Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Navy												Date: March 2024
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 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	118.546	74.722	76.379	-	76.379	75.518	78.928	79.693	84.542	Continuing	Continuing
0000: *Warfighter Sustainment Applied Res*	0.000	69.554	74.722	76.379	-	76.379	75.518	78.928	79.693	84.542	Continuing	Continuing
9999: *Congressional Adds*	0.000	48.992	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	48.992

A. Mission Description and Budget Item Justification

U.S. Sailors and Marines are key to mission success. This Program element (PE) supports research that advances artificial intelligence (AI) enabled decision aides, autonomy, human-machine teaming, augmented performance, command and control and protective equipment to ensure they outthink, outperform and outfight adversaries in a complex, maritime environment. This PE also supports developments in biocentric and advanced materials technologies to provide new options to enhance performance of warfighters and their platforms. This PE also supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners.

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

This Program Element (PE) funds Applied Research, which is the systematic study to understand the means to meet a recognized and specific need. Most of the work in this PE can be classified between Technology Readiness Level (TRL) 2 (technology concept and/or application formulation) and TRL 4 (component and/or breadboard validation in laboratory environments).

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

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B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	121.707	74.722	76.773	-	76.773
Current President's Budget	118.546	74.722	76.379	-	76.379
Total Adjustments	-3.161	0.000	-0.394	-	-0.394
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.161	0.000			
• Program Adjustments	0.000	0.000	-0.394	-	-0.394
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: 9999: *Congressional Adds*		
Congressional Add: *Polymer coatings for reduced ice and fouling adhesion*	4.826	0.000
Congressional Add: *Hypersonics Material Acceleration*	4.827	0.000
Congressional Add: *Physics Based Neutralization of Threats to Human Tissues and Organs*	9.653	0.000
Congressional Add: *Anticorrosion nanotechnology*	9.653	0.000
Congressional Add: *Development of chromate-free corrosion inhibitor coatings for marine application*	1.689	0.000
Congressional Add: *Biomaterial exterior for hypersonic projectable*	4.826	0.000
Congressional Add: *Wearable sensors for injury predicition*	4.827	0.000
Congressional Add: *Long-term underwater autonomy*	4.827	0.000
Congressional Add: *Ultra-compact heat exchangers*	3.864	0.000
Congressional Add Subtotals for Project: 9999	48.992	0.000
Congressional Add Totals for all Projects	48.992	0.000

Change Summary Explanation

Funding: The funding decrease is due to reduced S&T Investments in applied research.

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Technical: No significant change.

Schedule: No significant change

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COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
0000: *Warfighter Sustainment Applied Res*	0.000	69.554	74.722	76.379	-	76.379	75.518	78.928	79.693	84.542	Continuing	Continuing

