation and integration of single-value decomposition applications to forecast model output, application of automation-based compression techniques. Objective is to enable delivery of timely and relevant environmental information to communications-limited assets.					
-Continue validation and maturation of Ionospheric data collection and application programming interfaces important to forecasting the capabilities and limitations of long-range communications. Specific efforts support multiple programs.					
<b><i>FY 2025 OCO Plans:</i></b> N/A					
<b><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i></b> Decrease in funding from FY24 to FY25 is due to reduced efforts in advanced remote sensing retrievals of earth system characteristics, including using current and upcoming Satellite Based Environmental Monitoring (SBEM) frequencies available in optical, infrared and microwave spectral bands with a common processing software between sensors and applications.					
<b>Accomplishments/Planned Programs Subtotals</b>	8.806	8.979	7.935	0.000	7.935

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

N/A

**Remarks**

**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.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy												Date: March 2024			
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 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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 (DATA) Collections	WR	NRL : Washington, DC	85.178	0.800	Nov 2022	0.830	Nov 2023	0.936	Nov 2024	-		0.936	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	WR	SSC PAC : California	23.563	0.300	Nov 2022	0.200	Nov 2023	0.300	Nov 2024	-		0.300	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	0.500	Nov 2022	0.510	Nov 2023	0.600	Nov 2024	-		0.600	Continuing	Continuing	Continuing
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	Various	Various : Various	8.422	0.500	Nov 2022	0.500	Nov 2023	0.400	Nov 2024	-		0.400	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	WR	NSWC : Bethesda, MD	1.193	0.500	Nov 2022	0.500	Nov 2023	0.400	Nov 2024	-		0.400	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	APPLIED SCIENCE ASSOCIATED : RHODE ISLAND	0.466	0.450	Nov 2022	0.436	Nov 2023	0.400	Nov 2024	-		0.400	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	University of Washington : Seattle, WA	1.193	0.400	Oct 2022	0.400	Oct 2023	0.400	Oct 2024	-		0.400	Continuing	Continuing	Continuing
METOC (DATA) Collections	C/FP	METRON : Reston, VA	1.524	0.500	Oct 2022	0.200	Oct 2023	0.400	Oct 2024	-		0.400	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC : Virginia	1.781	0.000		0.200	Oct 2023	0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	CSC : Virginia	1.831	0.000		0.200	Oct 2023	0.000		-		0.000	Continuing	Continuing	Continuing
METOC (DATA) Collections	WR	NRL : Monterey, CA Stennis Space Center, MS	5.033	2.020	Oct 2022	2.200	Oct 2023	2.200	Oct 2024	-		2.200	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/CPFF	GDIT : Virginia	0.138	0.400	Oct 2022	0.200	Oct 2023	0.000	Oct 2024	-		0.000	Continuing	Continuing	Continuing

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy												Date: March 2024			
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 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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 (DATA) Collections	C/FP	Penn State University : PA	4.204	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
<b>Subtotal</b>			185.806	6.370		6.376		6.036		-		6.036	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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	7.018	1.086	Nov 2022	1.230	Nov 2023	1.199	Nov 2024	-		1.199	0.000	10.533	-
Littoral Battlespace Sensing - Autonomous Undersea Vehicle	C/FP	SAIC : Virginia	0.600	0.000		0.000		0.000		-		0.000	0.000	0.600	-
Tactical Oceanography Capabilities / Undersea Warfare (TOC USW)	WR	SSC PAC : California	0.247	0.000		0.000		0.000		-		0.000	0.000	0.247	-
METOC Future Mission Capabilities	C/CPFF	PSS/BAH : California	0.066	0.000		0.000		0.000		-		0.000	0.000	0.066	-
<b>Subtotal</b>			7.931	1.086		1.230		1.199		-		1.199	0.000	11.446	N/A
Test and Evaluation (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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
Developmental Test & Evaluation (DT&E)	Various	Various : Various	1.610	0.700	Nov 2022	0.723	Nov 2023	0.700	Nov 2024	-		0.700	0.000	3.733	-
<b>Subtotal</b>			1.610	0.700		0.723		0.700		-		0.700	0.000	3.733	N/A





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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2341 / <i>METOC Data Acquisition</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Forecasts using Satellite Observations -- NRL-MRY																												
<b><i>METOC Collections - targeted and tactical scales</i></b>																												
Emerging Air-Ocean Sensor Technology Test and Evaluation: ESTTE - LBS-G AN (Ambient Noise) -- SSC-PAC																												
Emerging Air-Ocean Sensor Technology Test and Evaluation: ESTTE - SHARC RFR -- Various																												
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- METRON Scientific Solutions, Inc.																												
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- NRL-DC																												
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- NSWCCD / METRON																												
Forward-based ocean and ocean acoustics modeling and data assimilation: RTP: An NCODA-based Capability for Forward Ocean Data Assimilation -- NRL-SSC																												
Through-the-sensor environmental data collections: P-8 Environmental Data Sensing -- SSC-LANT																												

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2341 / <i>METOC Data Acquisition</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>METOC Collections - global and theater scales</i></b>				
Oceanographic and Ocean Acoustics Database Development: Deep Ocean Bottom Backscattering Database -- ARL-PSU	1	2023	4	2026
Oceanographic and Ocean Acoustics Database Development: Deep Ocean Bottom Backscattering Database -- NPS	1	2023	4	2026
Oceanographic and Ocean Acoustics Database Development: "Use of Mobile Acoustic Source for In-situ Transmission	1	2023	4	2026
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Atmospheric Data Assimilation -- NRL-MRY	1	2023	4	2027
Satellite-based environmental monitoring for, analysis, assimilation and modeling: "DoD MW Sensors Special Sensor Microwave Imager Sounder (SSMIS),	1	2023	4	2026
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Operational Satellite Sea Ice Products -- NRL-DC	1	2023	4	2025
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Satellite Optical Data for Coupled Ocean-Atmosphere Models -- NRL-SSC	1	2023	4	2026
Satellite-based environmental monitoring for, analysis, assimilation and modeling: RTP: Flux Correction for Coupled System Extended Forecasts using Satellite Observations -- NRL-MRY	1	2023	4	2026
<b><i>METOC Collections - targeted and tactical scales</i></b>				
Emerging Air-Ocean Sensor Technology Test and Evaluation: ESTTE - LBS-G AN (Ambient Noise) -- SSC-PAC	1	2023	4	2026
Emerging Air-Ocean Sensor Technology Test and Evaluation: ESTTE - SHARC RFR -- Various	1	2023	4	2024
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- METRON Scientific Solutions, Inc.	1	2023	4	2026

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**Exhibit R-4A, RDT&E Schedule Details:** PB 2025 Navy **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2341 / <i>METOC Data Acquisition</i>
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<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- NRL-DC	1	2023	4	2026
Forward-based ocean and ocean acoustics modeling and data assimilation: NCODA-Forward Collaborative Integration -- NSWCCD / METRON	1	2023	4	2027
Forward-based ocean and ocean acoustics modeling and data assimilation: RTP: An NCODA-based Capability for Forward Ocean Data Assimilation -- NRL-SSC	1	2023	4	2027
Through-the-sensor environmental data collections: P-8 Environmental Data Sensing -- SSC-LANT	1	2023	4	2026

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy										<b>Date:</b> March 2024		
<b>Appropriation/Budget Activity</b> 1319 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603207N / Air/Ocean Tactical Applications				<b>Project (Number/Name)</b> 2342 / METOC Data Assimilation and Mod			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>FY 2029</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
2342: METOC Data Assimilation and Mod	349.964	18.607	18.640	20.428	-	20.428	21.400	20.899	20.873	20.477	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

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

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<b>Title:</b> Battlespace Data Assimilation and Prediction	18.607	18.640	20.428	0.000	20.428
<b>Articles:</b>	-	-	-	-	-
<b>Description:</b> The Battlespace Data Assimilation and Prediction Project (2342) enables the warfighter to leverage observed environmental data gathered under Project 2341 (METOC Collections) by assimilating data into and fusing them with sophisticated high-resolution (spatial and temporal) assessment and prediction models made possible by high-performance computing. These models gain increasing importance as weapons and sensors grow in sophistication and complexity, making them all the more sensitive to the effects of the natural environment. METOC Processing enables full understanding of the limitations and constraints imposed by ocean and atmosphere, in space and time, thus quantifying and minimizing their impact on weapons, sensors and mission. However, METOC Processing itself is limited by the temporal and spatial resolutions at which data are collected and numerically analyzed and predicted. Thus Projects 2341 and 2342 must remain aggressive in delivering higher and higher resolutions, demanding greater and greater computational and database capacities.					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>

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

METOC Processing efforts must also rise to the challenge of assimilating smaller-scale phenomena, particularly in the littorals, and predicting their spatial and temporal effects, as stated by Fleet and Force Commanders who require remote autonomous, clandestine, littoral battlespace sensing in near-shore areas. This next step in the TCPED continuum, METOC Processing, is critical to fully characterize the physical battlespace environment in real-time and in predictive/ forecasting modes, and gives the warfighter a decisive advantage in the complex blue-water, littoral and deep-strike battlespaces.

