Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy	Date: February 2018
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603671N *I (U)Navy Advanced Technology Development(ATD)*

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	0.000	131.502	-	131.502	171.675	181.216	160.056	163.309	Continuing	Continuing
3433: *Navy Advanced Technology Development (ATD)*	0.000	0.000	0.000	131.502	-	131.502	171.675	181.216	160.056	163.309	Continuing	Continuing

Note

Program Element (PE) 0603671N Navy Advanced Technology Development (ATD) is created in FY2019 to realign and consolidate Navy Advanced Technology Development efforts previously identified and justified in PEs 0603758N Navy Warfighting Experimentation and Demonstration, 0603782N Mine and Expeditionary Warfare Advanced Technology Dev., 0603729N Warfighter Protection Advanced Technology, 0603271N Electromagnetic Systems Advanced Technology, and 0603123N Force Protection Advanced Technology. These effort include Mine Technology; Joint EOD Demos; Naval Warfare Experimentation; Operations Analysis; SwampWorks; Tech Solutions; Noise Induced Hearing Loss (NIHL); Aircraft Technology; Electronic and Electromagnetic Systems Technology; Global Positioning System (GPS) and Navigation Technology; and Surface Ship and Submarine Hull Mechanical and Electrical Advanced Technology Development research efforts.

A. Mission Description and Budget Item Justification

The activities described in this program element (PE) address future Navy and Marine Corps capabilities needed to maintain maritime superiority and ensure national security. They are based on input from Naval Research Enterprise stakeholders and are designed to exploit breakthroughs in science and technology in order to deliver maximum warfighting benefit to our sailors and marines. These efforts are aligned with shared priorities throughout the Naval Research and Development Framework in order to quickly advance new capabilities from discovery to deployment across the warfighting domains. The portfolio of technologies advanced in the PE span the full breadth of research supporting the Navy and Marine Corp mission.

Technology development activities include projects and programs to support numerous high priority Advanced Technology Development opportunities and Navy and Marine Corp needs. These efforts include research supporting on-demand battlespace shaping through advanced undersea weapons; technologies to support a standoff or remote capability for detection and location, diagnosis, render safe, neutralization and enhanced access; efforts that seek to capitalize on recent technology breakthroughs to develop and integrate components including subsystems into prototypes quickly: efforts to provide operational analysis through studies, analyses, gaming and experimentation to identify Navy and Marine Corps capability needs that can be addressed with S&T solutions; exploration of high-risk, disruptive, and innovative technologies and concepts to provide a venue to develop innovative technologies that are targeted towards advancing the capabilities of naval warfighters; investments that provide rapid response Science and Technology (S&T) solutions to immediate Fleet/Force needs identified by individual warfighters at the deckplate level; specific electronic and electromagnetic systems research to improve weapons systems and data fusion technology; research to reduce and eliminate the incidence of noise reduced hearing loss; technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost; programs to develop, test, and demonstrate advanced communications, electronic attack (EA), electronic surveillance (ES), electronic warfare (EW), and radar functions; develop and demonstrate technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using either GPS systems, non-GPS navigation devices, or atomic clocks; efforts that support the development of technologies associated with various naval platforms (surface, subsurface and terrestrial) and the protection of those platforms; and protect the rights, safety, and welfare of human subjects in research supported by the Navy and Marine Corps.

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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 0603671N *I (U)Navy Advanced Technology Development(ATD)*

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

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	131.502	-	131.502
Total Adjustments	0.000	0.000	131.502	-	131.502
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Program Adjustments	0.000	0.000	131.895	-	131.895
• Rate/Misc Adjustments	0.000	0.000	-0.393	-	-0.393

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603671N / *(U)Navy Advanced Technology Development(ATD)*	Project (Number/Name) 3433 / *Navy Advanced Technology Development (ATD)*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
3433: *Navy Advanced Technology Development (ATD)*	0.000	0.000	0.000	131.502	-	131.502	171.675	181.216	160.056	163.309	Continuing	Continuing

