Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy											Date: May 2017	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602236N *I Warfighter Sustainment Applied Res*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	44.092	45.467	48.649	-	48.649	48.448	48.406	48.210	49.131	Continuing	Continuing
0000: *Warfighter Sustainment Applied Res*	0.000	44.092	45.467	48.649	-	48.649	48.448	48.406	48.210	49.131	Continuing	Continuing

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 S&T Strategic Plan 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: FY 2018 Navy					Date: May 2017
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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	45.047	45.467	46.269	-	46.269
Current President's Budget	44.092	45.467	48.649	-	48.649
Total Adjustments	-0.955	0.000	2.380	-	2.380
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.254	0.000			
• SBIR/STTR Transfer	-0.701	0.000			
• Program Adjustments	0.000	0.000	2.380	-	2.380
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Change Summary Explanation

The funding increase from FY 2017 to FY 2018 is due to increased emphasis and investment in structural materials applied research.

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
0000: *Warfighter Sustainment Applied Res*	0.000	44.092	45.467	48.649	-	48.649	48.448	48.406	48.210	49.131	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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: ADVANCED NAVAL MATERIALS	9.073	8.689	11.018	0.000	11.018
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. The funding increase from FY 2017 to FY 2018 is due to increased emphasis and investment in structural materials applied research. ***FY 2016 Accomplishments:*** - Continued development of acceptance testing methodologies for advanced transducer, single-crystal, high-strain materials and definition of standardized materials properties and composition ranges. - Continued development of compositional tuning of single-crystal, high-strain transducer materials, for specialized naval system applications. - Continued marine titanium alloy design and processing development, exploiting anticipated cost reductions for high performance, reduced maintenance naval applications. - Continued development of continuous, single wall, carbon nanotube composite materials for next generation air and naval platforms. - Continued stainless steel carburization study to enhance corrosion performance. - Continued development of surface preparation methods and characterization of corrosion performance for future naval ship materials.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued evaluation of low temperature, carburized materials for marine application. - Continued development of coating performance and knowledge database for Naval use. - Continued development of mechanistic model for stress corrosion cracking in Nickel Aluminum Bronze (NAB). - Continued development of innovative sonar transducers based on high-strain, high-coupling, piezoelectric single crystals. - Continued development of novel processing technologies for increasing the fatigue strength and corrosion resistance of weldments for ship structures with reduced weight and maintenance requirements. - Continued development of models and characterization methods for dynamic loading (water slamming and blast loading) in polymer composite materials. - Continued development of fiber-optic sensors, transducers and demodulation technology for structural health monitoring of ships and submarines. - Continued development of continuous based monitoring techniques of new synthetic fuels and lubricants based on electromagnetic signature analysis. - Continued development and application of distributed fiber optic Bragg gratings for structural health monitoring of ships and aircrafts. - Continued development of novel growth methods to specialized single crystal transducer materials tuned to requirements of specialized naval systems. - Continued assessment of the degree of sensitization potential of marine grade Al alloys. - Continued development of surface assessment technologies to measure surface profile and chlorine. - Continued evaluation of advanced material coating for erosion control on helicopter main rotor blade leading edges. - Continued studies on fuel cell corrosion. - Continued development of superhydrophobic surface modification technology. - Continued studies on mitigation of pitting corrosion and stress corrosion cracking in marine aluminum alloys. - Continued development of surface tolerant coating removal methods. - Continued development of processing technologies to fabricate piezoelectric single crystals into complex transducer assemblies. - Continued development of thermal management system(s) to arrest excessive heat fluxes and loads on amphibious ship by advanced Naval/USMC aircraft. - Continued development of the rational engineering design of Al-alloys for naval applications. - Continued to increase emphasis on research efforts to discover innovative fundamental technologies to shape future Naval investments and strategies, leveraging the globe to support the Sailors & Marines of today and tomorrow.