***FY 2024 Plans:***

- Conclude improvements for the deterministic operational global forecast model, NAVGEM, with components that will inform development of the next generation atmospheric model NEPTUNE.
- Conclude improvements to autonomous-platform control software, including integration with ocean circulation models and platform-specific interfaces.
- Continue improvements for the ensemble version of the operational global forecast model, NAVGEM, with components that will inform ensemble development of the next generation atmospheric model NEPTUNE.
- Continue development of the Earth Systems Prediction Capability (ESPC) ensemble global prediction mode via upgrades to physics subroutines and incorporation of high-altitude capabilities in the ESPC atmosphere model, NAVGEM.
- Continue development of the Navy Ionosphere Model for Operations (NIMO) towards a 24 hr forecast of atmospheric electron density, which will inform predictions for sensors, communications, and weapons performance.
- Continue improvements to the regional coupled ocean-atmospheric model COAMPS to enhance ocean surface, sea ice and near shore accuracy. Improve capabilities in soil moisture and flux representation to facilitate boundary layer and convective skill upgrades.
- Continue and expand intermodal data assimilation efforts to merge code bases and algorithm development across ocean and atmospheric applications, to gain efficiencies in development and implementation.

<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p>- Continue the design and implementation of seafloor acoustic, and ambient noise databases that include vertical and temporal dependencies, with the objective of providing higher resolution data to USW tactical decision aids.</p> <p>- Continue to improve, validate and implement ocean acoustic prediction models, analysis tools and critical environmental parameter databases in preparation for future increments of shipboard tactical combat system software and capability updates.</p> <p>- Continue enhancements to the Global Ocean Forecast System to include a higher order advective scheme and an expanded data assimilation capability via improvements to the NCODA data assimilation system.</p> <p>- Continue to integrate specific capability upgrades to regional modeling systems. Projects will include using improved tropical cyclone indicators for rapid intensification forecasts and probabilistic storm surge capabilities.</p> <p>- Continue improvements to ocean data assimilation systems for global models (NCODA 3DVAR) and regional models. (NCODA 4DVAR), with the objective of using more of the globally available data.</p> <p>- Continue to increase predictive capabilities of tactical acoustic models. Specific projects include upgrades to Navy Standard Parabolic Equation model in sound channel propagation and surface duct loss, and integration of uncertainty and confidence measures.</p> <p>- Initiate development of a unified aerosol global forecasting capability (deterministic, ensemble and retrospective) that will integrate into the NEPTUNE processing suite.,</p> <p>- Initiate improved coupled ocean-atmosphere modeling and validation strategies, including development of a common verification system between ocean and atmosphere modeling suites and targeted coupled modeling development and analysis focus areas (such as the Arctic.)</p> <p><b>FY 2025 Base Plans:</b></p> <p>-Continue to mature the ensemble global environmental prediction models. Specific efforts include adapting components of the operational NAVGEM model for use in the next generation NEPTUNE mode, and upgrading physics subroutines within the operational the Earth Systems Prediction Capability (ESPC) global forecast system. The objective is a robust long range (to 45 day) air/ocean forecast capability with high accuracy and resolution, and probability projections, to enable operational planning.</p>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p>-Continue maturation and transition of the Navy Ionosphere Model for Operations (NIMO). Specific efforts include addition of an ensemble forecast capability. Objective is to provide communications and surveillance planners with probabilistic forecasts of ionospheric effects on their systems.</p> <p>-Continue to mature regional (higher resolution) models. Specific efforts include improving the regional atmospheric model (COAMPS) capability to assess refractive conditions at land-sea boundaries, and to increase the ability of COAMPS to better predict the rapid intensification of tropical cyclones and the inland surge caused by those storms. The objective is increased warning time and more accurate depictions of expected impacts for operational planners.</p> <p>-Continue to mature and transition to operations ocean acoustic prediction models, analysis tools and critical environmental parameter databases. Specific efforts include upgrades in the various model components' ability to account for vertical ambient noise and provide improved depictions of model uncertainty. Objective is to provide more accurate undersea sensor performance predictions with associated measures of uncertainty, in order to better support decision making in an information-limited environment.</p> <p>-Continue enhancements to the Global Ocean Forecast System to include a higher order advective scheme and an expanded data assimilation capability via improvements to the NCODA data assimilation system.</p> <p>-Continue improvements to ocean data assimilation systems for global models (NCODA 3DVAR) and regional models. (NCODA 4DVAR), with the objective of using more of the globally available data.</p> <p>-Continue development of a unified aerosol global forecasting capability (deterministic, ensemble and retrospective) that will integrate into the NEPTUNE processing suite.,</p> <p>-Continue improved coupled ocean-atmosphere modeling and validation strategies, including development of a common verification system between ocean and atmosphere modeling suites and targeted coupled modeling development and analysis focus areas (such as the Arctic.)</p> <p><b>FY 2025 OCO Plans:</b> N/A</p> <p><b>FY 2024 to FY 2025 Increase/Decrease Statement:</b></p>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
Increase in funding from FY24 to FY25 is due to the increased development of a unified aerosol global forecasting capability that will integrate into the NEPTUNE processing suite and improvement in coupled ocean-atmosphere modeling and validation strategies, including development of a common verification system between ocean and atmosphere modeling suites and targeted coupled modeling development and analysis focus areas.					
<b>Accomplishments/Planned Programs Subtotals</b>	18.607	18.640	20.428	0.000	20.428

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

N/A

**Remarks**

**D. Acquisition Strategy**

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

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy													Date: March 2024		
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 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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	138.531	2.295	Nov 2022	2.295	Nov 2023	2.500	Nov 2024	-		2.500	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	Various	Various : Various	46.518	1.117	Oct 2022	1.117	Oct 2023	1.300	Oct 2024	-		1.300	0.000	50.052	-
METOC Space-Based Sensing Capabilities	WR	NRL : Washington, DC	17.742	0.585	Oct 2022	0.585	Oct 2023	0.585	Oct 2024	-		0.585	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	WR	NRL : Washington, DC	9.880	0.360	Oct 2022	0.360	Oct 2023	0.450	Oct 2024	-		0.450	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	University of Texas : TX	2.063	0.360	Oct 2022	0.360	Oct 2023	0.450	Oct 2024	-		0.450	0.000	3.233	-
Tactical Oceanography Capabilities / Undersea Warfare	WR	NSWC Carderock : West Bethesda, MD	2.940	0.315	Oct 2022	0.315	Oct 2023	0.360	Oct 2024	-		0.360	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	WR	NAVOCEANO : Mississippi	1.049	0.000		0.000		0.000		-		0.000	0.000	1.049	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	University of Washington : Seattle, WA	0.850	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Johns Hopkins University : MD	0.794	0.180	Nov 2022	0.180	Nov 2023	0.400	Nov 2024	-		0.400	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC/QNA : Various	1.876	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC Future Mission Capabilities	C/FP	SAIC/QNA : Various	3.096	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Penn State University : Pennsylvania	0.125	0.000		0.000		0.000		-		0.000	0.000	0.125	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy												Date: March 2024			
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 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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	0.050	0.000		0.000		0.000		-		0.000	0.000	0.050	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SPA : Virginia	0.375	0.000		0.000		0.000		-		0.000	0.000	0.375	-
METOC SUPPORT SPACE-SOFTWARE DEVELOPMENT	WR	NRL : WASHINGTON DC	0.640	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	METRON : Virginia	0.685	0.000		0.000		0.000		-		0.000	0.000	0.685	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	Vencore : Virginia	0.239	0.000		0.000		0.000		-		0.000	0.000	0.239	-
METOC Battlespace Data Assimilation and Prediction	WR	NRL : Monterey, CAI Stennis Space Center,MS	30.033	4.597	Oct 2022	4.370	Oct 2023	4.900	Oct 2024	-		4.900	0.000	43.900	-
Earth Systems Prediction Capability (ONR)	WR	NRL : Washington DC	61.147	5.095	Oct 2022	5.419	Oct 2023	5.578	Oct 2024	-		5.578	Continuing	Continuing	Continuing
ESPC	Various	Various : Various	9.329	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
CHIEF OF NAVAL OPERATIONS SPEED TO FLEET INITIATIVE	WR	NRL : WASHINGTON DC	0.850	0.000		0.000		0.000		-		0.000	1.130	1.980	-
<b>Subtotal</b>			328.812	14.904		15.001		16.523		-		16.523	Continuing	Continuing	N/A
Support (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy												Date: March 2024			
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 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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	0.473	0.000		0.000		0.000		-		0.000	0.000	0.473	-
Tactical Oceanography Capabilities / Undersea Warfare	C/FP	SAIC : Virginia	0.634	0.000		0.000		0.000		-		0.000	0.000	0.634	-
METOC Future Mission Capabilities	C/FP	SAIC : VIRGINIA	0.915	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
METOC SUPPORT SPACE-PROGRAM SUPPORT	WR	SSC PACIFIC : SAN DIEGO, CA	1.256	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Earth System Modeling Framework - Common Software Architecture	Various	Various : Boulder, CO; Various	3.535	1.000	Dec 2022	1.000	Dec 2023	1.000	Dec 2024	-		1.000	0.000	6.535	-
Program Support and Subject Matter Expertise	Various	UW-APL : Seattle, WA	3.284	0.270	Oct 2022	0.205	Oct 2023	0.205	Oct 2024	-		0.205	Continuing	Continuing	Continuing
<b>Subtotal</b>			10.892	1.270		1.205		1.205		-		1.205	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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
Prior Year Developmental Test & Evaluation Not Funded FYDP (PYDT&E)	TBD	Charles River : Boston, MA	1.457	0.000		0.000		0.000		-		0.000	0.000	1.457	-
<b>Subtotal</b>			1.457	0.000		0.000		0.000		-		0.000	0.000	1.457	N/A
Management Services (\$ in Millions)				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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	-