Note

Project 3433 in PE 0603671N Navy Advanced Technology Development (ATD) is created in FY2019 to realign and consolidate Navy Advanced Technology Development efforts previously identified and justified in PEs Navy Warfighting Experimentation and Demonstration, 0603782N Mine and Expeditionary Warfare Advanced Technology Dev., 0603729N Warfighter Protection Advanced Technology, 0603271N Electromagnetic Systems Advanced Technology, and 0603123N Force Protection Advanced Technology. These effort include Mine Technology; Joint EOD Demos; Naval Warfare Experimentation; Operations Analysis; SwampWorks; Tech Solutions; Noise Induced Hearing Loss (NIHL); Aircraft Technology; Electronic and Electromagnetic Systems Technology; Global Positioning System (GPS) and Navigation Technology; and Surface Ship and Submarine Hull Mechanical and Electrical Advanced Technology Development research efforts.

A. Mission Description and Budget Item Justification

The activities described in this project address future Navy and Marine Corps capabilities needed to maintain maritime superiority and ensure national security. They are based on input from Naval Research Enterprise stakeholders (including the Naval enterprises, the combatant commands, OPNAV and Headquarters Marine Corps) and are designed to exploit breakthroughs in science and technology in order to deliver maximum warfighting benefit to our sailors and marines. These efforts are aligned with shared priorities throughout the whole of RDT&E in order to quickly advance new capabilities from discovery to deployment across the warfighting domains. The portfolio of technologies advanced in the PE span the full breadth of research supporting the Navy and Marine Corp mission.