A. Mission Description and Budget Item Justification

U.S. Sailors and Marines are key to mission success. This Program element (PE) supports research that advances artificial intelligence (AI) enabled decision aides, autonomy, human-machine teaming, augmented performance, command and control and protective equipment to ensure they outthink, outperform and outfight adversaries in a complex, maritime environment. This PE also supports developments in biocentric and advanced materials technologies to provide new options to enhance performance of warfighters and their platforms. This Program conducts applied research to address Warfighter protection and performance concerns, including efforts that focus on advanced Naval materials, biocentric technologies, decision support, intelligent and autonomous systems, human performance optimization, training and education technologies, social and cultural science, and biomedical technologies. This PE also supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Title: Advanced Naval Materials	17.298	20.209	21.726	0.000	21.726
Description: Advanced Naval Materials efforts support several Science and Technology (S&T) Focus Areas, in particular Platform Design & Survivability, and perform research across a broad spectrum of technical areas including: advanced structural materials to increase the material pallet available to provide for paradigm shifting improvements in platform performance (i.e., detectability, susceptibility, recoverability, maintainability, capability, and survivability) at reduced weight and cost; advanced, high-performance materials for energy systems; corrosion mitigation strategies and tools; high-temperature materials for propulsion systems; and enhanced acoustic transducers and sensor materials.					
FY 2024 Plans: Materials - Continue ongoing research efforts to improve affordability and reliability of piezoelectric transduction materials. The focus will be on Acoustic Transduction Materials Technology to reduce SWaP and improve sensitivity of sensors and SONAR. - Continue research to develop advanced structural alloys and composites, joining and repair technologies. - Continue research to pursue commercially viable processing for nano-engineered materials, including ceramics, metals, and materials systems. The focus will be on Nanostructured Materials Processing aimed					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
at improved resilience of naval systems and platforms and capabilities for producing novel, high performance components. - Continue advance materials, processes and capabilities. Continue efforts focus on the development of a high thermal conductivity later for high power electronic device application to improve performance. Complete - Agile Manufacturing - Integrated Computational Materials Engineering (ICME) toolkit infrastructure development. Sustainment & Logistics - Continue applied research to investigate corrosion control technologies through investigation of corrosion inhibitor performance for coatings and corrosion mechanisms of compositionally complex alloys (CCA) and additive manufactured materials. Naval Power Systems - Continue to advance applied research efforts for development of naval materials in support of naval power systems, including efforts associated with attritable fuel cells. Platform Design and Engineering - Continue applied research efforts in support of advanced naval platform materials refining and concentrating efforts on advanced structural materials that improve Undersea Platform Survivability. - Initiate research to develop Advanced and Alternative Structural Alloys and Composites, as well as their associated Joining and Repair technologies. - Initiate applied research efforts in matrix materials and nano/micro-scale embedded structures useful for controlling platform signatures as well as their manufacturability in quantity.					
FY 2025 Base Plans: Materials: - Continue ongoing research efforts to improve affordability and reliability of piezoelectric transduction materials. The focus will be on Acoustic Transduction Materials Technology to reduce size, weight, and power (SWaP) and improve sensitivity of sensors and SONAR.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue research to pursue commercially viable processing for nano-ceramics. The focus will be on nano-ceramics aimed at improved resilience of naval systems and platforms and capabilities for producing novel, high performance components. - Continue advanced materials, processes and capabilities. - Continue efforts focused on the development of high thermal conductivity materials for high power electronic device application to improve performance. - Continue research to develop Advanced and Alternative Structural Alloys and Composites, as well as their associated Joining and Repair technologies. - Continue applied research efforts in matrix materials and nano/micro-scale embedded structures useful for controlling platform signatures as well as their manufacturability in quantity. - Complete development of new, damping steels for structural applications. (Initiated in FY21) - Initiate effort in Integrated Materials Systems Technology. Manufacturing and Sustainment (formerly Sustainment and Logistics): - Continue applied research to investigate corrosion control technologies through investigation of corrosion inhibitor performance for coatings and corrosion mechanisms of compositionally complex alloys (CCA) and additive manufactured materials. - Continue applied research to investigate computational tools for additive manufacturing materials and processes. (Initiated in FY24) - Continue investments in hybrid laser arc welding and high temperature polymeric composites. (Initiated in FY23) - Complete efforts in low cost ceramic matrix composites and nanocomposite weld wire development. (Initiated in FY22) - Initiate potential new investments in electronics/electro-optics and biomanufacturing. Power and Energy (formerly Naval Power Systems): - Continue to advance applied research efforts for development of naval materials in support of naval power systems, including efforts associated with attritable fuel cells. - Initiate research aimed at advancing materials, processes and capabilities necessary for mitigating climate risk to expeditionary water supply. Naval Engineering (formerly Platform Design and Engineering):					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue applied research efforts in support of advanced naval platform materials refining and concentrating efforts on advanced structural materials that improve Platform Survivability. - Initiate applied research in support of advanced materials aimed at improving naval platform susceptibility against detection and classification. (NRL) Continue research into Advanced Materials. The overall focus of these efforts is to demonstrate at pertinent scale and environment of the performance of advanced materials and innovative processing techniques. Successful manufacturing of devices/components utilized newly discovered advanced materials requires understanding the complex relationship between material constituents, fabrication methodologies and processes, device or component design and performance. While the primary focus is structural materials, this task area is not limited to material type. Efforts focus on the design, development and improvement of prototypes and new processes and the steps required for the transition of these processes from the laboratory to the production environment. The successful consistent production of advanced materials is based on understanding the advanced structural materials to enable improvement in device, component, and platform performance and to enable new capabilities. Work involves processing methodologies for advanced high performance functional materials providing advanced sensor capabilities, high performance structural materials including advanced computational methodologies for life prediction in extreme performance environments and, advanced corrosion mitigation solutions. This is an expansion of previously mentioned efforts that focused on development of a high thermal conductivity later for high power electronic device application to improve performance. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding increase from FY 2024 to FY 2025 is due primarily to increased funding for Water Resilience.					
Title: Biocentric Technologies ***Description:*** Applied research to develop knowledge and technologies for future Naval capabilities. Research areas include: bioinspired and biomimetic materials; synthetic biology for environmental surveillance and materiel production; bioenergy harvesting and electronics; warfighter augmentation and resilience; and marine mammal health. This research provides secure and agile options to enhance performance, increase novel power and energy solutions to safely extend operational duration, and improve stealth, maneuverability, and mission capability of platforms and autonomous systems.	9.127	9.668	8.178	0.000	8.178