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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Modeling</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
modeling: Operationally implementing satellite-derived ice products																												
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Satellite Aerosol Data Assimilation -- NRL-MRY																												
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Space METOC: Sea Surface Temp (SST) -- NRL-SSC																												
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Validating and assimilating SAR																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: Large Scale Prediction -- NRL-SSC																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: National Unified Operational Prediction Capability																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: FALCON NRL-MRY																												

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**Exhibit R-4, RDT&E Schedule Profile:** PB 2025 Navy **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: NCOM-4DVAR NRL-SSC	[Redacted]																											
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1 : Coupled Global Prediction System -- NRL-MRY	[Redacted]																											
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1 : Coupled Global Prediction System -- NRL-SSC	[Redacted]																											
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: NEPTUNE RTP	[Redacted]																											
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 10 Coupled Model Data Assimilation -- NRL-MRY	[Redacted]																											
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 10 Coupled Model Data Assimilation -- NRL-SSC	[Redacted]																											
METOC Processing - global and theater scales: Unified, coupled and ensemble	[Redacted]																											

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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
environmental numerical prediction, modeling and data assimilation: ESPC 1D Middle Atmosphere NRL-DC																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1D Middle Atmosphere NRL-MRY																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 2: NRL-MRY																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 2: NRL-SSC																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 3: Coupled Global Ensemble Prediction System																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 4 :Next Generation Model NEPTUNE -- NRL-MRY																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 4A - NexGen Ocean Model -- NRL-SSC																												

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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 6 Climate Analysis LR Forecasting (ACAF) Navy																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8: Extended range Ensemble Prediction NRL-MRY																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8: Extended range Ensemble Prediction NRL-SSC																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8a: Navy ESPC NRL-MRY																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8a: Navy ESPC -- NRL-SSC																												
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 9 National ESPC Committee Support -- NRL-MRY																												



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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 5: Computational Efficiency of Earth System Models - NRL-SSC																												
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 11: Integrated skill diagnostics - NRL-MRY																												
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 11: Integrated skill diagnostics - NRL-SSC																												
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC-11A: Characterization and Assessment of Forecast Dropouts in NAVGEM - NRL-MRY																												
METOC Processing - targeted and tactical scales: Forward-based ocean and ocean acoustics modeling and data assimilation: Acoustic Propagation and Uncertainty Model Upgrades: NSPE v6																												
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: Global Ensemble Aerosol Prediction (ENAAPS) -- NRL-DC																												
METOC Processing - targeted and tactical scales: Numerical prediction in support of																												

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**Exhibit R-4, RDT&E Schedule Profile:** PB 2025 Navy **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
EM warfare and spectrum operations: Navy Aerosol Analysis and Prediction System (NAAPS) -- NRL-MRY																												
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: ESPC 1 C NAVGEM Aerosol Model Development / NAVGEM In-Line NAAPS -- NRL-MRY																												
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: BUILDER SUPPORT - NRL-DC																												
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: BUILDER SUPPORT - NIWC PAC																												
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: RTP: Physics-based Ionosphere Model - Upgrades NRL-DC / APL-JHU / ARL-UT																												
METOC Processing - targeted and tactical scales: Numerical prediction in support of Tropical Cyclone characterization: Environmental and Tropical NRL-MRY																												
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Sphere Array Through-The-Sensor Bottom Loss Processing -- METRON Scientific Solutions, Inc.																												

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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applicati</i> <i>ons</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i> <i>ons</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Sphere Array Through-The-Sensor Bottom Loss Processing -- NRL-DC																												
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: COAMPS-OS and NEPTUNE-OS- NRL-MRY																												
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Small Scale Atmospheric Models -- NRL-MRY																												
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Small scale oceanography -- NRL-SSC																												
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Global aerosol forecasting capability and integration with NEPTUNE																												
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Integrate improved coupled ocean-atmosphere modeling																												

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Proj 2342</b>				
METOC Processing - global and theater scales: Numerical prediction in support of Precise Time and Astrometry: NAVGEM Upgrade for Improved Earth Orientation Parameters -- NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: Biological scattering and attenuation at tactical frequencies -- APL-JHU	1	2023	4	2023
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: Boundary Interactions - TOTLOS Improvements -- APL-UW	1	2023	4	2023
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: Cloud Enablement of Ocean and Atmospheric Master Library -- NRL-SSC	1	2023	4	2026
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: "OAML Models and Database Verification, Validation and Enhancement	1	2023	4	2024
METOC Processing - global and theater scales: Oceanographic and Ocean Acoustics Database Development: The Improved Synthetic Ocean Profiles (ISOP), Version 2 -- NRL-SSC	1	2023	4	2023
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Advanced Satellite Data Assimilation -- NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Aerosol observations for NAAPS validation -- NRL-MRY	1	2023	4	2026

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**Exhibit R-4A, RDT&E Schedule Details:** PB 2025 Navy **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Mean sea surface height for Sentinel -3A/B x -- NRL-SSC	1	2023	4	2025
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Modeling, Sensing and Forecasting Ocean Optical Products	1	2023	4	2024
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: NFLUX: Ocean Surface Bias Detection and Correction Using Satellites	1	2023	4	2024
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Operationally implementing sat-derived ice products	1	2023	4	2026
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Satellite Aerosol Data Assimilation -- NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Space METOC: Sea Surface Temp (SST) -- NRL-SSC	1	2023	4	2023
METOC Processing - global and theater scales: Satellite-based environmental monitoring for, analysis, assimilation and modeling: Validating and assimilating SAR	1	2023	4	2025
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: Large Scale Prediction -- NRL-SSC	1	2023	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: National Unified Operational Prediction Capability	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: FALCON NRL-MRY	1	2023	4	2026

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**Exhibit R-4A, RDT&E Schedule Details: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>
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<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: NCOM-4DVAR NRL-SSC	1	2023	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1 : Coupled Global Prediction System -- NRL-MRY	1	2023	4	2025
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1 : Coupled Global Prediction System -- NRL-SSC	1	2023	4	2025
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: NEPTUNE RTP	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 10 Coupled Model Data Assimilation -- NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 10 Coupled Model Data Assimilation -- NRL-SSC	1	2023	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1D Middle Atmosphere NRL-DC	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 1D Middle Atmosphere NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 2: NRL-MRY	1	2023	4	2027
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 2: NRL-SSC	1	2023	4	2026

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**Exhibit R-4A, RDT&E Schedule Details:** PB 2025 Navy **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / Air/Ocean Tactical Applications	<b>Project (Number/Name)</b> 2342 / METOC Data Assimilation and Mod
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 3: Coupled Global Ensemble Prediction System	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 4 :Next Generation Model NEPTUNE -- NRL-MRY	1	2023	4	2027
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 4A - NexGen Ocean Model -- NRL-SSC	1	2023	4	2025
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 6 Climate Analysis LR Forecasting (ACAF) Navy	1	2023	4	2024
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8: Extended range Ensemble Prediction NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8: Extended range Ensemble Prediction NRL-SSC	1	2023	4	2027
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8a: Navy ESPC NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 8a: Navy ESPC -- NRL-SSC	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 9 National ESPC Committee Support -- NRL-MRY	1	2023	4	2025
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC 9 National ESPC Committee Support -- NRL-SSC	1	2023	4	2025

