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 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602236N *I Warfighter Sustainment Applied Res*							
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	50.465	48.649	56.197	-	56.197	56.133	55.869	57.065	58.387	Continuing	Continuing
0000: *Warfighter Sustainment Applied Res*	0.000	45.629	48.649	56.197	-	56.197	56.133	55.869	57.065	58.387	Continuing	Continuing
9999: *Congressional Adds*	0.000	4.836	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.836

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval Research and Development Framework which is developed 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). 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. 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.

This PE supports innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on advanced Naval materials; biocentric technologies; environmental quality; human factors and organizational design; medical technologies; and Naval training technologies. Within the Naval Transformation Roadmap, this investment maps to future transformational capabilities and the FORCEnet pillar of the CNO and the Commandant of the Marine Corps vision for the future -- Naval Power 21.

This PE also includes the Office of Naval Research Global (ONRG) International Science Program whose mission is to search the globe for emerging scientific research and advanced technologies to enable the Office of Naval Research (ONR) and the NRE to address effectively the current needs of the Fleet/Forces (F/F), and investigate and assess revolutionary, high-payoff technologies for future Naval missions and capabilities. Within this Global mission is the Naval Science Advisor Program that develops leaders among civilian scientists and engineers in the Naval Research Enterprise (NRE). Upon tour completion, Science Advisors return to the NRE with first-hand knowledge of the F/F, warfighting issues, and strategic decision making. This program enables continuous communication and collaboration between the warfighters, the technical community, and strategic development commands.

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

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 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602236N *I Warfighter Sustainment Applied Res*

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	45.467	48.649	48.448	-	48.448
Current President's Budget	50.465	48.649	56.197	-	56.197
Total Adjustments	4.998	0.000	7.749	-	7.749
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.958	0.000			
• SBIR/STTR Transfer	-0.952	0.000			
• Program Adjustments	0.000	0.000	8.376	-	8.376
• Rate/Misc Adjustments	0.000	0.000	-0.627	-	-0.627
• Congressional General Reductions Adjustments	-0.008	-	-	-	-
• Congressional Add Adjustments	5.000	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2017	FY 2018
Project: 9999: *Congressional Adds*		
Congressional Add: *Program Increase*	4.836	0.000
Congressional Add Subtotals for Project: 9999	4.836	0.000
Congressional Add Totals for all Projects	4.836	0.000

Change Summary Explanation

The funding increase from FY 2018 to FY 2019 is due to the realignment of funds from PE 0601153N Defense Research Sciences to 0602236N Warfighter Sustainment Applied Research to consolidate ONR Global - International Science Program support costs.

The FY 2019 funding request was reduced by $0.459 million to reflect the Department of Navy's effort to support the Office of Management and Budget directed reforms for Efficiency and Effectiveness that include a lean, accountable, more efficient government.

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / *Warfighter Sustainment Applied Res*	Project (Number/Name) 0000 / *Warfighter Sustainment Applied Res*	

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
0000: *Warfighter Sustainment Applied Res*	0.000	45.629	48.649	56.197	-	56.197	56.133	55.869	57.065	58.387	Continuing	Continuing