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
FY 2024 Plans: Bio-Inspired Autonomous Systems Continue: - Conduct applied research on bio-inspired underwater vehicle propulsion and control as an effective alternative to current propulsion approaches. - Mature search behavior algorithms for autonomous vehicles to enhance object detection and recognition abilities. - Apply bio-inspired principles to design vehicles that can operate amphibiously and seamlessly transition from sea sub-surface to air operations. - Investigate application of flexible batteries to power underwater vehicle prototype. Naval Biosciences and Synthetic Biology for Naval Applications Continue: - Applied research in bio/bio-inspired materials for multi-spectral camouflage. - Applied research in bioengineering systems for the bioproduction/biodegradation of military relevant materials. - Applied research to incorporate microbial sensors on Naval platforms for environmental monitoring. - Applied research on the development of microbial fuel cells as power sources. Initiate: - Applied research on understanding and building bioelectronics systems for use in computing, data storage, and materials development. Marine Mammal Health (This thrust was previously part of the Bioengineering and Life Sciences FY23 Plan. The name was changed to more accurately describe the research.) Continue: - Conduct applied research to determine the role of lung membrane integrity in marine mammal respiratory diseases - Establish therapeutics to prevent kidney stone formation in dolphins - Facilitate surveillance of marine mammal viral pathogens in marine waters and indigenous mussels/oysters/clams - Implement dolphin vocalizations as a tool for diagnosing their well-being. Warfighter Augmentation and Resilience					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Continue: - Development of manned-unmanned teaming platforms to aid a diver in enhanced situational awareness and to expand diving windows of opportunity by eliminating current limitations such as restricted access (cold, depth, and enclosed spaces), visibility, and gas supply. - Translate basic research on oxygen separation and transport and carbon dioxide scrubbing into prototype oxygen-generating and carbon dioxide-disposing diving mask to replace existing rebreathers. - Applied research on gas management capabilities to support diver respiratory fitness. - Applied research in bio-inspired light polarization sensors and machine learning methods for predicting underwater geolocation and developing technology for underwater image dehazing. Complete: - Development of technologies that protect divers from environmental stressors by monitoring their heat loss and, assess new wetsuit designs to provide enhanced thermal protection.					
FY 2025 Base Plans: Bioinspired Autonomous Systems - Continue to conduct applied research on bio-inspired underwater vehicle propulsion and control as an effective alternative to current propulsion approaches. - Continue to mature search behavior algorithms for autonomous vehicles to enhance object detection and recognition abilities. - Continue to apply bio-inspired principles to design vehicles that can operate amphibiously and seamlessly transition from sea sub-surface to air operations. - Continue to investigate application of flexible batteries to power underwater vehicle prototype. Naval Biosciences and Synthetic Biology for Naval Applications - Complete applied research on the development of microbial fuel cells and biobatteries as power sources. - Complete applied research in bioelectronics for use in computing, data storage, and materials development. - Complete applied research in bio/bio-inspired materials for multi-spectral camouflage. - Continue applied research in bioengineering systems for the bioproduction (biomanufacturing) and biodegradation of Naval relevant materials. - Continue applied research to incorporate microbial sensors on Naval platforms for environmental monitoring. Marine Mammal Health and Performance					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Complete applied research to determine the role of lung membrane integrity in marine mammal respiratory diseases. - Continue to establish therapeutics to prevent kidney stone formation in dolphins. - Continue to facilitate surveillance of marine mammal viral pathogens in marine waters and indigenous mussels/ oysters/clams. - Continue to implement dolphin vocalizations as a tool for diagnosing their well-being. - Initiate the application of advanced technologies which focus on pulmonary and ocular disease. - Initiate applied research to implement personalized medicine for care of marine mammals under Navy Marine Mammal Program. - Initiate research on new military capabilities for dolphins and sea lions. Warfighter Augmentation and Resilience - Complete applied research in bio-inspired light polarization sensors and machine learning methods for predicting underwater geolocation and developing technology for underwater image dehazing. - Continue development of manned-unmanned teaming platforms to aid a diver in enhanced situational awareness and to expand diving windows of opportunity by eliminating current limitations such as restricted access (cold, depth, and enclosed spaces), visibility, and gas supply. - Continue to translate basic research on oxygen separation and transport and carbon dioxide scrubbing into prototype oxygen-generating and carbon dioxide-disposing diving mask to replace existing rebreathers. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The decrease in funding from FY 2024 to FY 2025 is due to the completion of efforts to develop: 1) power sources from microbial fuel cells and biobatteries; and 2) multi-spectral camouflage from bio-inspired materials.					
Title: Human Factors and Organizational Design ***Description:*** Operational and tactical level decision-making requires making time-critical decisions with imperfect information. This activity seeks to understand how warfighters make decisions despite uncertainty, and research practical strategies for managing information for Naval warfighter decision-making. These applied research efforts will improve mixed social-technical systems design, system interface designs and human-level decision support in Naval contexts. Research areas include the development of techniques to enhance warfighter performance in managing human-machine teaming and decision-making.	5.817	6.130	5.936	0.000	5.936

