Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy											Date: May 2017	
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	6.316	9.658	17.341	-	17.341	18.686	22.023	19.024	19.944	Continuing	Continuing
0706: *EMC & RF Mgmt*	0.000	6.316	9.658	17.341	-	17.341	18.686	22.023	19.024	19.944	Continuing	Continuing

Note

Increased budget from FY 2017 to FY 2018 is required make updates to the RTSO Software 1.0 to enable new features in support of enabling Electromagnetic Maneuver Warfare (Battlespace Awareness, Assured Command and Control, Maneuver, and Integrated Fires) and provide RTSO Software 1.0 to every ship in the Navy. Funding to support continual testing and updates, ship integration requirements (Ship Change Document, Information Assurance Accreditation, and Crew Training).

A. Mission Description and Budget Item Justification

Project 0706, Electromagnetic Compatibility (EMC) and Radio Frequency (RF) Management Program: Develops advanced technology to identify and eliminate Electromagnetic Interference (EMI) sources from Navy systems. Supports research and development technology efforts, develops top-level plans, and supports systems in the Space and Electronic Warfare (SEW) mission area.

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	5.316	9.658	11.520	-	11.520
Current President's Budget	6.316	9.658	17.341	-	17.341
Total Adjustments	1.000	0.000	5.821	-	5.821
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.000	0.000			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	5.800	-	5.800
• Rate/Misc Adjustments	0.000	0.000	0.021	-	0.021

Change Summary Explanation

Increased budget from FY 2017 to FY 2018 is required make updates to the RTSO Software 1.0 to enable new features in support of enabling Electromagnetic Maneuver Warfare (Battlespace Awareness, Assured Command and Control, Maneuver, and Integrated Fires) and provide RTSO Software 1.0 to every ship in the Navy.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
0706: *EMC & RF Mgmt*	0.000	6.316	9.658	17.341	-	17.341	18.686	22.023	19.024	19.944	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 EMI sources for Navy systems and platforms.

(a) It will support the Afloat Electromagnetic Spectrum Operations Program (AESOP), an automated spectrum Fleet operational capability. The application will be enhanced to comply with fleet operational requirements and streamline Strike Force frequency management processes. It will provide automated Spectrum Management (SM) tools 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.

(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.