A. Mission Description and Budget Item Justification

Efforts in this PE focus on; advanced naval materials; biocentric technologies; environmental quality; human factors and organizational design; medical technologies; international science and science advisor programs; and Naval systems training and education.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: ADVANCED NAVAL MATERIALS	8.389	11.018	11.455	0.000	11.455
Description: Advanced Naval Materials efforts support several S&T Focus Areas, in particular Platform Design & Survivability and Power & Energy, and perform research across a broad spectrum of technical areas including: structural materials to increase platform performance and survivability at reduced weight and cost; advanced, high-performance materials for energy systems; corrosion mitigation strategies; high-temperature energy systems; enhanced sonar transducers; and environmental quality technologies.					
FY 2018 Plans: ADVANCED NAVAL MATERIALS: Expand research on structural materials, including, but not limited to, the following: Nanostructured materials processing, composite development, cellular materials and high temperature materials. Conduct applied research related to critical S&T to investigate corrosion control modeling, acoustic transduction technologies and environmental quality. Complete the development of low AC loss high temperature superconductors for advanced power. MATERIALS AND PROCESSES: Develop novel and scalable processing methods to produce mechanically robust high temperature superconductor tapes with minimal AC loss for various naval applications such as transformers, inductors, stators and for pulsed power delivery systems for all electric ships. Design new microfluidic system for direct write additive manufacturing to significantly improve the existing techniques. Design of multifunctional material systems for use in new helmet suspension to mitigate multiple threats.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Compositional modifications and processing parameters to optimize material performance have been demonstrated. ***FY 2019 Base Plans:*** ADVANCED NAVAL MATERIALS: Continue research on structural materials, including, but not limited to, the following: Nanostructured materials processing, composite development, cellular materials, high temperature materials and alternative hull materials. Conduct applied research related to critical S&T to investigate corrosion control modeling, high strength corrosion resistant compositionally complex alloys, corrosion resistant additive manufactured alloys and acoustic transduction technologies. MATERIALS AND PROCESSES: Continue development of novel and scalable processing methods to produce mechanically robust high temperature superconductor tapes with minimal AC loss for various naval applications such as transformers, inductors, stators and for pulsed power delivery systems for all electric ships. Continue design new microfluidic system for direct write additive manufacturing to significantly improve the existing techniques. Continue design of multifunctional material systems for use in new helmet design to mitigate multiple threats. Continue compositional modifications and processing parameters to optimize material performance have been demonstrated leading to current plans for their utilization. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: BIOCENTRIC TECHNOLOGIES	5.626	5.717	5.684	0.000	5.684
Description: Biocentric technologies provide novel solutions for naval needs based upon the applications of bio-inspired sensors, materials, processes and systems. Topic areas include, but are not limited to: development of biologically-based signal processing for medical, surveillance and security applications; bioinspired robotics; synthetic biology to produce high-value naval materials or to develop sentinel organisms, and marine mammal diagnostics to support the Navy's Fleet Marine Mammal Systems. ***FY 2018 Plans:*** NAVAL BIOSCIENCE:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Continue research into the development of innovative naval biosensors, biomaterials, and bioprocess technology. Investigate engineering development and optimization of sea-floor sediment energy harvesting system for sustainable and autonomous powering of underwater sensor networks and AUV's. Conduct research on the development of microbial fuel cells for powering a linear sensor array. Study microbial electrochemical systems for shipboard desalination/ waste-to-energy conversion and the closed-loop microbial fuels cells. Research explosive-sensing plants and microbial electrobiosynthesis of liquid fuels. Initiate development of microbial electronic devices. SYNTHETIC BIOLOGY FOR SENSING & ENERGY PRODUCTION: Continue research on synthetic biology studies of engineered sentinel organisms for environmental surveillance. Initiate integration of programmable cellular controllers with robotic devices. LIFE SCIENCE AND BIOENGINEERING: Continue marine mammal diagnostics efforts, including immunobioassays for stress and infection detection and