Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy												Date: May 2021
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603271N *I Electromagnetic Systems Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	9.069	22.957	8.146	-	8.146	-	-	-	-	-	-
2913: *Electromagnetic Systems Advanced Technology*	0.000	9.069	7.957	8.146	-	8.146	-	-	-	-	-	-
9999: *Congressional Adds*	0.000	0.000	15.000	0.000	-	0.000	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Navy and Marine Corps' sophisticated electronics systems place heavy demands on the electromagnetic spectrum to accommodate information flow, defensive and offensive detection, tracking, and weapon system engagement. In distributed maritime operations, each of these platforms provides a set of capabilities that can be further combined for progressively larger and more complex operations. The Electromagnetic Systems Advanced Technology program addresses Radio Frequency (RF) technology for Surface and Aerospace Surveillance sensors and systems, Electronic Warfare (EW) sensors and systems, RF Communication Systems, Multi-Function sensor systems, and Position, Navigation and Timing (PNT) capabilities. Activities and efforts in this Program Element (PE) address technologies critical to enabling the transformation of discrete functions to network centric warfare capabilities, which simultaneously perform Radar, EW, and Communications and Network functions across platforms through multiple, simultaneous and continuous communications/data links.

Today's Sailors and Marines are enabled by Naval Science and Technology (S&T). Since 1946, the Office of Naval Research (ONR) has fostered scientific research related to the maintenance of maritime superiority and national defense. ONR manages the Department of the Navy's (DON) portfolio of naval Basic and Applied research, and Advanced Technology Development investments to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments hedge against uncertainty, providing solutions to commanders today, and options for the future. The Naval S&T budget supports higher guidance defined by the National Defense Strategy, and responds to requirements identified by the Secretary of the Navy through research priorities set by the Chief of Naval Research, coordinated across the Naval Research Enterprise (NRE), and outlined in the Naval R&D Framework.

This Program Element (PE) funds Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels (TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

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

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Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603271N *I Electromagnetic Systems Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	9.499	8.008	8.169	-	8.169
Current President's Budget	9.069	22.957	8.146	-	8.146
Total Adjustments	-0.430	14.949	-0.023	-	-0.023
• Congressional General Reductions	-	-0.051			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	15.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.199	0.000			
• SBIR/STTR Transfer	-0.231	0.000			
• Rate/Misc Adjustments	0.000	0.000	-0.023	-	-0.023

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: 9999: *Congressional Adds*		
Congressional Add: *All Digital Radar Technology*	0.000	15.000
Congressional Add Subtotals for Project: 9999	0.000	15.000
Congressional Add Totals for all Projects	0.000	15.000

Change Summary Explanation

funding: No significant change.