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**Exhibit R-4A, RDT&E Schedule Details: PB 2025 Navy** **Date:** March 2024

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<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC-7 Regional Arctic (Prediction) System -- NRL-MRY	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC-7 Regional Arctic (Prediction) System -- NRL-SSC	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: ESPC-99 Naval Capabilities Development and R2O	1	2023	4	2026
METOC Processing - global and theater scales: Unified, coupled and ensemble environmental numerical prediction, modeling and data assimilation: RTP Hi-res NAVGEM -- NRL-MRY	1	2023	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 5: Computational Efficiency of Earth System Models - NRL-MRY	1	2023	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 5: Computational Efficiency of Earth System Models - NRL-SSC	1	2023	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 11: Integrated skill diagnostics - NRL-MRY	1	2023	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC 11: Integrated skill diagnostics - NRL-SSC	1	2023	4	2024
MEOC Processing - assessments: Numerical predictions computational efficiency assessments and Skill Assessments: ESPC-11A: Characterization and Assessment of Forecast Dropouts in NAVGEM - NRL-MRY	1	2023	4	2025
METOC Processing - targeted and tactical scales: Forward-based ocean and ocean acoustics modeling and data assimilation: Acoustic Propagation and Uncertainty Model Upgrades: NSPE v6	1	2023	4	2024

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**Exhibit R-4A, RDT&E Schedule Details:** PB 2025 Navy **Date:** March 2024

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<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: Global Ensemble Aerosol Prediction (ENAAAPS) -- NRL-DC	1	2023	4	2025
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: Navy Aerosol Analysis and Prediction System (NAAPS) -- NRL-MRY	1	2023	4	2025
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: ESPC 1 C NAVGEM Aerosol Model Development / NAVGEM In-Line NAAPS -- NRL-MRY	1	2023	4	2026
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: BUILDER SUPPORT - NRL-DC	1	2023	4	2027
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: BUILDER SUPPORT - NIWC PAC	1	2024	4	2027
METOC Processing - targeted and tactical scales: Numerical prediction in support of EM warfare and spectrum operations: RTP: Physics-based Ionosphere Model - Upgrades NRL-DC / APL-JHU / ARL-UT	1	2023	4	2027
METOC Processing - targeted and tactical scales: Numerical prediction in support of Tropical Cyclone characterization: Environmental and Tropical NRL-MRY	1	2023	4	2026
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Sphere Array Through-The-Sensor Bottom Loss Processing -- METRON Scientific Solutions, Inc.	1	2023	4	2026
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Sphere Array Through-The-Sensor Bottom Loss Processing -- NRL-DC	1	2023	4	2026
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: COAMPS-OS and NEPTUNE-OS- NRL-MRY	1	2023	4	2026
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Small Scale Atmospheric Models -- NRL-MRY	1	2023	4	2024

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2342 / <i>METOC Data Assimilation and Mod</i>

<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Small scale oceanography -- NRL-SSC	1	2023	4	2024
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Global aerosol forecasting capability and integration with NEPTUNE	1	2024	4	2027
METOC Processing - targeted and tactical scales: Through-the-sensor environmental data collections: Integrate improved coupled ocean-atmosphere modeling	1	2024	4	2027

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy										<b>Date:</b> March 2024		
<b>Appropriation/Budget Activity</b> 1319 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>				<b>Project (Number/Name)</b> 2344 / <i>Precise Time and Astrometry</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>FY 2029</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
2344: <i>Precise Time and Astrometry</i>	18.665	6.818	8.689	6.254	-	6.254	7.911	6.583	6.056	6.146	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 Master Clock (MC) System, the Department of Defense (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 (EOP) for use by the DoD and national civilian infrastructure to establish the specific orientation of the Earth and to provide input to the terrestrial reference frame. The Astrometric Observation System provides the basic data needed to generate the Celestial Reference Frame (CRF) which is the standard for calibrating all inertial navigation systems, satellite orbits, and earth rotation determinations. Improvement to the MC System, Time Transfer, Earth Orientation, and Astrometric Observation Systems are needed to ensure that new and upgraded DoD and NTM capabilities meet their performance requirements. The U.S. Naval Observatory (USNO), 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 CRF data for military and NTM navigation, positioning, and guidance capabilities to all DoD.

The PTA research and development efforts are focused on several areas relating to timing and time transfer: (1) Fielding of Rubidium Fountain Atomic Clocks and development of improved Global Positioning System (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 (R&D) 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 EOP determination: (1) Upgrade of the Very Long Baseline Interferometry (VLBI) data acquisition system (2) Development of a Software (SW) Correlator for processing of VLBI data, necessary for the generation of 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 VLBI 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.). Automation is necessary to meet future DoD and GPS requirements; (5) Modifications to the EOP system for compatibility with the new international standard. PTA research and development for astrometry focuses on 1) Telescope research and deployment 2) research into the development of a GPS-denied reference frame as a navigation solution 3) instrumentation development across all wavelengths relevant to the DoD. These activities are necessary for producing CRF products in an era of new surveillance, targeting, intelligence, and reconnaissance technologies and instrumentation.

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<b>Title:</b> Precise Timing and Astronomy	6.818	8.689	6.254	0.000	6.254
<b>Articles:</b>	-	-	-	-	-

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2344 / <i>Precise Time and Astrometry</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p><b><i>FY 2024 Plans:</i></b></p> <ul style="list-style-type: none"> <li>- Finalize development of GPS III receiver--move to operations with Other Procurement Navy (OPN) tail in late FY24</li> <li>- Optical Time Transfer: Fiber and Free Space optical time transfer capability development</li> <li>- Optical Clock Development: Demonstrate cooling and develop final version of vacuum chamber</li> <li>- Operational Clock upgrades/advancements (laser upgrades, test slow atomic beam, component testing)</li> <li>- Earth Orientation Combination and Prediction Optimal Estimation Investigation: Validate R&amp;D code implementation and test</li> <li>- Earth Orientation Monitoring of Foreign GNSS experiment: Begin validation operational implementation.</li> <li>- Continue the development of the next generation IR camera: ASTROCAM</li> <li>- Fund team of RDTE researchers to progress Optical Clock Development, Optical/Radio offsets in Active Galactic Nuclei study (FRAMEX), and next generation GPS denied navigation studies</li> <li>- Fund post-doctoral program to support basic research in Precise Time and Astrometry</li> </ul> <p><b><i>FY 2025 Base Plans:</i></b></p> <ul style="list-style-type: none"> <li>*Finalize development of GPS III receiver--move to operations with OPN tail in late FY25</li> <li>*Optical Time Transfer: Fiber and Free Space optical time transfer capability development</li> <li>*Optical Clock Development: Demonstrate cooling and continue development final version of vacuum chamber</li> <li>* Operational Clock upgrades/advancements (laser upgrades, test slow atomic beam, component testing)</li> <li>*Earth Orientation Combination and Prediction Optimal Estimation Investigation: Validate R&amp;D code implementation and test</li> <li>*Fund cislunar reference frame research</li> <li>* Earth Orientation Monitoring of Foreign GNSS experiment: Begin validation operational implementation.</li> <li>* Fund team of RDTE researchers to progress Optical Clock Development, Optical/Radio offsets in Active Galactic Nuclei study (FRAMEX), and next generation GPS denied navigation studies</li> <li>* Fund post-doctoral program to support basic research in Precise Time and Astrometry</li> </ul> <p><b><i>FY 2025 OCO Plans:</i></b> N/A</p> <p><b><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i></b> The FY25 reduction marks the completion of the next generation GPS III receiver RDTE program that transitions to operations in FY25. Additional programmatic reductions to fund higher Department priorities.</p>					
<b>Accomplishments/Planned Programs Subtotals</b>	6.818	8.689	6.254	0.000	6.254

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2344 / <i>Precise Time and Astrometry</i>