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued research and development incorporating physics and chemistry of the materials-environment interface, with the focus on materials with melting points above 3000C. - Continued development of quantitative coasting quality assurance tools. - Continued development of advanced Naval Data Environment (NDE), Ship Hazardous Material (SHM), and Prognostics Technologies for improved readiness and reliability of air and naval platforms based on new and emerging electronic and photonics materials and devices. - Continued development of advanced structural composites with improved mechanical characteristics, blast resistance, and fire resistance, for more durable and reliable structures by optimizing the resin, the fibers and the interphases with new chemistries, additives and processes. - Continued development and exploitation of new and advanced forms of carbon based nanostructures (Graphene, Nanotubes, Diamond and others) for next generation family of materials and structures with outstanding mechanical, thermal, electrical and energy applications. - Continued investigating and characterizing cellular structures via additive manufacturing - Continued development of low AC loss high temperature superconductors for advanced power. - Completed investigation of criteria for stable pitting of stainless steel. - Completed acoustic damping coatings for ship tank application. - Completed development of mixed metal nanopowder additives for liquid fuels.					
FY 2017 Plans: - Continue all efforts of FY 2016, less those noted as completed. - Complete development and exploitation of new and advanced forms of carbon based nanostructures (Graphene, Nanotubes, Diamond and others) for next generation family of materials and structures with outstanding mechanical, thermal, electrical and energy applications. - Complete development of novel processing technologies for increasing the fatigue strength and corrosion resistance of weldments for ship structures with reduced weight and maintenance requirements.					
FY 2018 Base Plans: 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.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
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. Compositional modifications and processing parameters to optimize material performance have been demonstrated. ***FY 2018 OCO Plans:*** N/A					
Title: BIOCENTRIC TECHNOLOGIES	5.608	5.602	5.717	0.000	5.717
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 2016 Accomplishments:*** NAVAL BIOSCIENCE: - Continued development of innovative naval biosensors, biomaterials, and bioprocess technology. - Continued engineering development and optimization of sea-floor sediment energy harvesting system for sustainable and autonomous powering of underwater sensor networks and AUV's. - Continued development of microbial fuel cells for powering a linear sensor array - Continued study of microbial electrochemical systems for shipboard desalination/waste-to-energy conversion - Continued of closed-loop microbial fuels cells - Continued synthetic biology research on explosive-sensing plants - Continued researched on microbial electrobiosynthesis of liquid fuels SYNTHETIC BIOLOGY FOR SENSING & ENERGY PRODUCTION - Continued synthetic biology studies of engineered sentinel organisms for environmental surveillance LIFE SCIENCE AND BIOENGINEERING - Continued marine mammal diagnostics efforts, including immunobioassays for stress and infection detection. - Continued efforts to detect, treat, and prevent diseases in dolphins, including diabetes and kidney stones.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
NEURAL, SENSORY AND BIOMECHANICAL SYSTEMS - Continued efforts on naval biosensor to detect brain structures and blood vessels through skull bones - Continued efforts on advanced biomimetic sensing and neural control for human-robot interaction to enable effective collaboration of warfighters and autonomous systems. -Continued integration of biomimetic sonar with bioinspired autonomous undersea vehicles (with high-lift propulsors) to achieve closed loop control. - Continued efforts in bioinspired quiet, and maneuverable self-propelled line array using high-lift propulsors based on animal wing and fin biomechanics. - Continued efforts for bio-inspired massively parallel vision systems. - Continued studies to develop brain-based intelligent systems to support high level interaction between warfighters and autonomous systems. - Continued studies to develop electrosence and biosonar for MOC and EOD missions - Continued development of improved recombinant antibodies for biothreat agents					
FY 2017 Plans: - Continue all efforts of FY 2016. - SYNTHETIC BIOLOGY FOR SENSING & ENERGY PRODUCTION: Initiate studies of scalability of microbial liquid fuel component production via electrobiosynthesis or bioreactor methodology.					
FY 2018 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. Initiate development of micrpbial 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.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
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 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, the Naval Medical Research Center and the Naval Medical Research Laboratories, for rapid identification of highly resistant bacterial pathogens. ***FY 2018 OCO Plans:*** N/A					
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 2016 Accomplishments:*** - Continued development of new, advanced, environmentally benign Anti-Fouling (AF)/Anti-Corrosive (AC) coating systems for Navy platforms. - Continued development of advanced environmentally sound technologies for shipboard waste treatment and pollution abatement systems.	2.571	2.616	2.573	0.000	2.573