efforts to detect, treat, and prevent diseases in dolphins, including diabetes and kidney stones. NEURAL, SENSORY AND BIOMECHANICAL SYSTEMS: Continue efforts on naval biosensor to detect brain structures and blood vessels through skull bones. Investigate advanced biomimetic sensing and neural control for human-robot interaction to enable effective collaboration of warfighters and autonomous systems. Integrate biomimetic sonar with bioinspired autonomous undersea vehicles (with high-lift propulsors)to achieve closed loop control. Conduct research into bioinspired quiet, and maneuverable self-propelled line array using high-lift propulsors based on animal wing and fin biomechanics and in efforts of bio-inspired massively parallel vision systems. Study the development of brain-based intelligent systems to support high level interaction between warfighters and autonomous systems. Continue studies to develop electrosence and biosonar for MOC and Explosive Ordnance Disposal (EOD) missions and the development of improved recombinant antibodies for biothreat agents. MATERIALS AND CHEMISTRY: Develop novel approaches to rapidly identify antibiotic resistant genes in bacterial pathogens of importance for the entire US military force. This effort will enable our transitional partners,					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
the Naval Medical Research Center and the Naval Medical Research Laboratories, for rapid identification of highly resistant bacterial pathogens.					
FY 2019 Base Plans: NAVAL BIOSCIENCE: Continue research into the development of innovative naval biosensors, biomaterials, and bioprocess technology. Investigate engineering development and optimization of sea-floor sediment energy harvesting system for sustainable and autonomous powering of underwater sensor networks and AUV's. Conduct research on the development of microbial fuel cells for powering a linear sensor array. Study microbial electrochemical systems for shipboard desalination/ waste-to-energy conversion and the closed-loop microbial fuels cells. Research explosive-sensing plants and microbial electrobiosynthesis of liquid fuels. Continue development of microbial electronic devices. SYNTHETIC BIOLOGY FOR SENSING & ENERGY PRODUCTION: Continue research on synthetic biology studies of engineered sentinel organisms for environmental surveillance and integration of programmable cellular controllers with robotic devices. LIFE SCIENCE AND BIOENGINEERING: Continue marine mammal diagnostics efforts, including immunobioassays for stress and infection detection and efforts to detect, treat, and prevent diseases in dolphins, including diabetes and kidney stones. NEURAL, SENSORY AND BIOMECHANICAL SYSTEMS: Continue efforts on naval biosensor to detect brain structures and blood vessels through skull bones. Investigate advanced biomimetic sensing and neural control for human-robot interaction to enable effective collaboration of warfighters and autonomous systems. Integrate biomimetic sonar with bioinspired autonomous undersea vehicles (with high-lift propulsors)to achieve closed loop control. Conduct research into bioinspired quiet, and maneuverable self-propelled line array using high-lift propulsors based on animal wing and fin biomechanics and in efforts of bio-inspired massively parallel vision systems. Study the development of brain-based intelligent systems to support high level interaction between warfighters and autonomous systems. Continue studies to					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
develop electrosence and biosonar for Mine Counter Measures (MCM) and Explosive Ordinance Device (EOD) missions. MATERIALS AND CHEMISTRY: Continue development of novel approaches to rapidly identify antibiotic resistant genes in bacterial pathogens of importance for the entire US military force. Success of this effort will enable our transitional partners, the Naval Medical Research Center and the Naval Medical Research Laboratories, for rapid identification of highly resistant bacterial pathogens. A major success has been demonstrated by utilizing NRL developed microbial resistant determinant assay for its advances to system design. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: ENVIRONMENTAL QUALITY ***Description:*** Environmental Quality technologies enable sustained world-wide Navy operations in compliance with all local, state, regional, national and international laws, regulations and agreements. ***FY 2018 Plans:*** - Continue development of new, advanced, environmentally benign Anti-Fouling (AF)/Anti-Corrosive (AC) coating systems for Navy platforms. - Continue development of advanced environmentally sound technologies for shipboard waste treatment and pollution abatement systems. - Continue field evaluation of prototype robotic Hull BUG to identify gaps needed to refine and advance the technology for reduced drag, and significant fuel savings. - Complete studies on oil emulsion issues and development of novel bilge water treatment systems for existing and new ships. ***FY 2019 Base Plans:***	2.628	2.573	2.764	0.000	2.764