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
FY 2024 Plans: Cognitive Science for Human-Machine Teaming and Computational Neuroscience Continue: - Assess feasibility of incorporating realistic neural systems into autonomous systems for more robust on-board perception and intelligence. - Conducting applied research on system interface designs and human-machine interaction methodologies that enable or enhance Naval Warfighter performance and human-machine teaming. - Conduct applied research to develop agile humanoid robot teammates with enhancements including: (i) Embedding computer vision with visual-spatial reasoning; (ii) Auditory systems to enable human communication; and (iii) Neuromorphic (brain-like) processors. - Conduct applied research to train mission-capable robots to perform complex manipulation tasks, integrated with the ability to recognize patterns and learn from data (self-learning). - Investigate the effectiveness of incorporating vision and language processes in robots to facilitate human-robot team performance learning and communication. Social Networks and Computational Social Science Continue: - Applied research in information environment assessment. - Investigate and assess tactics, techniques and procedures that enable military personnel operating in the information environment to discover, monitor and counter adversarial maneuvers in digital and social media. Complete: - Applied research in humanitarian assistance / disaster relief information collection. Initiate: - Research in new techniques to address military concerns in digital and social media. Command Decision Making Continue: - Research to automate and display recommendations and characterize uncertainty, derived from machine learning (ML) algorithms. - Research automation algorithms for managing man-machine teaming and scalability of control to large numbers of autonomous entities (robots / swarms).					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Applied research to develop collaborative artificial intelligence (AI) decision support tools that learn from human command and control tasks. Initiate: - Study manned-unmanned teaming Command and Control (C2) solutions across different command echelons. Human Interaction with Autonomous Systems Continue: - Conduct applied research to incorporate computer vision, acoustic localization, reasoning and communication capabilities into humanoid and quadruped robot teammates. - Investigate best approaches to train mission-capable robots to perform complex manipulation skills essential for shipboard and urban operations. - Conduct applied research to understand how to enhance diver performance with small autonomous underwater vehicle (AUV) assistants. - Study approaches to incorporate cognitive architectures and visual reasoning processes on robotic teammates to enable enhanced cooperative, team-level, behaviors. Complete: N/A Initiate: - Evaluations of mobility and manipulation ability of advanced humanoid robot prototypes on shipboard maintenance and urban building inspection tasks. Naval Team Performance and Design Continue: - Conduct applied research to understand human factors engineering and physical design parameters of naval platforms that optimize decision-making. - Understand the impact of team composition, human factors, stress and social decision making to reduce decision biases and performance errors in operational settings.					
FY 2025 Base Plans: Cognitive Science for Human-Machine Teaming and Computational Neuroscience - Continue to assess feasibility of incorporating realistic neural systems into autonomous systems for more robust on-board perception and intelligence.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue to study approaches to incorporate cognitive architectures and visual reasoning processes on robotic teammates to enable enhanced cooperative, team-level, behaviors. Note: Previously under Human Interaction with Autonomous Systems Program Title in FY 2024 and earlier. - Continue conducting applied research on system interface designs and human-machine interaction methodologies that enable or enhance Naval Warfighter performance and human-machine teaming. - Continue to conduct applied research to develop agile humanoid robot teammates with enhancements including: (i) Embedding computer vision with visual-spatial reasoning; (ii) Auditory systems to enable human communication; and (iii) Neuromorphic (brain-like) processors. - Continue to investigate the effectiveness of incorporating vision and language processes in robots to facilitate human-robot team performance learning and communication. Social Networks and Computational Social Science - Continue applied research in information environment assessment. - Continue to investigate and assess tactics, techniques and procedures that enable military personnel operating in the information environment to discover, monitor and counter adversarial maneuvers in digital and social media. - Continue research in new applied techniques to address military concerns in digital and social media. - Initiate research in the application of large language models and similar new social computational techniques to improve information advantage on operations in the information environment concerns and challenges. Command Decision Making - Complete research to automate and display task recommendations and characterize uncertainty, derived from machine learning (ML) algorithms. - Continue to research automation algorithms for managing man-machine teaming and scalability of control to large numbers of autonomous entities (robots / swarms). - Continue applied research to develop collaborative artificial intelligence (AI) decision support tools that learn from human command and control tasks. - Continue to study manned-unmanned teaming Command and Control (C2) solutions across different command echelons. - Initiate decision centered design technology development. - Initiate research to evaluate manned-unmanned teaming Command and Control (C2) paradigms applied to different command echelons.