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued field evaluation of prototype robotic Hull BUG to identify gaps needed to refine and advance the technology for reduced drag, and significant fuel savings. - Continued studies on oil emulsion issues and development of novel bilge water treatment systems on existing and new ships. ***FY 2017 Plans:*** - Continue all efforts of FY 2016. ***FY 2018 Base Plans:*** - Continue all efforts of FY 2017. - Complete studies on oil emulsion issues and development of novel bilge water treatment systems for existing and new ships ***FY 2018 OCO Plans:*** N/A					
Title: HUMAN FACTORS AND ORGANIZATIONAL DESIGN	5.015	5.063	5.159	0.000	5.159
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 2016 Accomplishments:*** HUMAN COMPUTER INTERACTION/VISUALIZATION - Continued 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.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
COMMAND DECISION MAKING (CDM) - Continued to develop task management algorithms applicable to agile supervisory control of teams involving human and autonomous agents. - Continued development of information infrastructure that is operational context sensitive to allow the dynamic prioritization of date based on its anticipated information value and mission criticality. - Continued research building proactive decision support tools for Command and Control. - Initiated research for Navigating in Uncertainty. SOCIAL NETWORK ANALYSIS - Continued 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. - Initiated development of testbeds and tool chains for rapid disaster analysis and response. - Initiated development of novel information feeds for Pacific Command.					
FY 2017 Plans: - Continue all efforts of FY 2016. - SOCIAL NETWORK ANALYSIS: - Initiate efforts on information conflicts, social-cyber behavior and hybrid warfare.					
FY 2018 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					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
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 2018 OCO Plans:*** N/A					
Title: MEDICAL TECHNOLOGIES	5.709	6.392	6.465	0.000	6.465
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-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 2016 Accomplishments:*** UNDERSEA MEDICINE: - Continued efforts to reduce operational injuries - Continued studies on decompression sickness (DCS) and arterial gas embolism (AGE), to include novel approaches to the prevention, detection and treatment of DCS/AGE, particularly by nonrecompressive methods. - Continued efforts to develop prophylactic agents preventing hyperbaric oxygen toxicity. Prolonged exposure to hyperbaric oxygen can be toxic to lungs, nervous system and eyes. - Continued efforts to assess the impact of thermal (i.e., heat and cold) stress on operational performance. Underwater thermal extremes can affect diver performance and alter risk of incurring decompression sickness. - Continued studies related to optimization of diver performance. Operational performance in the undersea environment can be hampered by a variety of environmental stressors.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued studies related to optimization of submariner health and performance. Submarine crewmembers are exposed to a variety of unique stressors including prolonged deployments, effects of altered diurnal rhythms, non-standard breathing gases, lack of sunlight, etc. that can impact health and performance. - Continued research to explore novel pharmaceutical interventions for hyperbaric oxygen toxicity. - Continued research on resuscitation therapies for near-drowning victims. - Completed research into improved cognitive agility for divers and diving supervisors. - Completed research into diver human system integration - displays and biometric monitoring. REGENERATIVE MEDICINE: - Continued the program with the Armed Forces Institute for Regenerative Medicine (AFIRM). NOISE INDUCED HEARING LOSS (NIHL): - Continued research to reduce noise at the source, i.e. jet engine quieting and flight deck noise reduction. - Continued efforts to reverse NIHL. - Continued studies related to biomedical effects of underwater sound as military divers must operate safely and effectively in potentially complex underwater sound fields. - Continued efforts for "stress inoculation" to mitigate the impact of exposure to stressful combat environments prior to deployment. - Continued research to study the incidence, susceptibility, and mitigation strategies of NIHL and tinnitus. - Continued research in prevention and treatment of NIHL and tinnitus. - Continued research to improve personal protective equipment technology. - Continued 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 2017 Plans:*** - Continue all efforts of FY 2016, less noted as completed. - UNDERSEA MEDICINE: - Complete research on resuscitation therapies for near-drowning victims. ***FY 2018 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					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
nonrecompressive 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 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 2018 OCO Plans:*** N/A					
Title: THE OFFICE OF NAVAL RESEARCH GLOBAL ***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	11.614	12.235	12.757	0.000	12.757