(d) It will support the Real-Time Spectrum Operations Program. The program investigates Electromagnetic (EM) Environmental effects between shipboard transmitters/ receivers and develops EM and spectrum techniques with Commercial off the shelf (COTS) technologies to provide the ability to monitor EM spectrum usage and system EM degradation on all ships in a given strike group. The program will investigate technologies to build an EM Spectrum Common Operational Picture (COP) to detect and assess operational capabilities in real-time. Additional investigations will be performed to develop processes and procedures to predict the EM environment for planning purposes. In the out-years, these capabilities will be used to build the next generation combat system with inherent spectrum agility and self-awareness capability, further enhancing the Navy's ability to perform Command and Control (C2) of the EM Spectrum warfighting domain.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: Afloat Electromagnetic Spectrum Operations Program (AESOP)	0.420	0.420	0.680	0.000	0.680
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
FY 2016 Accomplishments: - Initiated effort to modularize AESOP source code to allow easier integration with next gen software tools [Real Time Spectrum Operations (RTSO) / Electromagnetic Maneuver Warfare (EMW) - Added Emission Control (EMCON) source code to both RTSO and AESOP systems, providing a more integrated approach. - Attended the Spectral Tsunami War-game and provided input for the use of AESOP in the future - Attended Department of Navy Spectrum Summit and delivered a brief on AESOP updates - Met with Spectrum Knowledge Framework (SKF) team from Office of Naval Research (ONR) and discussed the integration of AESOP data - Researched the Orchestrated Simulation through Modeling (OSM) program. - Attended System Integration meetings with the Orchestrated Simulation through Modeling (OSM) program. - Researched Spectral Warrior data / views for display within AESOP. - Researched and developed plans with RTSO/EMW teams to integrate Spectral Warrior modules. - Held six (6) integrated AESOP/RTSO Configuration Control Board (CCB) meetings to discuss software and database merger requirements.					
FY 2017 Plans: - Identify new/modified military equipment and review their spectrum usage to provide capability to ships. - Develop software and database modifications to support new Navy shipboard systems; i.e. DBR, AMDR, EASR, etc - Develop software and database modifications to enhance spectrum planning based on fleet requirements, including in the areas of TACAN and below decks wireless. - Update the common system database elements with equipment parameters, platform data, policy/littoral restrictions information. - Develop software modifications as needed to ensure interoperability and common analysis tools/techniques (e.g., propagation models). - Evaluate International, National, DoD and Navy spectrum processes that could impact Naval operations. - Assess potential changes and develop tests to evaluate potential updates to the fleet operational application.					
FY 2018 Base Plans: - Research International, National, DoD and Navy spectrum processes that could impact Naval operations. - Identify new/modified military equipment and review their spectrum usage to provide capability to ships.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Perform analysis of these new/modified systems against existing Fleet equipment spectrum use, and develop potential scenarios for further testing and evaluation. - Evaluate, test, and integrate into the software updates to toolkits and application programming interfaces (APIs), such as ArcGIS, SQL Server, and propagation models such as the Advanced Propagation Model (APM). ***FY 2018 OCO Plans:*** N/A					
Title: Shipboard Electromagnetic Compatibility Improvement Program (SEMCIP)	1.033	1.270	1.655	0.000	1.655
Articles:	-	-	-	-	-
FY 2016 Accomplishments: - Performed evaluation EMI on of USS ARLINGTON (LPD 24) to determine point of entry of HF transmissions to the Load and Motion Indicator (LMI) of the Boom Crane. Results of testing/analysis enabled crane manufacturer to redesign LMI signal wire installation routing to reduce interference. - Completed evaluation of mast reflections from AN/WSC-6(V)9 SATCOM to AN/SLD-4 Electronic Support Measure to identify and install radar absorbing material (RAM) on LCS Freedom Variant. - Completed evaluation of mast reflections from/to the AN/SPS-75 radar to identify and install radar absorbing material (RAM) on LCS Independence Variant. - Performed AN/SPQ-9B radar testing of the newest prototype receive band-pass filter design on AEGIS Cruiser test ship. The filter in conjunction with the newly designed Transmit filter improves radar performance and together they help to reduces identified radar interference. - Evaluated report of AN/SPS-35 radar interference to the AN/WSC-6 and AN/WSC-9 Navy Multi-Band Terminal SATCOMs causing reduced bit error rates. The EMI was identified as a maintenance issue, enclosure doors were opened allowing energy to penetrate critical components. A warning sticker has been created and will be placed on the exterior cabinets to remind Fleet technicians to ensure doors are properly secured after maintenance actions are complete.					