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Human Interaction with Autonomous Systems - Continue to conduct applied research to incorporate computer vision, acoustic localization, reasoning and communication capabilities into humanoid and quadruped robot teammates. - Continue to investigate best approaches to train mission-capable robots to perform complex manipulation skills essential for shipboard and urban operations. - Continue to conduct applied research to understand how to enhance diver performance with small autonomous underwater vehicle (AUV) assistants. - Continue evaluations of mobility and manipulation ability of advanced humanoid robot prototypes on shipboard maintenance and urban building inspection tasks. - Continue to conduct applied research to train mission-capable robots to perform complex manipulation tasks, integrated with the ability to recognize patterns and learn from data (self-learning). Note: Previously under Cognitive Science for Human-Machine Teaming and Computational Neuroscience Program Title in FY 2024 and earlier. - Initiate applied research on humanoid and animal inspired mission capable robots for urban and shipboard operations. Naval Team Performance and Design - Continue to conduct applied research to understand human factors engineering and physical design parameters of naval platforms that optimize decision-making. - Continue to understand the impact of team composition, human factors, stress and social decision making to reduce decision biases and performance errors in operational settings. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Title: Medical and Human Performance Technologies	8.490	8.953	8.676	0.000	8.676
Description: The overall objective of this activity is to sustain, extend, enhance, and repair warfighter endurance, resiliency and readiness while operating in multi-domain and expeditionary environments. This Activity includes two program areas: medical and human performance research. Efforts categorized as Human Performance Technologies focus on research before injury. Efforts categorized as Medical Technologies focus on research after injury.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
The human performance portion of this applied research activity centers on: improving performance of divers and submarine crews; developing biological markers of stress response; protecting warfighter performance and preventing injuries during exposure to high levels of acoustic or electromagnetic energy; and wearable physiological sensors to support safety and survivability of Naval forces during training and in operational environments. Results from these efforts will enhance readiness and lethality and will inform operational safety guidelines. The medical portion of this applied research activity addresses naval-unique threats and centers on: protecting warfighters from operational health threats; developing diagnostic and treatment capabilities for use in operational environments; and prototyping new capabilities to recover injured warfighters. Results from these efforts will improve the Fleet's ability to save lives, especially during prolonged field care. ***FY 2024 Plans:*** Medical Technologies Continue: - Explore use of novel technologies to improve warfighter survivability in the maritime domain including: nanotechnologies, microelectronics, artificial intelligence, non-invasive sensors, multifunctional materials and systems and protective equipment. - Use modeling, microelectronics and novel composite materials for biomedical sensing and therapeutic care to prototype equipment (e.g., helmet system) to protect, sense, respond, and enhance human performance. - Conduct applied research on autonomous recovery of impaired/injured personnel during operations ashore and afloat to improve casualty care. Complete: - Development of novel anti-infectives for improved wound care. Initiate: - Develop field ready bandages using mature novel anti-infective wound care technology. - Assess feasibility of using physics-based principles to understand the constitutive properties of biological tissues to support human digital twin representations. Human Performance Technologies Continue:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Applied research on communication technologies to enhance warfighter performance, including auditory cuing and alerting. - Investigate biomedical effects of electromagnetic energy exposures - Applied research to identify and validate capabilities that prevent and mitigate the safety risks of decompression sickness and oxygen toxicity. - Applied research to maintain a healthy metabolic balance for diver energy requirements to advance safe and optimized performance. - Applied research on the feasibility of new underwater ultrasound devices to generate individualized and deterministic