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
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 USN/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 2016 Accomplishments:*** INTERNATIONAL SCIENCE PROGRAM Engaged with international scientists and engineers through more than 500 liaison visits to research institutions in more than 60 countries. ONR Global actively fostered international research collaboration by awarding 47 grants totaling $1.5M. Additionally, the command established the second office in South America, ONR Global Sao Paolo. SCIENCE ADVISORS ONR Global embedded twenty-four (24) Science Advisors into Naval Fleet/Force Commands worldwide to fulfill the role of Science and Technology (S&T) liaison for the principal, assist in current & future S&T requirements definition, and to provide US Sailors & Marines with near term technology solutions/capabilities. ***FY 2017 Plans:*** - Continue all efforts of FY 2016. - Initiate the establishment of an ONR office in India. ***FY 2018 Base 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 2018 OCO Plans:*** N/A					
Title: TRAINING TECHNOLOGIES ***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,	4.502	4.870	4.960	0.000	4.960

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
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 2016 Accomplishments:*** COGNITIVE SCIENCE OF LEARNING - Continued research and assessment of advanced gaming technology for enhanced training. - Continued creation and conduct of experiments to validate automated performance assessment and after action reviews. - Continued a systematic program of applied research addressing unanswered questions regarding effective instructional strategies in artificially intelligent tutoring. - Continued research in the neuro-biology of learning including integration of the role of white matter - Continued development of games that incorporate AI techniques to teach complex warfighter skills decision-making and problem solving. - Continued development of intelligent avatars to interact with learners from different cultural, linguistic backgrounds, and preferences. - Continued development of scenarios generators that produce integrated training (e.g., individual and collective) training. - Continued development of optimal training strategies for intelligent jobs on mobile devices (e.g., IPad). - Continued development of immersive environments for training interpersonal and leadership skills. - Continued design and conduct experiment to assess training effectiveness of intelligent tutor for training ship handling skills. - Continued development of novel psychometric approaches to assess human performance in medical/ military simulations and simulators. - Continued research in design features of medical and military simulators and simulations. - Continued field studies and user tests evaluating new features and job aiding tools. - Continued research into computational neuron-models in the design of training systems. ENHANCING WARFIGHTER COGNITIVE CAPABILITY:					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued research to understand the structural relations among the latent variables of short-term memory, working memory, executive attentional control, and fluid intelligence. - Continued research to assess the improvement in recruit classification provided by the addition of measures of fluid intelligence and working memory. - Continued research to understand the role of intrinsic motivation in facilitating the transfer of working memory training to other cognitive capabilities. - Continued research to assess the efficacy of game-based brain training using hand-held (fieldable) hardware platforms. - Continued research to determine the relationship between induced gains in fluid intelligence and cognitive adaptability and agility, considered from the perspective of military decision-making. - Continued task to 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: - Continued research into game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise - Continued research on software tools to facilitate building natural language tutorial dialogs for artificially intelligent tutoring. - Continued the integration of cognitive and neuron-computational models of human learning					
FY 2017 Plans: - Continue all efforts of FY 2016.					
FY 2018 Base 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 neuro-biology 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.					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Conduct field studies and user tests evaluating new features and job aiding tools. Research computational neuron-models in the design of training 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 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	44.092	45.467	48.649	0.000	48.649

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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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.