FY 2017 Plans: - As new problems are identified, perform EMI Problem Characterization and Quantification to identify level of problem severity. - EMI problems with a high severity level can debilitate the combat capability of strike force capability and operational readiness will be added to the priority list for evaluating potential EMI solutions. - In FY2017 the program will continue evaluation of the Navy's Next Generation: Radars (i.e., Multi-Band and Dual Band Radars), Electronic Warfare Systems (i.e., Ships Signal Exploitation Equipment Increment F),					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Satellite Communication (i.e., the Navy Multi-Band Terminal and the Commercial Broadband Satellite Program), and Common Data Link (CDL) Programs. - An additional focus area is the evaluation of Commercial Off the Shelf (COTS) systems/radars and the integration of Unmanned Aircraft Systems (UAS). - Develop and evaluate the effectiveness of proposed EMI solutions and coordinate with system program managers for proper integration of the final EMI solution. ***FY 2018 Base Plans:*** - As new problems are identified, perform EMI Problem Characterization and Quantification to identify level of problem severity. EMI problems with a high severity level can debilitate the combat capability of strike force capability and operational readiness will be added to the priority list for evaluating potential EMI solutions. - The program will evaluate the Navy's Next Generation: Radars (i.e., Multi-Band and Dual Band Radars), Electronic Warfare Systems (i.e., Ships Signal Exploitation Equipment Increment F), Satellite Communication (i.e., the Navy Multi-Band Terminal and the Commercial Broadband Satellite Program), and Common Data Link (CDL) Programs. - The program will focus on the evaluation of Commercial Off the Shelf (COTS) systems/radars and the integration of Unmanned Aircraft Systems (UAS). - The program will develop and evaluate the effectiveness of proposed EMI solutions and coordinate with system program managers for proper integration of the final EMI solution. ***FY 2018 OCO Plans:*** N/A					
Title: Electromagnetic Pulse (EMP) Survivability	0.924	1.004	0.834	0.000	0.834
Articles:	-	-	-	-	-
FY 2016 Accomplishments: - Supported the EMP Maritime Standard for Surface Ships. Attended and participated in 6 meetings. MIL-STD 4023 published 25 Jan 2016 - Held Pulse Current Injection Technical Interchange to review current test methods and proposed enhancements; performed side-by-side comparison testing utilizing various test equipment; and discussed the development of an improved Electromagnetic Pulse (EMP) test method - Modified test fixture to be used as a shielded enclosure for the purposes R&D work relating to free-field cable coupling and pulse current injection analysis and design					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Investigated signal reconstruction algorithms to process signals collected during testing of afloat and ashore HEMP testing - Developed Low Level Continuous Wave Illumination test plan for a ship test in accordance with MIL-STD 4023 Appendix C and to support upfront planning and testing for potential Central Test &Evaluation Investment Program (CTEIP) investment of a large scale LLCWI simulator - Refined Navy patented Cable Shield Ground Adaptor for use in ashore facilities -Supported ashore facility in Pulse Current Injection (PCI) testing as well as installation of Navy patented Cable Shield Ground Adaptor. Assisted with shore based Hardness Maintenance / Hardness Surveillance plan and Integrated Survivability and Endurability Report (INSER) On-Site Assessment ***FY 2017 Plans:*** - Investigate Modeling and Simulation (M&S) Verification, Validation, & Accreditation (VV&A) efforts in support of obtaining a higher confidence, low cost High Altitude Electromagnetic Pulse (HEMP) survivability assessment in lieu of full ship threat level testing. - Conduct HEMP survivability assessment using existing methods onboard an existing ship and compare measurements to multiple, independent M&S investigations leveraging different methodologies. - Continue support for the Naval NSWCDD Naval Ordinance Transient Electromagnetic Simulator (NOTES) EMP Facility (ashore test bed). - Develop Data Acquisition conceptual capability for HEMP testing at NOTES facility and on afloat platforms - Investigate HEMP afloat testing technology concepts in order to support full ship HEMP testing requirements in MIL-STD 4023 ***FY 2018 Base Plans:*** - - Perform Modeling and Simulation (M&S) Verification, Validation, & Accreditation (VV&A) efforts - Support Development of obtaining a higher confidence, low cost High Altitude Electromagnetic Pulse (HEMP) survivability assessment in lieu of full ship threat level testing. - Conduct HEMP survivability assessments using existing methods onboard an existing ship and compare measurements to multiple, independent M&S investigations leveraging different methodologies -Complete Data Acquisition capability design - Initiate conceptual at-sea HEMP demonstration plan ***FY 2018 OCO Plans:*** N/A					
Title: Real-Time Spectrum Operations (RTSO)	3.939	6.964	14.172	0.000	14.172