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

N/A

**Remarks**

**D. Acquisition Strategy**

The included technology developments are lead in-house with selected contractor participation.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy												Date: March 2024			
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 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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 HW Development (NPOI) 1.8m Telescope Project (1)	SS/FFP	Lowell Observatory : Flagstaff, AZ	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
Primary HW Development (NPOI) 1.8m Telescope (2)	SS/FFP	AZ Embedded System : Not Specified	0.500	0.000		0.000		0.000		-		0.000	0.000	0.500	-
Ancillary HW Development 1	Various	U.S. Naval Observatory : Washington, DC	0.398	0.125	Dec 2022	0.125	Dec 2023	0.125	Dec 2024	-		0.125	0.000	0.773	-
Ancillary HW Development 2	Various	U.S. Naval Observatory : Washington, DC	0.397	0.125	Jan 2023	0.125	Jan 2024	0.125	Jan 2025	-		0.125	0.000	0.772	-
Ancillary HW Development 3	Various	U.S. Naval Observatory : Washington, DC	0.436	0.125	Apr 2023	0.125	Apr 2024	0.125	Apr 2025	-		0.125	0.000	0.811	-
Ancillary HW Development 4	Various	U.S. Naval Observatory : Washington, DC	0.341	0.125	Jul 2023	0.125	Jul 2024	0.125	Jul 2025	-		0.125	0.000	0.716	-
Next Generation Secure Time Transfer	TBD	TBD : Not Specified	1.865	0.000		0.000		0.000		-		0.000	0.000	1.865	-
1.8 meter infrared camera development	TBD	NAVSEA : University of Hawaii	2.008	0.000		0.000		0.000		-		0.000	0.000	2.008	-
Primary Hardware Development (Antenna Receiver Electronics)	C/FFP	NASA : GSFC	1.000	0.000		0.000		0.000		-		0.000	0.000	1.000	-
Primary Hardware Development (Site Prep)	SS/FFP	NASA/GSFC : HI	0.100	0.000		0.000		0.000		-		0.000	0.000	0.100	-
1.8 meter Telescope Enclosure	C/FFP	NAVFAC SW : Not Specified	2.153	0.000		0.000		0.000		-		0.000	0.000	2.153	-
Advanced Time and Frequency Transfer Upgrade	C/FFP	TBD : Not Specified	1.207	0.850	Apr 2023	0.600	Apr 2024	0.500	Apr 2025	-		0.500	0.000	3.157	-

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2344 / <i>Precise Time and Astrometry</i>
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<b>Product Development (\$ in Millions)</b>				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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			
Optical Lattice Clocks	C/FFP	U.S. Naval Observatory : Washington, DC	0.810	0.500	Jul 2023	0.500	Jul 2024	0.250	Jul 2025	-		0.250	0.000	2.060	-
GPS III Receiver	Various	NAVSEA: University of Texas : Austin, Texas	2.239	1.265	Jan 2023	0.220	Jan 2024	0.000		-		0.000	0.000	3.724	-
TST Replacement	Various	U.S. Naval Observatory : Washington, DC	0.135	0.000		0.000		0.000		-		0.000	0.000	0.135	-
Modem	TBD	NAVSEA: APL : Not Specified	0.000	0.250	Jun 2023	0.250	Jan 2024	0.150	Jan 2025	-		0.150	0.000	0.650	-
ARGOS/Cislunar Instrumentation	C/FFP	TBD:NAVSUP-Contracted : Not Specified	0.000	0.903	Mar 2023	1.235	Feb 2025	0.246	Feb 2025	-		0.246	0.000	2.384	-
PTA Network	C/FFP	TBD : Washington, DC	0.000	0.000		2.463	Mar 2024	1.670	Mar 2025	-		1.670	0.000	4.133	-
<b>Subtotal</b>			13.789	4.268		5.768		3.316		-		3.316	0.000	27.141	N/A

<b>Support (\$ in Millions)</b>				FY 2023		FY 2024		FY 2025 Base		FY 2025 OCO		FY 2025 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			
Development Support (All PTA - Labor) 1	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.603	0.363	Dec 2022	0.384	Dec 2023	0.394	Dec 2024	-		0.394	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 2	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.603	0.363	Jan 2023	0.384	Jan 2024	0.394	Jan 2025	-		0.394	Continuing	Continuing	Continuing
Development Support (All PTA - Labor) 3	Allot	U.S. Naval Observatory (Civilian	0.603	0.363	Apr 2023	0.384	Apr 2024	0.394	Apr 2025	-		0.394	Continuing	Continuing	Continuing

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**Exhibit R-3, RDT&E Project Cost Analysis: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / Air/Ocean Tactical Applications	<b>Project (Number/Name)</b> 2344 / Precise Time and Astrometry
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<b>Support (\$ in Millions)</b>				<b>FY 2023</b>		<b>FY 2024</b>		<b>FY 2025 Base</b>		<b>FY 2025 OCO</b>		<b>FY 2025 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
		Labor) : Washington, DC													
Development Support (All PTA - Labor) 4	Allot	U.S. Naval Observatory (Civilian Labor) : Washington, DC	0.603	0.363	Jul 2023	0.384	Jul 2024	0.394	Jul 2025	-		0.394	Continuing	Continuing	Continuing
Development Support (ALL PTA - Labor) 1 CTR	Allot	U.S. Naval Observatory : Washington, DC	0.000	0.598	Jan 2023	0.549	Jan 2024	0.547	Jan 2025	-		0.547	0.000	1.694	-
EOP Optimal Estimation	C/FFP	U.S. Naval Observatory : Washington, DC	0.831	0.250	Jan 2023	0.250	Jan 2024	0.250	Jan 2025	-		0.250	0.500	2.081	-
Foreign GNSS	C/FFP	U.S. Naval Observatory : Washington, DC	0.780	0.250	Jan 2023	0.250	Jan 2024	0.250	Jan 2025	-		0.250	0.500	2.030	-
SLAC Software Upgrade	C/FFP	Classified : Not Specified	0.230	0.000		0.000		0.000		-		0.000	0.690	0.920	-
Primary Hardware Development (NPOI) 1.8m Telescope Project (2)	SS/FFP	NASA : Varies	0.342	0.000		0.000		0.000		-		0.000	0.000	0.342	-
SIBR Placeholder	SS/FFP	NASA : Varies	0.281	0.000	Mar 2023	0.336	Mar 2024	0.315	Mar 2025	-		0.315	0.000	0.932	-
<b>Subtotal</b>			4.876	2.550		2.921		2.938		-		2.938	Continuing	Continuing	N/A

<b>Management Services (\$ in Millions)</b>				<b>FY 2023</b>		<b>FY 2024</b>		<b>FY 2025 Base</b>		<b>FY 2025 OCO</b>		<b>FY 2025 Total</b>	<b>Cost To Complete</b>	<b>Total Cost</b>	<b>Target Value of Contract</b>
<b>Cost Category Item</b>	<b>Contract Method &amp; Type</b>	<b>Performing Activity &amp; Location</b>	<b>Prior Years</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>	<b>Award Date</b>	<b>Cost</b>			
Engineering and Development Services	Various	Classified-4 : Not Specified	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Engineering and Development Services	Various	Classified : Not Specified	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
<b>Subtotal</b>			0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	N/A



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<b>Exhibit R-4, RDT&amp;E Schedule Profile: PB 2025 Navy</b>		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2344 / <i>Precise Time and Astrometry</i>

FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

<b><i>Precise Timing and Astronomy (PTA)</i></b>																												
Master Clock System: Rb Full Operational Capability (FOC) - AMC																												
Master Clock System: Optical Fiber Time (OFT) Transmission																												
Master Clock System: Fiber Time Transmission - Urban Demo																												
Master Clock System: Master Clock System; Optical Clock Development																												
GPS M-Code Receiver: GPS Denied Navigation Pipeline																												
GPS M-Code Receiver: M-Code IOC at USNO																												
GPS M-Code Receiver: M-Code FOC at USNO																												
USNO: Transition Earth Orientation Parameters (EOP) Automation software to operations (FOC)																												
USNO: Next Generation Time Transfer Transceiver (modem) CDR, transition to operations																												
1.8m Telescope Deployment: FAC-D Development for Telescope Enclosure																												
1.8m Telescope Deployment: Development of 1.8m Robotic Adaptive Optics System																												
1.8m Telescope Deployment: GPSIII development																												

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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2344 / <i>Precise Time and Astrometry</i>
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	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

1.8m Telescope Deployment: EO Optimal Estimation	
1.8m Telescope Deployment: EO Foreign GNSS	