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Continue all FY 2018 efforts, less those noted to complete and expand research related to naval environmental technology. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: HUMAN FACTORS AND ORGANIZATIONAL DESIGN	5.085	5.159	5.777	0.000	5.777
Description: Description: The overarching objective of this activity is the achievement of FORCEnet and Sea Power 21 goals by developing human factors principles and cognitive models for human centric design, decision support systems for collaborative decision making, and adaptive command and control structures. The CNO's Maritime Strategy and the Commander Fleet Forces Command complementary plan to revise organization of Maritime Operations Centers (MOC) place high priority on the aforementioned FORCEnet and Sea Power 21 goals. Specific objectives focus on improving small team, platform, task force, and battle group operations by developing advanced human factors technologies for incorporation into operational systems. The goals and payoffs are to enhance human performance effectiveness; improve the timeliness and quality of decision making; develop strategies to mitigate high workload and ambiguity; reduce manning; improve situational awareness and speed of command through a deeper understanding of human capabilities and limitations; and improvement of team decision making in ad-hoc, complex problem solving scenarios. ***FY 2018 Plans:*** HUMAN COMPUTER INTERACTION/VISUALIZATION: Continue research on audio-visual cue integration for 360-degree periscope displays by utilizing eye-tracking, sleep studies and traditional behavioral measures to characterize human performance on periscope-related tasks under a variety of physiological conditions. COMMAND DECISION MAKING (CDM): Continue development of task management algorithms applicable to agile supervisory control of teams involving human and autonomous agents. Research the development of an information infrastructure that is operational context sensitive to allow the dynamic prioritization of date based					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
on its anticipated information value and mission criticality. Study building proactive decision support tools for Command and Control. Investigate Navigating in Uncertainty. SOCIAL NETWORK ANALYSIS: Continue research on socio-technical aspects of community mobilization and complex humanitarian operations, including the use of novel platforms, social networks and the impact of novel technologies on human behavior in crisis and collaborative contexts. Continue development of novel information feeds for Pacific Command and for testbeds and tool chains for rapid disaster analysis and response. Continue efforts on information conflicts, social-cyber behavior and hybrid warfare. Initiate research on competitive narrative and digital media assessment. ***FY 2019 Base Plans:*** HUMAN COMPUTER INTERACTION/VISUALIZATION: Continue research on audio-visual cue integration for 360-degree periscope displays by utilizing eye-tracking, sleep studies and traditional behavioral measures to characterize human performance on periscope-related tasks under a variety of physiological conditions. COMMAND DECISION MAKING (CDM): Continue development of task management algorithms applicable to agile supervisory control of teams involving human and autonomous agents. Research the development of an information infrastructure that is operational context sensitive to allow the dynamic prioritization of date based on its anticipated information value and mission criticality. Study building proactive decision support tools for Command and Control. Investigate Navigating in Uncertainty. SOCIAL NETWORK ANALYSIS: Initiate development of warfighting experiments for information environment assessment, civil-military communications (public affairs), information operations and psychological operations. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change FY 2018 to FY 2019.					
Title: MEDICAL TECHNOLOGIES ***Description:*** This program supports the development of field medical equipment, diagnostic capabilities and treatments; technologies to improve warfighter safety and to enhance personnel performance under adverse conditions; and systems to prevent occupational injury and disease in hazardous, deployment environments; including regenerative medicine technologies and therapeutic/restorative practices for the treatment of combat-	6.420	6.465	5.839	0.000	5.839