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603271N / *Electromagnetic Systems Advanced Technology*	Project (Number/Name) 2913 / *Electromagnetic Systems Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
2913: *Electromagnetic Systems Advanced Technology*	0.000	9.069	7.957	8.146	-	8.146	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Work in this project addresses cost-effective Radio Frequency (RF) technology for Surface and Aerospace Surveillance sensors and systems, Electronic Warfare (EW) sensors and systems, RF Communication Systems, Multi-Function sensor systems, and Position, Navigation and Timing (PNT) capabilities.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Electronic and Electromagnetic Systems	3.965	4.154	4.252	0.000	4.252
Articles:	-	-	-	-	-
Description: The overarching objective of the Electronic and Electromagnetic Systems Activity is to develop, test, and demonstrate Communications, Electronic Attack (EA), Electronic Surveillance (ES), Electronic Warfare (EW), and Radar functions. A portion of this Program Element (PE) is devoted to mid-term technology development in close concert with acquisition programs of record. The products of these efforts are planned for transition at the end of their schedule into the associated acquisition program of record. Technology development is focused on Distributed Electronic Warfare in support of Distributed Maritime Operations. Major thrust within the Electronics and Electromagnetic Systems program are: a) Advanced EW Enabling Technologies - Develop classified advanced electronic warfare technology in support of current and predicted capability requirements. ***FY 2021 Plans:*** Advanced Electronic Warfare Enabling Technologies: - Perform focused developments in the areas of Electronic Support (ES); decoys and countermeasures against weapon tracking and guidance systems; Electronic Attack (EA) against adversary Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance and Targeting (C4ISRT). - Develop Electronic Protection for our own weapons and Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) from intentional and unintentional interference. - Conduct Live, Virtual, and Constructive (LVC) test events of force-level kinetic/non-kinetic coordination and resource optimization.					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603271N / *Electromagnetic Systems Advanced Technology*	**Project (Number/Name)** 2913 / *Electromagnetic Systems Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Conduct analysis and report the results of FY 2020 test & evaluation activities. ***FY 2022 Base Plans:*** Advanced Electronic Warfare Enabling Technologies: - Continue research in the areas of Electronic Support (ES); decoys and countermeasures against weapon tracking and guidance systems; Electronic Attack (EA) against adversary Command, Control, Communications, Computers, Cyber Defense, Intelligence, Surveillance, Reconnaissance and Targeting (C5ISRT). - Continue development of Electronic Protection (EP) for our own weapons and C5ISRT from intentional and unintentional interference. - Continue analysis of results of FY21 test and evaluation activities, leading to refinement and modification of designs based on results. - Initiate implementation of modified and additional Electronic Warfare (EW) capabilities. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** No significant changes from FY 2021 to FY 2022.					
Title: Global Positioning System (GPS) and Navigation Technology	5.104	3.803	3.894	0.000	3.894
Articles:	-	-	-	-	-
Description: The overarching objective of this activity is to develop technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using non-Global Positioning System (GPS) navigation devices, or atomic clocks. This activity will increase the operational effectiveness of U.S. Naval units. The focus is on the mitigation of GPS electronic threats, the development of atomic clocks that possess unique long-term stability and precision, and the development of compact, low-cost, Inertial Navigation Systems (INS). ***FY 2021 Plans:*** Position, Navigation and Timing (PNT): - Complete research on automated celestial day night navigation for surface ships, transitioning to the Cooperative Engagement Capability program office. - Complete research on protected tactical waveforms for time transfer, transitioning to PMW 170's Wideband Anti-Jam Modem (WAM) system. - Continue research on miniature fiber optic inertial capability.					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603271N / *Electromagnetic Systems Advanced Technology*	**Project (Number/Name)** 2913 / *Electromagnetic Systems Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Continue research on wave forms for precision two way time transfer techniques and modem development. - Initiate research into mounted navigation for United States Marine Corps (USMC) specific platforms. - Initiate research into Low Earth Orbit constellation receivers for naval platforms. ***FY 2022 Base Plans:*** Position, Navigation and Timing (PNT): - Continue research on miniature fiber optic inertial capability to improve non-GPS navigation. - Continue research on waveforms for precision two-way time transfer techniques to mitigate GPS electronic threats. - Continue research into mounted alternative navigation systems for USMC specific platforms to improve operational effectiveness. - Continue research into Low Earth Orbit constellation receivers for naval platforms to improve operational effectiveness. - Initiate/Complete research on atom-interferometry-based gyroscope. - Initiate the development of components and systems to support alternative PNT solutions, e.g., Optical Doppler Velocity Log and Micro-Electromechanical Systems based gyroscopes. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** No significant changes from FY 2021 to FY 2022.					
Accomplishments/Planned Programs Subtotals	9.069	7.957	8.146	0.000	8.146

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603271N / *Electromagnetic Systems Advanced Technology*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	15.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Navy and Marine Corps' sophisticated electronics systems must continually be updated to accommodate increasing information flow, harsh electromagnetic operating conditions, defensive/offensive detection, tracking, and weapon system engagement needs. All Digital Radar Technology, already the core technology to an Air Force advanced threat emulator program, may be fully leveraged via the Electromagnetic Systems Advanced Technology Program to meet additional near term Department of Navy operational needs. With the requested funding, the Office of Naval Research will conduct an All Digital Radar Technology Advanced Technology Demonstration (ATD) and evaluation. The project will expand utilization beyond current advanced threat simulator applications, construct a U.S. prototype demo and evaluation and when appropriate, facilitate technology transfer to the United States..

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Congressional Add: All Digital Radar Technology	0.000	15.000
FY 2020 Accomplishments: N/A		
FY 2021 Plans: Conduct research supporting All Digital Radar Technology. Planned FY21 activities include contract award and kickoff meeting.		
Congressional Adds Subtotals	0.000	15.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A