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<b>Exhibit R-4A, RDT&amp;E Schedule Details: PB 2025 Navy</b>		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 2344 / <i>Precise Time and Astrometry</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>Precise Timing and Astronomy (PTA)</i></b>				
Master Clock System: Rb Full Operational Capability (FOC) - AMC	1	2023	2	2024
Master Clock System: Optical Fiber Time (OFT) Transmission	1	2023	4	2027
Master Clock System: Fiber Time Transmission - Urban Demo	4	2023	4	2023
Master Clock System: Master Clock System; Optical Clock Development	1	2023	4	2027
GPS M-Code Receiver: GPS Denied Navigation Pipeline	1	2023	4	2024
GPS M-Code Receiver: M-Code IOC at USNO	2	2023	4	2024
GPS M-Code Receiver: M-Code FOC at USNO	1	2023	4	2024
USNO: Transition Earth Orientation Parameters (EOP) Automation software to operations (FOC)	1	2023	1	2023
USNO: Next Generation Time Transfer Transceiver (modem) CDR, transition to operations	1	2023	2	2023
1.8m Telescope Deployment: FAC-D Development for Telescope Enclosure	1	2023	4	2024
1.8m Telescope Deployment: Development of 1.8m Robotic Adaptive Optics System	1	2023	4	2024
1.8m Telescope Deployment: GPSIII development	1	2023	2	2025
1.8m Telescope Deployment: EO Optimal Estimation	2	2023	4	2027
1.8m Telescope Deployment: EO Foreign GNSS	1	2023	4	2027

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy										<b>Date:</b> March 2024		
<b>Appropriation/Budget Activity</b> 1319 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>				<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>FY 2029</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
3207: <i>Fleet Synthetic Training</i>	0.000	0.002	0.000	3.101	-	3.101	2.186	2.439	2.510	2.584	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**Note**

Not a New Start, previously funded in PE 0605013N, Project 2901

**A. Mission Description and Budget Item Justification**

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

The required training is based on realistic characterizations of the physical environment, a key factor in achieving this new way of training Naval Forces. 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.

**IW INTEGRATION INTO LIVE, VIRTUAL, AND CONSTRUCTIVE (LVC) TRAINING DEVELOPMENT**

Not a New Start, previously funded in PE 0605013N, Project 2901

The Live, Virtual, and Constructive (LVC) Training program funds will be used to develop, integrate and deliver Information Warfare (IW) training in a scalable, Navy Continuous Training Environment (NCTE) compliant capability in a controlled environment. This effort builds upon existing trainers Fleet Synthetic Training (FST) Electronic Warfare (EW) Trainer and the Naval Research Development and Engineering (NRD&E) labs to enable continuous development and iterations introducing new technologies and methodologies to advance the IW capabilities in a shore and afloat Tactical Level environment to address the continually evolving threats.

LVC includes fleet requirements to integrate realistic IW capabilities and effects - specifically Intelligence (Intel), Cryptology (Crypto), Electronic Warfare (EW), Meteorology and Oceanography (METOC) inputs at the Secret and TS/SCI level. This capability enables individual units and Carrier Strike Group (CSG), Amphibious Readiness Group (ARG) and Destroyer Squadron (DESRON) to exercise integrated kinetic and non-kinetic capabilities at the Shore Tactical Level utilizing the Maritime Operation Center (MOC) to include operations/intelligence fusion required to overcome Strategic Competition threats. Additionally, LVC facilitates classified IW Tactics, Techniques and Procedures (TTP) development (including Signals Intelligence / Counter - Intelligence, Surveillance, and Reconnaissance (SIGINT / C-ISR)) in a closed network, minimizing the potential for compromise to adversaries. Integration of a realistic IW capability into LVC events via NCTE supports holistic readiness through force generation of effectively trained, resilient IW forces.

The key pieces to integrate IW capabilities into current and future LVC Training Environments include:

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy	<b>Date:</b> March 2024
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<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>
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- Leverage existing trainers (e.g. Naval Research, Development and Engineering (NRDE) laboratories and Electronic Warfare (EW) Fleet Synthetic Trainer) to employ current virtual IW capabilities (including Intel, Crypto, METOC,) via Navy Enterprise Tactical Training Network (NETTN) to enable distributed training for the fleet.
- Virtualize existing IW training tools using serious gaming technologies.
- Develop additional unit level and team training vignettes, scenarios, and curricula based on real-world use cases to provide "reps and sets" and build IW critical thinking skills and tactical proficiency.
- Utilize authoritative standards, such as NCTE Interoperability Standards (NIS) as means to guide future training development.
- Provide Warfare Development Centers the capability to evaluate blue force doctrine and TTP capabilities and limitations in a threat representative environment against replicated realistic opposing force/adversary TTPs to generate viable training events and scenarios.

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

	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
<p><b>Title:</b> Live Virtual Constructive (LVC)</p> <p align="right"><b>Articles:</b></p> <p><b>Description:</b> Funds development and integration of Information Warfare (IW)-informed LVC-enabled training events for FRTP and rehabilitate (3) shore IWTTFs in Norfolk, San Diego, and Yokosuka for unit, staff, and fleet-level training, Tactics Techniques Procedures (TTP) development, exercises, and mission rehearsal.</p> <p><b>FY 2024 Plans:</b> N/A</p> <p><b>FY 2025 Base Plans:</b> Funds the Development Lab Capability Production / Testing and Evaluation</p> <p><b>FY 2025 OCO Plans:</b> N/A</p> <p><b>FY 2024 to FY 2025 Increase/Decrease Statement:</b> Funding starts in FY25. FY25 funds the Development Lab Capability Production / Testing and Evaluation at Navai Information Development Warfare Command.</p>	0.000	0.000	1.298	0.000	1.298
<b>Articles:</b>	-	-	-	-	-
<p><b>Title:</b> Fleet Synthetic Training</p> <p align="right"><b>Articles:</b></p>	0.002	0.000	0.000	0.000	0.000
<b>Articles:</b>	-	-	-	-	-

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p><b>Description:</b> 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 (CCMD) mandated BMD exercises while pier-side or underway, as well as enhance BMD training objective accomplishment in current Optimized Fleet Response Plan (O-FRP) 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.</p> <p><b>FY 2024 Plans:</b> N/A</p> <p><b>FY 2025 Base Plans:</b> N/A</p> <p><b>FY 2025 OCO Plans:</b> N/A</p>					
<p><b>Title:</b> IW Live, Virtual and Constructive (LVC) Training Development</p> <p align="right"><b>Articles:</b></p> <p><b>FY 2024 Plans:</b> N/A</p> <p><b>FY 2025 Base Plans:</b> Continue the identification of technical and training requirements required to develop and integrate Information Warfare (IW) capabilities into IW Live, Virtual, and Constructive Training (LVCT). Continue to collaborate with IW Systems owners to ensure understanding of IW LVCT training requirements. Continue to facilitate the development of IW LVCT capabilities development by providing Secure Compartmentalized Information Facility (SCIF) and LVCT infrastructures and architectures required to develop IW LVCT capabilities.</p> <p>Continue to work with Naval Information Warfare Systems Center Pacific (NIWC PAC) on the identification of technical and training requirement required to develop and integrate IW capabilities into IW LVCT. Continue to collaborate with IW Systems owners to ensure understanding of IW LVCT training requirements.</p>	0.000 -	0.000 -	1.803 -	0.000 -	1.803 -

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
Continues to facilitate the development of IW LVCT capabilities development by provide SCIF and LVCT infrastructures and architectures required to develop IW LVCT capabilities at NIWC PAC.					
Deliver final IW LVCT training and technical requirements definitions for IW areas to include: Intelligence (INTEL), Cryptology (CRY), Meteorology and Oceanography (METOC), Communications (COMMS), Electronic Warfare (EW).					
Deliver IW LVCT Ready for Training (RFT) capabilities under IW areas to include: Intelligence (INTEL), Cryptology (CRY), Meteorology and Oceanography (METOC), Communications (COMMS), Electronic Warfare (EW).					
Deliver IW LVCT integration demonstration events (4) to include shipboard stimulation of Secret IW Systems, and TS/SCI as shipboard architectures allow.					
<b><i>FY 2025 OCO Plans:</i></b> N/A					
<b><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i></b> FY25 increase of \$1.803M is associated with The Live, Virtual, and Constructive (LVC) Training program which will develop, integrate and deliver Information Warfare (IW) training in a scalable, Navy Continuous Training Environment (NCTE) compliant capability in a controlled environment.					
<b>Accomplishments/Planned Programs Subtotals</b>	0.002	0.000	3.101	0.000	3.101

<b>C. Other Program Funding Summary (\$ in Millions)</b>											
<b>Line Item</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>FY 2029</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
• OPN BLI 8106: <i>Command Support Equipment - LVC</i>	1.006	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.006

**Remarks**

**D. Acquisition Strategy**  
The included technology developments are primarily in-house with contractor participation through existing vehicles.  
IW LIVE VIRTUAL AND CONSTRUCTIVE (LVC) TRAINING DEVELOPMENT

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>

LVC Training will leverage existing government contracts through Naval Information Warfare Systems Center Pacific (NIWC PAC), US Air Force and Naval Air Systems Command (NAVAIR) to provide integrated test facilities, scenario development and experimentation on Virtual Wizard Capability Build(s) - Next Generation Threat Simulator (NGTS) platform interface/ experimentation and IW Systems Navy Continuous Training Environment (NCTE) integration.