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
related traumatic injuries. Navy investment in these areas is essential because Navy/USMC mission needs are not adequately addressed by the civilian sector or other Federal agencies. For example, civilian emergency medicine does not address casualty stabilization during long transit times to definitive care. The National Institutes of Health (NIH) focuses on the basic science of disease processes and not applied research related to development. Programs are coordinated with other Services through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee, and Joint Technical Coordinating Group (JTCG) process, to prevent duplication of effort. ***FY 2018 Plans:*** UNDERSEA MEDICINE: Continue efforts to reduce operational injuries. Study decompression sickness (DCS) and arterial gas embolism (AGE), to include novel approaches to the prevention, detection and treatment of DCS/AGE, particularly by non-recompressive methods. Investigate the development of prophylactic agents preventing hyperbaric oxygen toxicity. Prolonged exposure to hyperbaric oxygen can be toxic to lungs, nervous system and eyes. Study the optimization of diver and submariner health and performance when exposed to a variety of environmental and unique stressors (heat and cold, prolonged deployments, effects of altered diurnal rhythms, non-standard breathing gases, lack of sunlight, etc). Explore novel pharmaceutical interventions for hyperbaric oxygen toxicity. Initiate research on improving performance in extreme environments including integrated diving helmet audio-visual displays; human-machine symbiosis; nutrition, hydration and gut microbiome studies; and genomics/ metabolomic approaches. REGENERATIVE MEDICINE: Continue the program with the Armed Forces Institute for Regenerative Medicine (AFIRM). NOISE INDUCED HEARING LOSS (NIHL): Continue research to reduce noise at the source, i.e. jet engine quieting and flight deck noise reduction. Study the biomedical effects of underwater sound as military divers must operate safely and effectively in potentially complex underwater sound fields. Mitigate the impact of exposure to stressful combat environments prior to deployment through "stress inoculation". Study the incidence, susceptibility, and mitigation strategies of NIHL and tinnitus. Research the					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
prevention, treatment and reversal of NIHL and tinnitus. Investigate the improvement of personal protective equipment technology. Continue Jet Noise Reduction Project to utilize analytical modeling and simulation tools anchored by experiment to develop and assess solutions enabling mitigation of jet induced noise from high performance tactical aircraft.					
FY 2019 Base Plans: UNDERSEA MEDICINE: Continue efforts to reduce operational injuries. Study decompression sickness (DCS) and arterial gas embolism (AGE), to include novel approaches to the prevention, detection and treatment of DCS/AGE, particularly by non-recompressive methods. Investigate the development of prophylactic agents preventing hyperbaric oxygen toxicity. Prolonged exposure to hyperbaric oxygen can be toxic to lungs, nervous system and eyes. Study the optimization of diver and submariner health and performance when exposed to a variety of environmental and unique stressors (heat and cold, prolonged deployments, effects of altered diurnal rhythms, non-standard breathing gases, lack of sunlight, etc). Explore novel pharmaceutical interventions for hyperbaric oxygen toxicity. Continue research on improving performance in extreme environments including integrated diving helmet audio-visual displays; human-machine symbiosis; nutrition, hydration and gut microbiome studies; and genomics/ metabolomic approaches. REGENERATIVE MEDICINE: Continue the program with the Armed Forces Institute for Regenerative Medicine (AFIRM). NOISE INDUCED HEARING LOSS (NIHL): Continue research to reduce noise at the source, i.e. jet engine quieting and flight deck noise reduction. Study the biomedical effects of underwater sound as military divers must operate safely and effectively in potentially complex underwater sound fields. Mitigate the impact of exposure to stressful combat environments prior to deployment through "stress inoculation". Study the incidence, susceptibility, and mitigation strategies of NIHL and tinnitus. Research the prevention, treatment and reversal of NIHL and tinnitus. Investigate the improvement of personal protective equipment					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
technology. Continue Jet Noise Reduction Project to utilize analytical modeling and simulation tools anchored by experiment to develop and assess solutions enabling mitigation of jet induced noise from high performance tactical aircraft. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Title: THE OFFICE OF NAVAL RESEARCH GLOBAL ***Description:*** Description: This PE supports the Office of Naval Research (ONR) Global mission to search the globe for emerging scientific research and advanced technologies to enable ONR and the Naval Research and Development Establishment (NR&DE) to effectively address the current needs of the Naval Fleet/Forces (F/F), and discover and assess revolutionary, high-payoff technologies for future Naval missions and capabilities. Within this Global mission, funding for the ONR Global Science Advisor Program ensures the F/F help shape the DON investment in science and technology (S&T), develops teaming relationships to rapidly demonstrate and transition technology, supports development of technology-based capability options for Naval Forces, and enables warfighting innovations based on technical and conceptual possibilities. Science Advisors provide insight into issues associated with Naval Warfighting Capabilities that influence S&T program decision making. The program develops leaders among civilian scientists and engineers in the NR&DE. Upon completion of their tours, Science Advisors return to the NR&DE with firsthand knowledge of the how the SN/USMC conduct business, operational warfighting issues, and strategic decision making. The ONR Global Science Advisor Program enables continuous communication and collaboration between the warfighters, the technical community, and strategic development commands. ***FY 2018 Plans:*** ONR Global will continue to support all Science Advisor program efforts and will continue to engage with the international S&T community through 28 PhD-level scientists, placed in seven overseas offices, utilizing liaison visits and awarding applied research grants. Complete the establishment of an office in India. ***FY 2019 Base Plans:*** Continue all FY 2018 efforts.	12.590	12.757	19.760	0.000	19.760

