Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy											Date: March 2023	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 6: *RDT&E Management Support*					R-1 Program Element (Number/Name) PE 0605866N *I Navy Space & Electr Warfare Supt*							
COST ($ in Millions)	**Prior Years**	**FY 2022**	**FY 2023**	**FY 2024 Base**	**FY 2024 OCO**	**FY 2024 Total**	**FY 2025**	**FY 2026**	**FY 2027**	**FY 2028**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	17.238	27.172	27.504	-	27.504	27.435	26.712	27.014	27.562	Continuing	Continuing
0706: *EMC & RF Mgmt*	0.000	2.550	2.584	2.686	-	2.686	2.620	2.648	2.687	2.733	Continuing	Continuing
3239: *Real-Time Spectrum Operations (RTSO)*	0.000	14.688	24.588	24.818	-	24.818	24.815	24.064	24.327	24.829	Continuing	Continuing

A. Mission Description and Budget Item Justification

Project 0706, Electromagnetic Compatibility (EMC) and Radio Frequency (RF) Management Program. This project develops tools, processes, EMC Criteria for Navy Systems, and algorithms to identify and mitigate Electromagnetic Interference (EMI) sources for Navy systems and platforms.

Project 3239, The Real-Time Spectrum Operations (RTSO) effort researches and develops software to automate analyses of the electromagnetic (EM) environmental effects (E3) between shipboard transmitters and receivers on ships and the interactions of the EM systems within the other systems installed on units within a strike group. RTSO develops and updates numerical models, algorithms, data bases, and software aiding and supporting warfighter spectrum planning, sensing and monitoring of the EM environment, EM spectrum characterization and prediction, and managing and maneuvering within the EM spectrum.

B. Program Change Summary ($ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	17.653	27.175	27.650	-	27.650
Current President's Budget	17.238	27.172	27.504	-	27.504
Total Adjustments	-0.415	-0.003	-0.146	-	-0.146
• Congressional General Reductions	-	-0.003			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.415	0.000			
• Program Adjustments	0.000	0.000	-0.500	-	-0.500
• Rate/Misc Adjustments	0.000	0.000	0.354	-	0.354

Change Summary Explanation

FY24 program adjustments: -$500K reduction to Real Time Spectrum Operations (RTSO)

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 6	R-1 Program Element (Number/Name) PE 0605866N / *Navy Space & Electr Warfare Supt*	Project (Number/Name) 0706 / *EMC & RF Mgmt*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
0706: *EMC & RF Mgmt*	0.000	2.550	2.584	2.686	-	2.686	2.620	2.648	2.687	2.733	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Electromagnetic Compatibility (EMC) and Radio Frequency (RF) Management Program. This project develops tools, processes, and algorithms to identify and mitigate Electromagnetic Interference (EMI) sources for Navy systems and platforms.

(a) It will support the research, development, testing, and evaluation of electromagnetic compatibility criteria and frequency management to support afloat electromagnetic spectrum operations. The RF EMC criteria will be enhanced to include new RF systems and to comply with fleet operational requirements and streamline Strike Force frequency management processes. It will provide automated Spectrum Management (SM) compatibility criteria for development of operational task communication and radar/weapon plans to support fleet deployments, exercises, and contingency operations. It will provide identification and mitigation of EMI in Navy, North Atlantic Treaty Organization (NATO), Allied, Ashore and Joint Combat Operations. It will provide analysis related to spectrum reallocation proposals to assess impacts on Navy operations and systems, as well as for the Spectrum Supportability Risk Assessments. It will assist numbered fleet commands and DoD commands with determination of EMC criteria and processes to maximize ships' ability to operate in contested and congested environments.

(b) It will support the Shipboard Electromagnetic Compatibility Improvement Program (SEMCIP) to identify, engineer, and evaluate effectiveness of potential EMI corrections. The program also characterizes and quantifies the operational impact of EMI problems on system's mission performance.