Technology development activities include projects and programs to support numerous high priority Advanced Technology Development opportunities and Navy and Marine Corp needs. These efforts include research supporting on-demand battlespace shaping through advanced undersea weapons; technologies to support a standoff or remote capability for detection and location, diagnosis, render safe, neutralization and enhanced access; efforts that seek to capitalize on recent technology breakthroughs to develop and integrate components including subsystems into prototypes quickly: efforts to provide operational analysis through studies, analyses, gaming and experimentation to identify Navy and Marine Corps capability needs that can be addressed with S&T solutions; exploration of high-risk, disruptive, and innovative technologies and concepts to provide a venue to develop innovative technologies that are targeted towards advancing the capabilities of naval warfighters; investments that provide rapid response Science and Technology (S&T) solutions to immediate Fleet/Force needs identified by individual warfighters at the deckplate level; specific electronic and electromagnetic systems research to improve weapons systems and data fusion technology; research to reduce and eliminate the incidence of noise reduced hearing loss; technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost; programs to develop, test, and demonstrate advanced communications, electronic attack (EA), electronic surveillance (ES), electronic warfare (EW), and radar functions; develop and demonstrate technologies that enable the development of affordable, effective and robust Position, Navigation and Timing (PNT) capabilities using either GPS systems, non-GPS navigation devices, or atomic clocks; efforts that support the development of technologies associated with various naval platforms (surface, subsurface and terrestrial) and the protection of those platforms; and protect the rights, safety, and welfare of human subjects in research supported by the Navy and Marine Corps.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603671N / *(U)Navy Advanced Technology Development(ATD)*	**Project (Number/Name)** 3433 / *Navy Advanced Technology Development (ATD)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Mine Technology	0.000	0.000	11.188	0.000	11.188
Description: This activity focuses on developing and demonstrating technology to support on-demand battlespace shaping through advanced undersea weapons. Efforts include command & control (C2), remote control, advanced sensing technologies, compatibility with unmanned delivery options, detection & classification, and targeting solutions. The program, Modular Undersea Effector System (MUSE), is a limited duration effort for advanced mining and responds to recent request for capability from the fleet. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Conduct advanced technology development and demonstration in advanced mining concepts including remote control, advanced sensing, command & control (C2), and more discriminative targeting solutions. Efforts in this thrust include prototyping advanced sensors and sensor configuration technologies for improved discrimination as well as communications, command, and control technologies. Initiate prototyping and demonstration for next-generation target detection devices. Funding supports JEON PC-0012 Advanced Maritime Mining Capability. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Mine Technology from PE 0603782N Mine and Expeditionary Warfare Advanced Technology.					
Title: Joint EOD Demos	0.000	0.000	1.984	0.000	1.984
Description: This activity focuses on developing and demonstrating technologies to support a standoff or remote capability for detection and location, diagnosis, render safe, neutralization and enhanced access. Efforts include: electromagnetic, electro-optical, and acoustic sensors and systems for detection of explosive threat components including explosives, device housings/containers, and triggering mechanisms, standoff identification and confirmation of trace explosives, fusion of multi-sensor input for high confidence detection and diagnosis of buried threats, highly dexterous manipulators and imitative controllers for lightweight, efficient (strength/ weight ratio) dual manipulator systems integrated onto EOD robots for enhanced access, enhanced robotic					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
autonomy to support EOD missions, data compression and visualization techniques to support precise render safe and neutralization, and neutralization devices containing reactive materials to neutralize devices with low collateral damage. This S&T investment supports the Joint Requirements Oversight Council (JROC) and DoD EOD Program Board validated requirements for Joint EOD missions. This S&T investment provides critical S&T transitions to acquisition programs. This investment in Joint EOD S&T is reported annually to the DoD EOD Program Board. This S&T investment is documented in the DoD EOD Applied Research Program Plan which is reviewed and approved annually by the DoD EOD Program Board. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Conduct advanced technology development and demonstration in electro-optic & acoustic technologies for buried mine detection, robotic manipulation for ordnance exploitation & neutralization, standoff detection and classification for ordnance, and identification of explosives. Efforts in this thrust include prototype and demonstration of laser interferometric sensor / systems for detection of buried objects, highly dexterous dual manipulator systems (manipulators, controllers) for EOD robots for precision render safe and neutralization missions, Resonance Raman (single or dual wavelength) detector for standoff detection, and excavation tools and techniques for precision recovery and diagnosis of buried objects. Initiate development and demonstration of technologies for low-observability underwater ordnance neutralization. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Joint EOD Demos from PE 0603782N Mine and Expeditionary Warfare Advanced Technology.					
Title: Naval Warfare Experimentation ***Description:*** The objective of this project is to capitalize on recent technology breakthroughs to develop and integrate components including subsystems into prototypes quickly. These technologies are provided to the warfighter for experimentation, field experiments, and/or tests in simulated or actual environments. The use of Navy Warfare Development Command (NWDC) Fleet Experimentation (FLEX) events is encouraged and the net results are to gain the knowledge that only an experiment can provide.	0.000	0.000	20.602	0.000	20.602

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
FY 2018 Plans: N/A ***FY 2019 Base Plans:*** Continue efforts from FY18 that were in progress within PE 0603758N Navy Warfare Experimentation and initiate new efforts to address the priorities of the Chief of Naval Research and the Chief of Naval Operations. Efforts will be conducted within areas such as Augmented Warfighter, Integrated & Distributed Forces, Operational Endurance, Sensing & Sense-Making, and Scalable Lethality. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Navy Warfare Experimentation from PE 0603758N Navy Warfighting Experimentation and Demonstration, and increased investment in Augmented Warfighter, Integrated & Distributed Forces, Operational Endurance, Sensing & Sense Making, and Scalable Lethality due to CNO direction to increase participation in Fleet Experimentation events.					
Title: Operations Analysis ***Description:*** The objective of this project is to provide operational analysis through studies, analyses, gaming and experimentation to identify Navy and Marine Corps capability needs that can be addressed with S&T solutions. The effort includes core analysis of S&T programs, military utility/capability gaps analyses, war gaming, structured experimentation events, the articulation of the results of that analysis and war gaming, and the development of innovation strategies and messages resulting from these analyses. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Conduct war games, Technology Innovation Games and technology analysis efforts to inform ONR S&T initiatives in such areas as Augmented Warfighter, Integrated & Distributed Forces, Operational Endurance, Sensing & Sense-Making, and Scalable Lethality. ***FY 2019 OCO Plans:***	0.000	0.000	2.216	0.000	2.216