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
-ONR Global will support 28 PhD level scientists, in seven overseas offices, continuing to engage with international scientists and engineers through liaison visits to research institutions and continue actively fostering international collaboration by awarding research grants. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The funding increase from FY 2018 to FY 2019 reflects the realignment of funds from PE 0601153N Defense Research Sciences to consolidate International Science Program support costs under single a program element.					
Title: TRAINING TECHNOLOGIES	4.891	4.960	4.918	0.000	4.918
Description: Training technologies enhance the Navy's ability to train effectively and affordably in classroom settings, in simulated environments, while deployed, and to operate effectively in the complex, high stress, information-rich and ambiguous environments of modern warfare such as asymmetric warfare. Technology development responds to a variety of requirements, including providing more affordable approaches to training and skill maintenance. Improved training efficiency and cost-effectiveness is achieved by applying operations research, modeling and simulation, and instructional, cognitive, and computer sciences to the development, delivery, evaluation, and execution of training. ***FY 2018 Plans:*** COGNITIVE SCIENCE OF LEARNING: Research and assess advanced gaming technology for enhanced training. Conduct experiments to validate automated performance assessment and after action reviews. Develop a systematic program of applied research addressing unanswered questions regarding effective instructional strategies in artificially intelligent tutoring. Research the neurobiology of learning including integration of the role of white matter. Develop games that incorporate artificial intelligence (AI) techniques to teach complex warfighter skills decision-making and problem solving. Develop optimal training strategies for intelligent jobs on mobile devices (e.g., IPad) and immersive environments for training interpersonal and leadership skills. Design and conduct experiment to assess training effectiveness of intelligent tutor for training ship handling skills. Design features and develop novel psychometric approaches to assess human performance in medical/military simulations and simulators. Conduct field studies and user tests evaluating new features and job aiding tools. Research computational neuron-models in the design of training					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
systems. Develop skill decay models for psychomotor, perceptual, and cognitive skills and refresher training strategies. Create intelligent avatars to interact with learners from different cultural, linguistic backgrounds, and preferences. Design scenarios generators that produce integrated (e.g.,individual and collective) training. Initiate development of computational model for learning theory to drive design of instruction and continue research on individual differences. ENHANCING WARFIGHTER COGNITIVE CAPABILITY: Continue research to understand the structural relations among the latent variables of short-term memory, working memory, executive attentional control, and fluid intelligence. Assess the improvement in recruit classification provided by the addition of measures of fluid intelligence and working memory. Understand the role of intrinsic motivation in facilitating the transfer of working memory training to other cognitive capabilities. Study the efficacy of game-based brain training using hand-held (fieldable) hardware platforms. Determine the relationship between induced gains in fluid intelligence and cognitive adaptability and agility, considered from the perspective of military decision-making. Develop multi-agent based architectures for modeling human behavior, improve techniques for human cognitive and behavioral modeling, and create highly realistic simulated teammates. COMPUTATIONAL MODELS OF HUMAN BEHAVIOR: Research game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. Develop software tools to facilitate building natural language tutorial dialogs for artificially intelligent tutoring. Integrate cognitive and neuron-computational models of human learning.					