decompression profiles to reduce the risk of decompression sickness. - Assess feasibility of using predictors of stress in a military population to understand the parameters for developing a performance prediction tool. - Applied research to reduce high performance tactical jet noise through the evaluation of noise reduction concepts. - Applied research to investigate approaches to excite natural instability wave of the jet flow. Complete: - Research on the spleen size as a function of modified breath control. This effort resulted from the FY23 plan to continue applied research to develop countermeasures that prevent and mitigate the safety risks of decompression sickness, oxygen toxicity, and supplement metabolic diver energy requirements to advance safe and optimized performance. - Applied research to develop novel biological sensor hardware that autonomously monitor warfighter performance and physiology (e.g., blood pressure, heart rate) in real-time. - Exploration of large data sets of human biology and physiology to enhance algorithms that will improve sensors that monitor human performance. - Development of lab scale capability for the purpose of investigating jet noise at afterburner conditions. Initiate: -Development of a novel biologic prophylactic and therapeutic for decompression sickness using an anti-inflammatory protein. - Applied research to develop novel augmented reality platforms that will autonomously track/display environmental factors and hazards for warfighters operating in environments with low or no visibility, and enhance warfighter performance in such scenarios. - Theoretical and computational study of jet noise control. - Evaluation of active control of jet noise via bi-modal excitation.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Resonance prediction and mitigation in rectangular twin-jets.					
FY 2025 Base Plans: Medical Technologies - Complete development of field ready bandages using mature novel anti-infective wound care technology. - Continue to conduct applied research into the use of novel technologies to improve warfighter survivability in the maritime domain including: nanotechnologies, microelectronics, artificial intelligence, non-invasive sensors, multifunctional materials and systems and protective equipment. - Continue modeling, microelectronics and novel composite materials for biomedical sensing to prototype equipment to protect, sense, respond, and enhance human performance. - Continue to conduct applied research on autonomous recovery of impaired/injured personnel during operations ashore and afloat to improve casualty care. - Continue application of novel quantification methods for soft materials to determine constitutive properties of biological tissues to support human digital twin representations. - Initiate experimental trials of autonomous fluid resuscitation and ventilation algorithms. Human Performance Technologies - Complete applied research on communication technologies to enhance warfighter performance, including auditory cuing and alerting. - Complete applied research to maintain a healthy metabolic balance for diver energy requirements to advance safe and optimized performance. - Complete development of a novel biologic prophylactic and therapeutic for decompression sickness using an anti-inflammatory protein. Note: In FY25 this effort has transitioned to PE 0602750N. - Complete applied research to reduce high performance tactical jet noise through the evaluation of noise reduction concepts. - Complete applied research to investigate approaches to excite natural instability wave of the jet flow. - Continue to investigate biomedical effects of electromagnetic energy exposures. - Continue to assess feasibility of using predictors of stress in a military population to understand the parameters for developing a performance prediction tool. - Continue applied research to develop novel augmented reality platforms that will autonomously track/display environmental factors and hazards for warfighters operating in environments with low or no visibility, and enhance warfighter performance in such scenarios.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue applied research to identify and validate capabilities that prevent and mitigate the safety risks of decompression sickness and oxygen toxicity. - Continue applied research on the feasibility of new underwater ultrasound devices to generate individualized and deterministic decompression profiles to reduce the risk of decompression sickness. - Continue theoretical and computational study of jet noise control. - Continue evaluation of active control of jet noise via bi-modal excitation. - Continue resonance prediction and mitigation in rectangular twin-jets. - Initiate research to evaluate the efficacy and properties of anti-oxidants in mitigating accumulation of harmful reactive oxygen species in hyperoxic conditions. - Initiate novel underwater biosensors for physiologic health status monitoring. - Initiate machine-learning for resolvent-based jet-noise models. - Initiate collaborative Research on machine-learning for jet noise prediction and control. - Initiate F135 Noise Assessment. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Title: Human Research Protection Program (HRPP)	2.798	2.850	2.763	0.000	2.763