(c) It will support the Nuclear Electromagnetic Pulse (EMP) Survivability Program. The program assesses the EMP survivability of all mission critical systems and funds development of a hardness assurance and maintenance program. It will develop improved modeling capability to reduce hardness validation costs at delivery and over the lifetime of the system/platform. The program develops new and updated design criteria, test methodology, test limits, and survivability validation procedures for all Navy systems, ships, submarines and shore facilities.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: RF Management	0.404	0.385	0.409	0.000	0.409
Articles:	-	-	-	-	-
FY 2023 Plans: - Provide engineering analyses and recommendations for updating Littoral Radiation Restrictions for numbered fleet areas of responsibility. Document the worldwide Littoral Radiation Restrictions and provide to the fleet and to Real-Time Spectrum Operations (RTSO).					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 6	**R-1 Program Element (Number/Name)** PE 0605866N / *Navy Space & Electr Warfare Supt*	**Project (Number/Name)** 0706 / *EMC & RF Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Conduct engineering analyses and testing to determine EMC criteria for Navy assets, such as AN/SPN-50. - Document EMC criteria in NAVSEA Operational Publication S9407-AA-GYE-010/(S) OP-3840 "Electromagnetic Compatibility Criteria for Navy Systems (U)". - Revise and update Standing Operational Tasking (OPTASK) Communications Plans to accommodate Navy equipment and host nation regulations. - Provide impact assessments and analysis for new spectrum-dependent equipment, spectrum policy updates, and changing geopolitical conditions. - Serve as the Navy's subject matter experts for spectrum de-confliction, EMC, and tactical spectrum management within Navy, DoD, and external components. - Represent Navy tactical spectrum management requirements in various working groups and venues, including Electromagnetic Battle Management (EMBM), electromagnetic maneuver warfare (EMW), and electromagnetic spectrum operations (EMSO) efforts. Integrate Navy spectrum management requirements into joint and DoD enterprise architectures and processes.					
FY 2024 Base Plans: - Provide engineering analyses and recommendations for updating Littoral Radiation Restrictions for numbered fleet areas of responsibility. Document the worldwide Littoral Radiation Restrictions and provide to the fleet and to Real-Time Spectrum Operations (RTSO). - Continue to conduct engineering analyses and testing to determine EMC criteria for Navy assets, such as AN/SPN-50. - Document EMC criteria in NAVSEA Operational Publication S9407-AA-GYE-010/(S) OP-3840 "Electromagnetic Compatibility Criteria for Navy Systems (U)". - Continue to revise and update Standing Operational Tasking (OPTASK) Communications Plans to accommodate Navy equipment and host nation regulations. - Continue to provide impact assessments and analysis for new spectrum-dependent equipment, spectrum policy updates, and changing geopolitical conditions. - Serve as the Navy's subject matter experts for spectrum de-confliction, EMC, and tactical spectrum management within Navy, DoD, and external components. - Represent Navy tactical spectrum management requirements in various working groups and venues, including Electromagnetic Battle Management (EMBM), electromagnetic maneuver warfare (EMW), and electromagnetic spectrum					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 6	**R-1 Program Element (Number/Name)** PE 0605866N / *Navy Space & Electr Warfare Supt*	**Project (Number/Name)** 0706 / *EMC & RF Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
operations (EMSO) efforts. Integrate Navy spectrum management requirements into joint and DoD enterprise architectures and processes. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** .024 increase provides additional hours for EMC criteria development, testing.					
Title: Shipboard Electromagnetic Compatibility Improvement Program (SEMCIP) ***Articles:*** ***FY 2023 Plans:*** - Continue characterization of technical impacts of new, high priority shipboard EMI problems reported and predicted from to date. - Develop new EMI fixes and evaluate their effectiveness in mitigating shipboard EMI. - Implement Unmanned Bit Error Rate Test (UBERT) capability into Ship EMC Certification to characterize EMI impacts on SATCOM links. - Evaluate Unmanned Bit Error Rate Test (UBERT) capability for adaptive, shipboard EBEM replacement modem. - Evaluate and improve autonomous EMI detection capabilities for radar and communication systems in order to reduce test time and quantify likelihood over extended periods, like ship underway periods or operational deployments. - Continue development and implementation of high frequency (HF) intermodulation (IMI) test methods and standards, and alternate test methods applicable to digital HF receivers. ***FY 2024 Base Plans:*** - Continue characterization of technical impacts of new, high priority shipboard EMI problems reported and predicted from to date. - Continue to develop new EMI fixes and evaluate their effectiveness in mitigating shipboard EMI. - Continue to implement Unmanned Bit Error Rate Test (UBERT) capability into Ship EMC Certification to characterize EMI impacts on SATCOM links. - Continue to evaluate Unmanned Bit Error Rate Test (UBERT) capability for adaptive, shipboard EBEM replacement modem.	1.219 -	1.245 -	1.307 -	0.000 -	1.307 -