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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>
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<b>Proj 3207.L60</b>	<b>FY 2023</b>				<b>FY 2024</b>				<b>FY 2025</b>				<b>FY 2026</b>				<b>FY 2027</b>				<b>FY 2028</b>				<b>FY 2029</b>			
	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
	FLC																											

2025OSD - 0603207N - 3207.L60

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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>
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Proj 3207.S39	FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
	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
<b>Live Virtual and Constructive (LVC) Training Development</b>	LVC Scenario Development																											

2025DON - 0603207N - 3207.S39

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3207 / <i>Fleet Synthetic Training</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Proj 3207.L60</b>				
FLC	1	2023	4	2023
Live Virtual and Constructive (LVC) Training Development: LVC Scenario Development	1	2025	4	2029

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy										<b>Date:</b> March 2024		
<b>Appropriation/Budget Activity</b> 1319 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603207N / Air/Ocean Tactical Applications				<b>Project (Number/Name)</b> 3404 / Tactical Environmental Support			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>FY 2029</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
3404: <i>Tactical Environmental Support</i>	9.793	3.073	3.100	2.811	-	2.811	2.908	2.956	3.016	3.081	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

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

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<b>Title:</b> Tactical Environmental Support	3.073	3.100	2.811	0.000	2.811
<b>Articles:</b>	-	-	-	-	-
<b>Description:</b> The Tactical Environmental Support Project (3404) enables the future warfighter to leverage environmental data gathered, assimilated and predicted under Projects 2341 (METOC Collections) and 2342 (METOC processing) by incorporating them into warfighting technological, net-centric applications that shape the way in which commanders engage the enemy, take full advantage of environmental conditions (and their impacts on systems and sensors) and complete the mission in the most efficient manner feasible. These software decision support tools complement the capabilities found in the Naval Integrated Tactical Environmental System Next Generation (NITES-Next) POR, and provide platform, sensor, communications, and weapon systems performance assessments for littoral and deep-strike warfighters.					
The following warfighting disciplines benefit directly from these METOC Exploitation capabilities (1) Undersea Warfare (USW), Anti-Submarine Warfare (ASW), Mine Warfare (MIW), Amphibious Warfare (AMW), Anti-Surface Warfare (ASUW), Anti-Air Warfare, (AAW), Strike Warfare (STW), Expeditionary Warfare (EXW), Electronic Warfare (EW), Information Operations (IO), Intelligence Operations (INT), Non-Combat Operations					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3404 / <i>Tactical Environmental Support</i>

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

(NCO), Command, Control, Communication (CCC), and Naval Special Warfare (NSW). Accomplishments and plans described below are examples for each effort category.

***FY 2024 Plans:***

- Continue to add capability to the Interactive Scenario Builder Tactical Decision Aid (BUILDER). Specific elements including improved boundary layer characteristics (focused on vertical refractivity profiles), integration of expanded METOC numerical model information, and demonstration of probabilistic ensemble information to better inform uncertainty range of applications given environmental variability.
- Continue to transition ocean acoustic prediction and database innovations via the Scalable Tactical Acoustic Propagation Loss Engine (STAPLE) project, which leverages ties to USW programs of record via the APB/CPB incremental build processes.
- Continue to transition Ocean-Atmosphere Master Library (OAML) model and database improvements into the Scalable Tactical Acoustic Propagation Loss Engine (STAPLE). The objective is to provide state-of-the-art propagation models and tactical environmental information to ASW units.
- Continue enhancements to newly fielded RF and EO capabilities per fleet feedback, including efforts to transition tactical EMW and undersea warfare environmental information dissemination systems, and adoption of new tactical decision aid capabilities.
- Conclude incorporating lessons learned from NAVSLaM to create a holistic approach to atmospheric boundary layer turbulence observation, data-basing and modeling.

***FY 2025 Base Plans:***

- Continue mature capabilities in the operational Interactive Scenario Builder Tactical Decision Aid (BUILDER). Specific elements include incorporation of long-range surveillance performance prediction, improved boundary layer characteristics and EO/IR sensor prediction performance, integration of expanded METOC numerical model information- and demonstration of probabilistic ensemble information. Objective is to develop a comprehensive module providing electromagnetic impacts to tactical sensors.
- Continue to transition ocean acoustic prediction and database innovations via the Scalable Tactical Acoustic Propagation Loss Engine (STAPLE) project and its follow-on, the Common Tactical Decision Aid (CTDA).

<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3404 / <i>Tactical Environmental Support</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p>Specific efforts include direct integration of METOC programs into platform and sensor programs of record via the APB/CPB incremental build processes.</p> <p>-Continue to transition Ocean-Atmosphere Master Library (OAML) model and database improvements into the Scalable Tactical Acoustic Propagation Loss Engine (STAPLE)/Common Tactical Decision Aid (CTDA). The objective is to provide state-of-the-art propagation models and tactical environmental information to ASW units.</p> <p>-Continue enhancements to newly fielded RF and EO capabilities per fleet feedback, including efforts to transition tactical EMW and undersea warfare environmental information dissemination systems, and adoption of new tactical decision aid capabilities.</p> <p><b>FY 2025 OCO Plans:</b> N/A</p> <p><b>FY 2024 to FY 2025 Increase/Decrease Statement:</b> Decrease in funding from FY24 to FY25 is due to the conclusion of incorporating lessons learned from NAVSLaM to create a holistic approach to atmospheric boundary layer turbulence observation, data-basing and modeling.</p>					
<b>Accomplishments/Planned Programs Subtotals</b>	3.073	3.100	2.811	0.000	2.811

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

N/A

**Remarks**

**D. Acquisition Strategy**

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



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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3404 / <i>Tactical Environmental Support</i>

FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

<b>Proj 3404</b>	
Forward-based ocean and ocean acoustics modeling and data assimilation: STAPLE Transitions -- NSWCCD	██████████
Numerical prediction in support of atmospheric acoustics characterization: Atmospheric Acoustic Propagation (AAP) -- NRL-MRY	██
Numerical prediction in support of EM warfare and spectrum operations: RTP: Electromagnetic Spectrum Performance Products Ashore -- NRL-MRY / NRL-DC / NIWC-PAC	██
Numerical prediction in support of EM warfare and spectrum operations: Improved Atmospheric Models for Electromagnetic Maneuver Warfare -- NPS	██
Numerical prediction in support of EM warfare and spectrum operations: REFRACTIVITY PROFILE SUPPORT -- NRL-MRY	██
Numerical prediction in support of EM warfare and spectrum operations: NEOSPP and EMSPPA and SSCPAC Code 55280 TrueView team efforts -- SSC-PAC	██
Oceanographic and Ocean Acoustics Database Development: Environmental Post-Mission Analysis - TTS ocean and atmosphere data collection -- NRL-SSC	██



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<b>Exhibit R-4A, RDT&amp;E Schedule Details: PB 2025 Navy</b>		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3404 / <i>Tactical Environmental Support</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Proj 3404</b>				
Forward-based ocean and ocean acoustics modeling and data assimilation: STAPLE Transitions -- NSWCCD	1	2023	4	2023
Numerical prediction in support of atmospheric acoustics characterization: Atmospheric Acoustic Propagation (AAP) -- NRL-MRY	1	2023	4	2026
Numerical prediction in support of EM warfare and spectrum operations: RTP: Electromagnetic Spectrum Performance Products Ashore -- NRL-MRY / NRL-DC / NIWC-PAC	1	2023	4	2026
Numerical prediction in support of EM warfare and spectrum operations: Improved Atmospheric Models for Electromagnetic Maneuver Warfare -- NPS	1	2023	4	2027
Numerical prediction in support of EM warfare and spectrum operations: REFRACTIVITY PROFILE SUPPORT -- NRL-MRY	1	2023	4	2024
Numerical prediction in support of EM warfare and spectrum operations: NEOSPP and EMSPPA and SSCPAC Code 55280 TrueView team efforts -- SSC-PAC	1	2023	4	2026
Oceanographic and Ocean Acoustics Database Development: Environmental Post-Mission Analysis - TTS ocean and atmosphere data collection -- NRL-SSC	1	2023	4	2024
Satellite-based environmental monitoring for, analysis, assimilation and modeling: Preparing Tactical Optical Ocean Products from Satellite Sensors -- NRL-SSC	1	2023	4	2027
Scalable, distributed and adaptive ocean data collections methodologies: CAST: Cooperative Autonomous Sensing Team -- APL-UW	1	2023	4	2023
Scalable, distributed and adaptive ocean data collections methodologies: Guidance for Heterogeneous Observation Systems (GHOST) -- NRL-SSC	1	2023	4	2024