Description: The Federal Policy for the Protection of Human Subjects is codified in the Department of Defense (DoD) as part 219 of title 32, Code of Federal Regulations (also known and hereinafter referred to as the "Common Rule"). DoD Instruction 3216.02 establishes policy and assigns responsibilities for the protection of human subjects in DoD-supported programs to implement the Common Rule and requires Heads of DoD Components to establish and oversee DoD Component policies and procedures that ensure compliance with federal and DoD requirements. The Secretary of the Navy Instruction (SECNAVINST) 3900.39E CH-1 identifies the Chief of Naval Research as providing support and expertise for human research protection in research conducted or supported by the Navy and Marine Corps Systems Commands and institutions, operational forces, training Commands, and Department of the Navy (DON)-supported research involving human subjects performed by non-DoD institutions. The Human Research Protection Program (HRPP) protects the rights, safety, and welfare of human subjects in research conducted or sponsored by the Navy and Marine Corps by: 1) ensuring that research involving human subjects complies with federal regulations, DoD Directives, DON Instructions, and Marine Corps Orders governing research protection requirements; and 2) providing education					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
and training programs in human research ethics to all levels of staff involved in the review, approval, conduct, management, or support of DON human subjects research (HSR). ***FY 2024 Plans:*** Continue: - Establish five new human research protection programs (HRPP). - Program Management of the DON Research Protections Information Technology Management System (RPITMS) for management and compliance oversight of ongoing human research protections activities. - Continue providing education and training programs in human research ethics to all levels of staff involved in the review, approval, conduct, support or management of DON human subjects research. - Provide subject matter expertise and guidance on all DON-conducted and -supported research involving human subjects. - Continue developing the Research Protection Community of Excellence to share best practices across the DON research protection enterprise. - Conduct site visits (site inspections and assist visits) to Navy and Marine Corps Commands as part of the ongoing monitoring and quality improvement program for human research protections within the Department of the Navy and in accordance with 32 CFR 219, DoD Instruction 3216.02, and Secretary of the Navy Instruction (SECNAVINST) 3900.39E CH-1. - Revise all human research protection program standard operating procedures to make consistent with 32 CFR 219, DoD Instruction 3216.02 and SECNAVINST 3900.39E CH-1. Initiate: - Review and revise the Office of Naval Research Instruction 3900.39B, "Protection of Human Subjects", bringing it into compliance with 32 CFR 219 and DoD Instruction 3216.02. ***FY 2025 Base Plans:*** - Complete establishment of five new human research protection programs (HRPP). - Continue Program Management of the DON Research Protections Information Technology Management System (RPITMS) for management and compliance oversight of ongoing human research protections activities, as well as the ONR HRPP's web-based research ethics training program (Collaborative Institutional Training Initiative (CITI)); annually this required training is completed by more than 6,000 Navy and Marine Corps personnel.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Continue providing education and training programs in human research ethics to all levels of staff involved in the review, approval, conduct, support or management of DON human subjects research. - Continue to provide subject matter expertise and guidance on all DON-conducted and -supported research involving human subjects. - Continue to conduct site visits (site inspections and assist visits) to Navy and Marine Corps Commands as part of the ongoing monitoring and quality improvement program for human research protections within the Department of the Navy and in accordance with 32 CFR 219, DoD Instruction 3216.02 CH-1, and Secretary of the Navy Instruction (SECNAVINST) 3900.39E CH-1. - Continue to revise all human research protection program standard operating procedures to make consistent with 32 CFR 219, DoD Instruction 3216.02 CH-1 and SECNAVINST 3900.39E CH-1. - Continue developing the Research Protection Community of Excellence to share best practices across the DON research protection enterprise. - Initiate review and revise SECNAVINST 3900.39E CH-1, "Human Research Protection Program", bringing it into compliance with DoD Instruction 3216.02 CH-1. - Initiate review and update the DON Component HRPP Management Plan (CMP). The CMP identifies the single, senior official having the authority and responsibility for implementing the management plan and identifies all authorities delegated by the Secretary of the Navy. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Title: The Office of Naval Research Global ***Description:*** Supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners. Science Advisors (SA) This effort ensures that the operational Naval fleet/force help shape the DON investment in science and technology (S&T), develops teaming relationships to rapidly prototype, experiment, demonstrate and transition technology, supports development of technology-based capability options for Naval forces, and enables	21.021	21.794	24.143	0.000	24.143