FY 2019 Base Plans: COGNITIVE SCIENCE OF LEARNING: Continue research and associated efforts to assess advanced gaming technology for enhanced training. Continue experiments to validate automated performance assessment and after action reviews. Continue development a systematic program of applied research addressing unanswered questions regarding effective instructional strategies in artificially intelligent tutoring. Continue research the neurobiology of learning including integration of the role of white matter. Continue to develop games that incorporate artificial intelligence (AI) techniques to teach complex warfighter skills decision-making and problem solving. Continue work to develop optimal training strategies for intelligent jobs on mobile devices (e.g., IPad) and immersive environments for training interpersonal and leadership skills. Work to design and conduct experiment to assess training					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
effectiveness of intelligent tutor for training ship handling skills. Continue efforts to design features and develop novel psychometric approaches to assess human performance in medical/military simulations and simulators. Conduct field studies and user tests evaluating new features and job aiding tools. Continue research in computational neuron-models in the design of training systems. Conduct ongoing efforts to develop skill decay models for psychomotor, perceptual, and cognitive skills and refresher training strategies. Continue work to create intelligent avatars to interact with learners from different cultural, linguistic backgrounds, and preferences. Continue design scenarios generators that produce integrated (e.g.,individual and collective) training. Continue development of computational model for learning theory to drive design of instruction and continue research on individual differences. ENHANCING WARFIGHTER COGNITIVE CAPABILITY: Continue research to understand the structural relations among the latent variables of short-term memory, working memory, executive attentional control, and fluid intelligence. Work to assess the improvement in recruit classification provided by the addition of measures of fluid intelligence and working memory. Continue efforts to understand the role of intrinsic motivation in facilitating the transfer of working memory training to other cognitive capabilities. Continue the study the efficacy of game-based brain training using hand-held (fieldable) hardware platforms. Continue work to determine the relationship between induced gains in fluid intelligence and cognitive adaptability and agility, considered from the perspective of military decision-making. Develop multi-agent based architectures for modeling human behavior, improve techniques for human cognitive and behavioral modeling, and create highly realistic simulated teammates. COMPUTATIONAL MODELS OF HUMAN BEHAVIOR: Research game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. Continue development of software tools to facilitate building natural language tutorial dialogs for artificially intelligent tutoring. Continue integration of cognitive and neuron-computational models of human learning. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no significant change from FY 2018 to FY 2019.					
Accomplishments/Planned Programs Subtotals	45.629	48.649	56.197	0.000	56.197

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

As discussed in Section A, there are a significant number of varied efforts within this PE. Each effort is measured against both technical and financial milestones. Each program effort and its projects are reviewed in depth for technical and transition performance against established goals. The Program Managers conduct routine site visits to performing organizations to assess programmatic and technical progress and most projects conduct an annual or biannual review by an independent board of visitors who assess the level and quality of the Science and Technology (S&T) basis for the project.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / *Warfighter Sustainment Applied Res*	Project (Number/Name) 9999 / *Congressional Adds*	

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
9999: *Congressional Adds*	0.000	4.836	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.836

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018
Congressional Add: Program Increase	4.836	0.000
FY 2017 Accomplishments: SOCIAL NETWORKING: Analyze and develop social network models to create effective mitigation strategies of extremist groups. UNDERSEA MEDICINE: Mitigate the human challenges of the extreme maritime environment such as hyperbaric exposure, thermal regulation, nutrition/hydration in the field and optimize physical fitness for performance and injury prevention.		
FY 2018 Plans: N/A		
Congressional Adds Subtotals	4.836	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional Interest Items not included in other Projects.