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Operations Analysis from PE 0603758N Navy Warfighting Experimentation and Demonstration.					
Title: SwampWorks ***Description:*** The objective of this portfolio is to explore high-risk, disruptive, and innovative technologies and concepts, and provide a venue to develop innovative technologies that are targeted towards advancing the capabilities of naval warfighters. Because of the portfolio's high-risk nature, brief exploratory studies can be performed to examine the maturation of the technology proposed before making substantial investments. The program has substantial flexibility in planning and execution which includes a streamlined approval process allowing for the shortest possible technology development timeframe. The portfolio is not limited to any set of technology areas with innovative technology development ultimately providing a dramatic improvement for the warfighter. Some of these technologies may become part of a follow-on technology development, may end up in the hands of the warfighter for Fleet/Force experimentation, or may culminate in a significant Fleet/Force exercise that demonstrates capability that transitions into the Acquisition Program of Record (POR). ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Continue projects in response to the Chief of Naval Research and the Chief of Naval Operations priorities as well as technologies of interest for the Pacific Area of Responsibility (AOR). The SwampWorks portfolio explores high-risk, disruptive, and innovative technologies and concepts, and provides a venue to develop innovative technologies. All SwampWorks activities are targeted towards advancing the capabilities of naval warfighters. Because of the portfolio's high-risk nature. While the portfolio is open to a wide variety of technology areas, some focus is applied to areas such as initiatives in such areas as Augmented Warfighter, Integrated & Distributed Forces, Operational Endurance, Sensing & Sense-Making, and Scalable Lethality. The balance of the S&T projects that will start in FY19 will be identified during FY19 as the needs of the warfighters, for investments in this portfolio, evolve or change. ***FY 2019 OCO Plans:***	0.000	0.000	22.383	0.000	22.383

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for SwampWorks from PE 0603758N Navy Warfighting Experimentation and Demonstration					
Title: Tech Solutions ***Description:*** TechSolutions develops rapid response Science and Technology (S&T) solutions to immediate Fleet/Force needs identified by individual warfighters at the deckplate level. Sailors, Marines and Science Advisors submit their issues throughout the year via the TechSolutions website, email, phone, or chain of command. Projects are initiated from such requests and are completed in approximately twelve to eighteen months, concluding with a prototype demonstration. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** This program will conduct new S&T developments based on Fleet/Force interactions and expressed warfighter needs. The program will be readily available to support the mission of the fleet by responding to Sailors/Marines need for technology. Developments will be undertaken to deliver rapid response solutions so warfighters can achieve mission success and perform their duties better, faster, or easier by leveraging technology that has recently been developed or is emergent. Demonstrations will be conducted with warfighters at the conclusion of developments to assess the utility of the technology and understand what steps remain to achieve transition. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Tech Solutions from PE 0603758N Navy Warfighting Experimentation and Demonstration.	0.000	0.000	10.184	0.000	10.184
Title: Special Projects ***Description:*** The efforts described in this Activity are based on investment directions as defined in the Naval Research and Development Framework. This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps).	0.000	0.000	12.445	0.000	12.445

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare. Efforts in this area support Naval Precision Strike Operations, providing the Navy capability to quickly locate, target, and strike critical targets. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Conduct kill-chain studies to identify and recommend engineering trades to enable weapon system interoperability and data fusion alternatives. These studies assess engineering feasibility of various kill-chain options and assess the capability provided. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Special Projects from PE 603758N Navy Warfighting Experimentation and Demonstration					
Title: Noise Induced Hearing Loss (NIHL) ***Description:*** The goal of this program is to reduce the incidence of NIHL by nearly 100%. This program employs a total systems engineering approach that includes advancements in medical technology, jet engine physics, personal protective equipment, and mitigation analyses. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** NOISE INDUCED HEARING LOSS: Conduct advanced research in medical prevention and treatment of NIHL and tinnitus. Investigate the incidence and susceptibility of NIHL and tinnitus, and evaluate mitigation strategies. Study the reduction of noise at the source, jet engine quieting and flight deck noise reduction and improve personal protective equipment technology. ***FY 2019 OCO Plans:***	0.000	0.000	4.877	0.000	4.877