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 6	**R-1 Program Element (Number/Name)** PE 0605866N / *Navy Space & Electr Warfare Supt*	**Project (Number/Name)** 0706 / *EMC & RF Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue to evaluate and improve autonomous EMI detection capabilities for radar and communication systems in order to reduce test time and quantify likelihood over extended periods, like ship underway periods or operational deployments. - Continue development and implementation of high frequency (HF) intermodulation (IMI) test methods and standards, and alternate test methods applicable to digital HF receivers. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** .062 increase provides more engineering hours supporting core capability to achieve electromagnetic compatibility (EMC) by effective prevention, identification, characterization, resolution, and control of electromagnetic interference (EMI) impacting U.S. Naval surface and strike groups in joint and littoral operations					
Title: Electromagnetic Pulse (EMP) Survivability	0.927	0.954	0.970	0.000	0.970
Articles:	-	-	-	-	-
FY 2023 Plans: - Continue research, development and refinement of new Hybrid-Based High Altitude Electrometric Pulse (HEMP) evaluation technique to evaluate HEMP hardness of navy ships via a low-cost, low potential for equipment damage and quicker method of analysis (decreasing costs in the performance of tests). - Continue research, development and investigation of small, inexpensive measurement devices for incorporation into Hybrid-Based HEMP evaluation methodology. - Validate Cable Shield Transfer Impedance in-situ testing for evaluating shipboard cables. - Investigate Parametric Cable measurement techniques. - Investigate usage of magneto-optic media High Altitude Electrometric Pulse (HEMP)-Induced Current Sensors to observe magnetic-field onboard ships using swept continuous wave testing. - Research and develop integration of Continuous Wave Antenna into EXpanded EMP Test - Capabilities (EXEMPT C) effort for ship High Altitude Electrometric Pulse (HEMP) health testing and demonstration. - Integrate Digital Data re-construction of magnetic tapes to computer format from the early 1990's Electromagnetic Pulse Radio Frequency (RF) Environment Simulator for Ships (EMPRESS) II into the validation of Computational Electromagnetics modeling.					
FY 2024 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 6	**R-1 Program Element (Number/Name)** PE 0605866N / *Navy Space & Electr Warfare Supt*	**Project (Number/Name)** 0706 / *EMC & RF Mgmt*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research, development and refinement of new Hybrid-Based High Altitude Electrometric Pulse (HEMP) evaluation technique to evaluate HEMP hardness of navy ships via a low-cost, low potential for equipment damage and quicker method of analysis (decreasing costs in the performance of tests) and identify potential EMP vulnerabilities and mitigating solutions. - Continue research, development and investigation of small, inexpensive measurement devices for incorporation into Hybrid-Based HEMP evaluation methodology. - Continue to validate Cable Shield Transfer Impedance in-situ testing for evaluating shipboard cables. - Continue to investigate Parametric Cable measurement techniques. - Continue to investigate usage of magneto-optic media High Altitude Electrometric Pulse (HEMP)-Induced Current Sensors to observe magnetic-field onboard ships using swept continuous wave testing. - Research and develop integration of Continuous Wave Antenna into EXpanded EMP Test - Capabilities (EXEMPT C) effort for ship High Altitude Electrometric Pulse (HEMP) health testing and demonstration. - Integrate Digital Data re-construction of magnetic tapes to computer format from the early 1990's Electromagnetic Pulse Radio Frequency (RF) Environment Simulator for Ships (EMPRESS) II into the validation of Computational Electromagnetics modeling. ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** .016 increase due development of ship HEMP health demonstration planned for out-year.					
Accomplishments/Planned Programs Subtotals	2.550	2.584	2.686	0.000	2.686

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy			Date: March 2023
Appropriation/Budget Activity 1319 / 6	R-1 Program Element (Number/Name) PE 0605866N / *Navy Space & Electr Warfare Supt*	Project (Number/Name) 3239 / *Real-Time Spectrum Operations (RTSO)*	

COST ($ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
3239: *Real-Time Spectrum Operations (RTSO)*	0.000	14.688	24.588	24.818	-	24.818	24.815	24.064	24.327	24.829	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Real-Time Spectrum Operations (RTSO) develops tools, processes, and algorithms to conduct spectrum planning, sense and monitor the electromagnetic (EM) environment, characterize and predict electromagnetic (EM) environmental effects (E3), and manage and maneuver to avoid and mitigate electromagnetic interference (EMI) and EM vulnerability of Navy systems and platforms.

RTSO supports Navy and Marine Corps Electromagnetic Spectrum Operations for global spectrum usage and allocation planning. The effort researches the effects between shipboard transmitters and receivers on ships and EM systems interactions within the other systems installed on strike ship units. RTSO developed a capability to sense and monitor shipboard EM spectrum usage and validate spectrum plans to support Emissions Control (EMCON) within the strike group. RTSO software validates and displays spectrum plan compliance with a spectrum common operational picture. This EM spectrum management aid, combined with an Own Force Monitoring (OFM) sensor input, supports Battlespace Awareness and Information Operations. These self-awareness and validation capabilities greatly enhance the Navy's ability to perform command and control of the EM spectrum warfighting domain.