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Articles:	-	-	-	-	-
FY 2016 Accomplishments: - Held a Propagation Workshop to build propagation and coupling application development plans. - Successfully integrated and demonstrated RTSO EMCON software with Pacific Pivot Own Force Monitoring System onboard USS JOHN C. STENNIS (CVN 74). - Installed RTSO Speed-to-Fleet (S2F) software and hardware on USS VELLA GULF (CG 72) and completed ship checks and several underway demonstrations. The S2F hardware provides the electronic warfare operator EMCON and spectrum policy validation in real-time. The system has proved to be very valuable to the warfighter.					
FY 2017 Plans: - Integrate the RTSO S2F Own Force Monitoring Software demonstrated on USS VELLA GULF (CG 72) with the 59 Fleet Forces Command Purchased Own Force Monitoring Kits. The kits are provided to deploying units. - Deliver the RTSO Software 1.0 (S2F Own Force Monitoring Software) to every ship in the Navy. The OFM software when used with the Own Force Monitoring Kits will provide the user interface to quickly identify EMCON compliance and authorized frequency plan compliance in real-time. - Investigate running the RTSO Software on the CANES shipboard server for future applications in providing spectrum awareness and status to multiple users. - Demonstrate the capability for real-time Electromagnetic Inference / Jamming detection awareness in a lab or test range environment.					
FY 2018 Base Plans: - Develop and integrate ship's positional updates to enable real-time calculations of electromagnetic interference/feed into a RTSO fleet/user interface that provides recommended actions to resolve the interference. - Investigate and integrate Meteorological and Oceanographic (METOC), refractivity, climatology data and update propagation models to include in the real-time calculations. - Finalize Consolidated Afloat Networks and Enterprise Services (CANES) network interface specification and integrate RTSO Software into the CANES network. This will provide spectrum awareness to multiple users. - Develop and publish a RTSO Spectrum Common Operating Picture (COP) to enable Electromagnetic Maneuver Warfare (EMW) capabilities and provide spectrum situational awareness of the strike group within the AOR.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Develop and integrate multiple user defined displays and Graphical User Interfaces (GUIs) so the operator can tailor their views based on the operational needs. - Develop and integrate Satellite Communications (SATCOM) tools (i.e., jamming, interference, and coverage) into a RTSO GUI for mission critical SATCOM systems. - Develop RTSO Software interface requirements for specific systems such as radar, electronic warfare, and communication systems. - Investigate and develop RTSO Software interface requirements for Combat Systems baselines [i.e., AEGIS and Ship Self-Defense System (SSDS)]. - Define RTSO Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities and Policy (DOTMLPF-P) requirements that effect Manpower, Personnel, Training and Education (MPT&E) requirements and solutions. -Perform initial DOTMLPF-P analysis to assess RTSO training requirements. Perform review/update/ development of Navy Tactical Tasks (NTAs) measures, standards, and criteria to support RTSO operation and maintenance. Perform review/update of Defense Readiness Reporting System-Navy (DRRS-N) to evaluate RTSO Personnel, Equipment, Supply, Training, Ordnance and Facilities (PESTOF) resource measures. -Develop a plan for RTSO training and certification requirements analysis for course development and implementation within the RTSO NTSP and Theater/Fleet Training Plans. Develop/update Job Duty Task Analysis (JDTA) requirements to support RTSO equipment basic operation/maintenance; and tactical operation to support Task Unit and Strike Group personnel. -Identify the Knowledge, Skills, and Abilities (KSAs) necessary for leaders, warfighters, civilians, and contractor personnel to understand and effectively utilize RTSO. Develop/update Personnel Qualification Standard (PQS) to support RTSO JDTA requirements. ***FY 2018 OCO Plans:*** - Provide fleet-requested RTSO software improvements to accommodate the intense/severe operational environment and constraints encountered in overseas contingency operations.					
Accomplishments/Planned Programs Subtotals	6.316	9.658	17.341	0.000	17.341

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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D. Acquisition Strategy

An acquisition strategy is not required.

E. Performance Metrics

Performance metrics will consist of quarterly program reviews.