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Noise Induced Hearing Loss (NIHL) from PE 0603729N Warfighter Protection Advanced Technology.					
Title: Aircraft Technology ***Description:*** The Aircraft Technology activity develops technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scalable Naval air vehicle technologies, such as - autonomous air vehicle command and control, helicopter and tiltrotor rotor drive systems, aerodynamics, propulsion systems, materials, structures and flight controls for future and legacy air vehicles. This activity directly supports the Naval Research and Development Framework, principally in the Autonomy and Unmanned Systems, Platform Design and Survivability, Power and Energy and Total Ownership Cost Focus Areas. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Conduct advanced technology development efforts and demonstrations of the Variable Cycle Advanced Technology (VCAT) Program. Critical technology development efforts continue with major engine manufactures and system contractors to develop/mature the highest priority, long lead propulsion system technologies, including variable/adaptive cycle engine components, for next generation carrier based Tactical Air (TACAIR) Intelligence, Surveillance and Reconnaissance (ISR) systems. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Aircraft Technology from PE 0603123N Force Protection Advanced Technology	0.000	0.000	6.251	0.000	6.251
Title: Electronic and Electromagnetic Systems ***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	0.000	0.000	4.204	0.000	4.204

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
(EW), and Radar functions. A portion of this 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. 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; and b) Electromagnetic Maneuver Warfare Command & Control (EMC2) (FY16-FY20) - Enable a battle group to work cooperatively in the EM Spectrum (EMS) to optimize Electronic Warfare (EW), Information Operations (IO), Communications (Comms) and Radar performance. EMC2 will build upon the Resource Allocation Manager (RAM) that was previously developed for single multifunction systems under the Integrated Topside (InTop) program to optimize spectrum and functional use across a platform and an entire battle group. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Continue research in the areas of improved threat warning systems; electronic warfare support (ES); decoys and countermeasures against weapon tracking and guidance systems; electronic attack (EA) against adversary command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); and electronic protection (EP) of our own weapons and C4ISR from intentional and unintentional interference to control the electromagnetic spectrum (EMS) by exploiting, deceiving, or denying enemy use of the spectrum while ensuring its use by friendly forces. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Electronic and Electromagnetic Systems from PE 0603271N Electromagnetic Systems Advanced Technology					
Title: Global Positioning System (GPS) & NavigationTechnology	0.000	0.000	4.600	0.000	4.600
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 either GPS systems, non-GPS navigation devices, or atomic clocks. This activity will increase the operational effectiveness of U.S.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
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). The following are non-inclusive examples for projects funded in this activity. As a result of a comprehensive DOD wide assessment of current S&T investments in the area of Position, Navigation and Timing, funding was increased in FY 2018 in the Global Positioning System (GPS) & Navigation Technology thrust for increased investment in Assured Time Dissemination research. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Conduct advanced research and development in position, navigation and timing. This research aims to develop devices and systems that provide assured, cost-effective, and mission relevant PNT to the warfighter. Areas of investment included robust GPS, non-GPS navigation aids, and assured timekeeping. Specifically, research that enables robust integrity checking and monitoring of GPS in the presence of electronic threats and anti-spoofer/ anti-jam processors for the purpose of providing precision navigation capabilities in the presence of emergent threats; atomic clocks that possess unique long-term stability and precision for the purpose of providing GPS-independent precision time as well as time-transfer techniques for the purpose of providing GPS-independent precision time; and Inertial navigation systems for the purpose of providing an alternative means of providing precision navigation, correlation navigation technique using high precision earth maps, for those Naval platforms which may not have GPS navigation capabilities and/or loss of GPS signals. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Global Positioning System (GPS) & Navigation Technology from PE 0603271N Electromagnetic Systems Advanced Technology					
Title: Human Research Protection Program (HRPP) ***Description:*** The purpose of Department of the Navy (DON) Human Research Protection Program (HRPP) is to protect the rights, safety, and welfare of human subjects in research supported by the Navy and Marine Corps. The Office of Naval Research (ONR) Research Protections Division, a component of the DON HRPP, is responsible for: 1) ensuring that research involving human subjects complies with Federal, DoD, and DON research protection requirements; and 2) providing education programs in human research ethics to all levels	0.000	0.000	2.685	0.000	2.685