FY 2024 will develop and test Spectral Warrior capability replacements and begin to deploy OFM capability to non- Ship's Signal Exploitation Equipment (SSEE) platforms. Additionally, funds will allow further Joint Capability Technology Demonstration (JCTD) Radiant Touchstone development efforts. (Details held at a higher classification)

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Real-Time Spectrum Operations (RTSO)	14.688	24.588	24.818	0.000	24.818
Articles:	-	-	-	-	-
FY 2023 Plans: - Begin to develop a permanent solution to Spectral Warrior capability replacements and integration efforts to deploy Own Force Monitoring (OFM) capability to non- Ship's Signal Exploitation Equipment (SSEE) platforms. (Details held at a higher classification) - Begin to test, integrate, and transition Ship's Signal Exploitation Equipment (SSEE) Own Force Monitoring (OFM) capability to non-SSEE platforms. Fielding designs meet critical Fleet requirements for Emissions Control (EMCON) validation and Tactical Situation (TACSIT) management on all non-Ship's Signal Exploitation					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 6	**R-1 Program Element (Number/Name)** PE 0605866N / *Navy Space & Electr Warfare Supt*	**Project (Number/Name)** 3239 / *Real-Time Spectrum Operations (RTSO)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Equipment (SSEE) capable ships, to meet validated Own Force Monitoring (OFM) capability requirements outlined in U.S. Fleet Forces Command / Commander, U.S. Pacific Fleet RTSO Requirements. - Continue transition efforts for an OFM capability integrated with SSEE systems. Fielding designs meet critical Fleet requirements for Emissions Control (EMCON) validation and TACSIT management on all non-capable ships, to meet validated OFM capability requirements outlined in U.S. Fleet Forces Command / Commander, U.S. Pacific Fleet RTSO Requirements. - Continue to research, develop, enhance and refine Cloud architecture, Spectrum Common Operational Picture (COP), Live data, Detect, counter-detect (1-to-1), Time slide, and Network nodes - Continue research and development of proof-of-concept capabilities for spectrum mission planning decision aids and intelligent sectoring/cut-outs for radiating systems - Continue research and development efforts for models to estimate effective RF performance ranges of spectrum dependent systems in the complex electromagnetic environment (one-on-one and multi-on-one effects) - Continue to participate in LOEs to demonstrate incremental capability to Fleet users - Continue development of an architecture supporting mission module delivery of RTSO capability on all platforms - Finalize RTSO v2.0 release to ashore and afloat Fleet users in a cloud environment					
FY 2024 Base Plans: - Continue developing a permanent solution to non-permanent Spectral Warrior capabilities, detecting electromagnetic interference (EMI) of satellite communications and integration efforts to deploy Own Force Monitoring (OFM) capability to non- Ship's Signal Exploitation Equipment (SSEE) platforms. (Details held at a higher classification) - Continue testing, integration, and transition of SSEE OFM capability to non-SSEE platforms. Fielding designs will meet critical Fleet requirements for EMCON validation and Tactical Situation (TACSIT) management on all non-SSEE capable ships, to meet validated OFM capability requirements outlined in U.S. Fleet Forces Command / Commander, U.S. Pacific Fleet RTSO Requirements - Continue transition efforts for an OFM capability integrated with SSEE systems on surface combatants and force level platforms to meet validated OFM capability requirements outlined in U.S. Fleet Forces Command / Commander, U.S. Pacific Fleet RTSO Requirements - Continue research, development, enhancement and refinement of RTSO software cloud architecture, spectrum common operational picture (COP), live data ingest, detection and counter-detection (1-to-1), time slide, and network nodes					

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 6	**R-1 Program Element (Number/Name)** PE 0605866N / *Navy Space & Electr Warfare Supt*	**Project (Number/Name)** 3239 / *Real-Time Spectrum Operations (RTSO)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
- Continue research and development of proof-of-concept capabilities for spectrum mission planning decision aids and intelligent sectoring/cut-outs for radiating systems - Continue research and development efforts for models to estimate effective RF performance ranges of spectrum dependent systems in the complex electromagnetic environment (one-on-one and multi-on-one effects) - Continue to participate in LOEs to demonstrate incremental capability to Fleet users - Continue development of a software architecture supporting mission module delivery of RTSO capability on all platforms - Finalize RTSO v2.1 release to afloat Fleet users in a cloud environment, including integration testing, cybersecurity authorization, and completing deployment configurations for all deployment environments - Begin engineering work to validate current design for at least seven different ship classes. - Begin engineering research and development integrating RTSO software and outputs with other software applications - Hold fleet user engagements to gain sailor feedback on latest software capabilities to improve usability, functionality, and applicability to user requirements ***FY 2024 OCO Plans:*** N/A ***FY 2023 to FY 2024 Increase/Decrease Statement:*** Real-Time Spectrum Operations (RTSO) FY 2023 to FY 2024 increase (+$0.23M) is attributed to beginning engineering research and development integrating RTSO software and outputs with other software applications.					
Accomplishments/Planned Programs Subtotals	14.688	24.588	24.818	0.000	24.818

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
• OPN/2360: *Shipboard IW Exploit*	261.735	289.974	379.230	-	379.230	368.023	397.560	418.278	429.876	Continuing	Continuing

Remarks

D. Acquisition Strategy

N/A