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy										<b>Date:</b> March 2024		
<b>Appropriation/Budget Activity</b> 1319 / 4					<b>R-1 Program Element (Number/Name)</b> PE 0603207N / Air/Ocean Tactical Applications				<b>Project (Number/Name)</b> 3405 / Decision Support Products & Dissemination			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>	<b>FY 2026</b>	<b>FY 2027</b>	<b>FY 2028</b>	<b>FY 2029</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
3405: Decision Support Products & Dissemination	4.629	1.180	1.245	1.236	-	1.236	1.280	1.301	1.327	1.355	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

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

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

	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<b>Title:</b> Decision Support Products and Dissemination	1.180	1.245	1.236	0.000	1.236
<b>Articles:</b>	-	-	-	-	-
<b>Description:</b> The Decision Support Products and Dissemination Project (3405) enables the future warfighter to leverage environmental data gathered, assimilated, predicted and exploited under Projects 2341 (METOC Collections), 2342 (METOC processing) and 3404 (METOC exploitation) by optimizing data formatting, compression, packaging, depiction, data-basing and transfer methodologies that permit the rapid dissemination of actionable battlespace environmental (METOC) information over tactical and reach-back networks. This project ensures warfighters, commanders and those who support them are fully synchronized in terms of environmental data products shared among a multitude of platforms, systems and common operating pictures (COPs). METOC information is highly dynamic. Just as time synchronization is essential to navigation principles, timely METOC knowledge and information synchronization is vital to battlespace environmental exploitation, placing the warfighter and all of those who support him on the "same sheet of music" and at a collective advantage, in terms of the current and predicted states of the ocean and atmosphere.					
Accomplishments and plans described below are examples for each effort category.					
<b>FY 2024 Plans:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3405 / <i>Decision Support Products &amp; Dissemination</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
<p>- Continue development of modeling and simulation capabilities for maritime targeting into BUILDER's Target Acquisition Weather Software (TAWS) replacement features, with increasing focus on next generation software integration, maturation, and verification/validation.</p> <p>- Continue to operationally evaluate and integrate automated mission environmental forecast briefings for unmanned aircraft. Specific projects will address large unmanned aircraft and will develop the capability to rapidly generate NATOPS compliant flight weather briefs.</p> <p>- Continue development of enhanced integration/visualization of meteorology and oceanography products for improved support to multiple mission areas.</p> <p>- Continue development of data compression and reduced-bandwidth transmission techniques to enable timely receipt of relevant environmental assessment and prediction data to forward platforms in strict communications environments.</p> <p>- Initiate improvements of aviation METOC services and integration into aviation decision tools, including integration into the next generation replacement for the Joint Mission Planning System (JMPS).</p> <p><b><i>FY 2025 Base Plans:</i></b></p> <p>-Continue to operationally evaluate and integrate automated mission environmental forecast briefings for unmanned aircraft. Specific projects will address large-unmanned aircraft and will develop the capability to rapidly generate NATOPS compliant flight weather briefs.</p> <p>-Continue development of enhanced integration/visualization of meteorology and oceanography products for improved support to multiple mission areas. Specific efforts include incorporating 3D visualization technology for tactical USW displays on forward deployed units, with the objective of enabling rapid decision making in low-information scenarios.</p> <p>-Continue development of data compression and reduced-bandwidth transmission techniques to enable timely receipt of relevant environmental assessment and prediction data to forward platforms in strict communications environments. Specific efforts include transmission of volumetric ocean data over extremely low bandwidth for forward use in USW scenarios.</p>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3405 / <i>Decision Support Products &amp; Dissemination</i>

<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>	<b>FY 2023</b>	<b>FY 2024</b>	<b>FY 2025 Base</b>	<b>FY 2025 OCO</b>	<b>FY 2025 Total</b>
-Continue maturation of aviation METOC services and integration into aviation decision tools, including integration into the next generation replacements for the Joint Mission Planning System (JMPS).					
-Conclude development of modeling and simulation capabilities for maritime targeting into BUILDER's Target Acquisition Weather Software (TAWS) replacement features, with increasing focus on next generation software integration, maturation, and verification/validation.					
<b><i>FY 2025 OCO Plans:</i></b> N/A					
<b><i>FY 2024 to FY 2025 Increase/Decrease Statement:</i></b> Decrease in funding from FY24 to FY25 due to the conclusion of certain modeling and simulation capabilities for maritime targeting into BUILDER's Target Acquisition Weather Software (TAWS) replacement features.					
<b>Accomplishments/Planned Programs Subtotals</b>	1.180	1.245	1.236	0.000	1.236

**C. Other Program Funding Summary (\$ in Millions)**  
N/A

**Remarks**

**D. Acquisition Strategy**

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



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**Exhibit R-4, RDT&E Schedule Profile: PB 2025 Navy** **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3405 / <i>Decision Support Products &amp; Dissemination</i>
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FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

<b><i>METOC Decisions and Dissemination - assessments</i></b>	
Numerical predictions skill assessments: Global Ocean Multi-Model Comparison -- NRL-SSC	
Numerical predictions skill assessments: Ocean model performance indicators for operational Navy ocean and acoustic model assessment -- NRL-SSC	
<b><i>METOC Decisions and Dissemination - targeted and tactical scales</i></b>	
Forward-based ocean and ocean acoustics modeling and data assimilation: Adaptive Air ASW Planning and Evaluation Tool	
Forward-based ocean and ocean acoustics modeling and data assimilation: Numerical prediction in support of Navy Resource protection: ADVANCED ship routing and base preparedness algorithms	
Numerical prediction in support of EM warfare and spectrum operations: Environmental Performance Surfaces for OTH Radars and HF Communications (AKA, Pearman OTH RADAR Exploitation) -- NRL-SSC	
Numerical prediction in support of EM warfare and spectrum operations: Improve aviation METOC services and integration into aviation decision tools, including integration to for replacement JMPS.	

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 3405 / <i>Decision Support Products &amp; Dissemination</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>METOC Decisions and Dissemination - assessments</i></b>				
Numerical predictions skill assessments: Global Ocean Multi-Model Comparison -- NRL-SSC	1	2023	4	2024
Numerical predictions skill assessments: Ocean model performance indicators for operational Navy ocean and acoustic model assessment -- NRL-SSC	1	2023	4	2024
<b><i>METOC Decisions and Dissemination - targeted and tactical scales</i></b>				
Forward-based ocean and ocean acoustics modeling and data assimilation: Adaptive Air ASW Planning and Evaluation Tool	1	2023	4	2024
Forward-based ocean and ocean acoustics modeling and data assimilation: Numerical prediction in support of Navy Resource protection: ADVANCED ship routing and base preparedness algorithms	1	2023	4	2027
Numerical prediction in support of EM warfare and spectrum operations: Environmental Performance Surfaces for OTH Radars and HF Communications (AKA, Pearman OTH RADAR Exploitation) -- NRL-SSC	1	2023	4	2026
Numerical prediction in support of EM warfare and spectrum operations: Improve aviation METOC services and integration into aviation decision tools, including integration to for replacement JMPS.	1	2024	4	2027

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**Exhibit R-2A, RDT&E Project Justification:** PB 2025 Navy **Date:** March 2024

<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>
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COST (\$ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
9999: <i>Congressional Adds</i>	0.000	20.272	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	20.272
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

**A. Mission Description and Budget Item Justification**

Conduct research in infrared optimized telescope and maritime unattended sensors.

**B. Accomplishments/Planned Programs (\$ in Millions)**

	FY 2023	FY 2024
<b>Congressional Add:</b> Infrared optimized telescope	2.896	0.000
<b>FY 2023 Accomplishments:</b> Conduct research in infrared optimized telescope.		
<b>FY 2024 Plans:</b> N/A		
<b>Congressional Add:</b> Maritime unattended sensors	17.376	0.000
<b>FY 2023 Accomplishments:</b> Conduct research in maritime unattended sensors.		
<b>FY 2024 Plans:</b> N/A		
<b>Congressional Adds Subtotals</b>	20.272	0.000

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

N/A

**Remarks**

**D. Acquisition Strategy**

N/A



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<b>Exhibit R-4, RDT&amp;E Schedule Profile:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>

FY 2023				FY 2024				FY 2025				FY 2026				FY 2027				FY 2028				FY 2029			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

<b>Proj 9999</b>	
Environmental and Tropical	[REDACTED]

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2025 Navy		<b>Date:</b> March 2024
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603207N / <i>Air/Ocean Tactical Applications</i>	<b>Project (Number/Name)</b> 9999 / <i>Congressional Adds</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Proj 9999</b>				
Environmental and Tropical	4	2024	3	2025