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
of staff involved in the review, approval, conduct, management, or support of DON research involving human subjects. The Secretary of the Navy Instruction (SECNAVINST) 3900.39D identifies the Navy Surgeon General (SG) as the single point of accountability for the DON-wide program and identifies the Chief of Naval Research (CNR) as providing support and expertise for human research protection in the systems commands, operational forces, training commands and DON-supported non-DoD institutions. The program is essential to enabling DON to satisfy mandated DoD Instruction 3216.02 requirements. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Execute DON HRPP Management Plan; provide day-to-day oversight of DON HRPP activities; conduct periodic site inspections and assist visits; conduct Component-level review of DON-supported human subjects research; provide subject matter expertise and guidance on all DON-supported research involving human subjects; implement revisions to SECNAVINST 3900.39D; and provide DON input to ASD(R&E) and other DoD policy guidance impacting DON human research-related efforts. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase in FY19 reflects the realignment of funding for the Human Research Protection Program (HRPP) from Operation and Maintenance, Navy (O&M,N) BA 3 Administration (4A1M) for proper alignment of funding.					
Title: Surface Ship and Submarine Hull Mechanical & Electrical ***Description:*** This project addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with various naval platforms (surface, subsurface and terrestrial) and the protection of those platforms. The primary research efforts within this activity are focused on advanced technology demonstrations to evaluate emerging energy technologies, advanced technology development for Unmanned Sea Surface Vehicles in support of Naval S&T Focus Area on Autonomy and Unmanned Vehicles and At-Sea Vertical Launch	0.000	0.000	27.883	0.000	27.883

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603671N / *(U)Navy Advanced Technology Development(ATD)*	**Project (Number/Name)** 3433 / *Navy Advanced Technology Development (ATD)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
System rearming. Unmanned Sea Surface Vehicle (USSV) technology development includes autonomous navigation for USSVs. ***FY 2018 Plans:*** N/A ***FY 2019 Base Plans:*** Conduct advanced research related to critical S&T for development of autonomous navigation for Unmanned Sea Surface Vehicles from host ship. Expand research for conducting advanced technology demonstrations to evaluate innovative energy technologies using Navy and Marine Corps facilities as test beds. Perform non-recurring engineering, modeling and fabrication necessary for a prototype and demonstration of At-Sea Rearm of Vertical Launch System (VLS) capability in a relevant environment during FY22. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY18 to FY19 reflects the realignment of funding for Surface Ship & Submarine Hull Mechanical & Electrical (HM&E) from PE 0603123N Force Protection Advanced Technology. Additionally, funds are increased in FY 2019 for engineering and prototype development cost associated with the scheduled demonstration of the Vertical Launch System (VLS) Reload at Sea effort.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	131.502	0.000	131.502

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Overall metric goals are to transition the 6.3 advanced technology projects into acquisition programs of record, demonstrate successful technologies to enable new operational concepts, and enable the production of technology products such as proofs of concept and manufacturing packages. The performance of the work funded in

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this PE is reviewed at several levels to ensure that the investment is relevant and productive. At the macroscopic level, investments are often coordinated with a variety of organizations, examples of which include the Navy Warfare Development Command, Commander, Fleet Forces Command, resource sponsors, program offices, etc. to address the goals, objectives and needs identified by the warfighters. At the microscopic level, the work funded in this PE is reviewed periodically by the Program Manager to ensure the investment is meeting the goals defined for each project. This review includes feedback collected from the warfighter community on all sea trials and Limited Objective Experiments to support the Program Manager's assessment of the value and relevance of each investment. Furthermore, the entire program is reviewed yearly by the Chief of Naval Research.