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
warfighting innovations based on technical and conceptual possibilities. The SA Program also informs capability-based war games using current and future technology to identify future capability strengths and shortfalls that assist in shaping the DON investment strategy. The ONR Global SA Program enables continuous communication and collaboration between the warfighters, the Naval Research & Development Enterprise, and strategic development commands. International science The ONR Global mission is also accomplished through PhD-level scientists located in Asia, Australia, Europe and South America, providing coverage in these regions as well as Africa, Indo-Pacific and the Middle East. ONR Global scientists actively search the globe for emerging scientific research and promising technologies, collaborating with international organizations and researchers through liaison visits and grants in innovative applied research. The direct impact of this investment is to leverage international research during increasingly dynamic global interdependence and improve the ability to solve DON S&T challenges through shared knowledge and technologies with partners. In addition, this investment builds global S&T awareness to reduce the risk of potential technological surprise and supports theater security cooperation goals to sustain cooperative relationships with an expanding set of international partners. International engagement ONR Global also supports international engagement with partner nations through the development and maintenance of bilateral and multilateral relationships, international agreements, and other activities that promote RDT&E collaboration and interoperability. ***FY 2024 Plans:*** Continue to: - Support all Science Advisor program efforts across Fleet and Forces Commands; objectively assess placement of current Science Advisors and requests for additional support in terms of impact to the Fleet and S&T return on investment. - Support PhD-level scientists, in multiple deployed overseas locations (Asia, Europe, South America, and Australia) to engage with international scientists and engineers through visits to research institutions and actively foster international collaboration by awarding research grants. Maintain and report on global technical awareness.					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Support international meetings and agreements with ten partner nations, three multi-lateral groups, and the North Atlantic Treaty Organization (NATO), in order to increase collective Naval capability, capacity, and interoperability. ***FY 2025 Base Plans:*** Continue to: - Support all Science Advisor program efforts across Fleet and Forces Commands; objectively assess placement of current Science Advisors and requests for additional support in terms of impact to the Fleet and S&T return on investment. - Support PhD-level scientists, in multiple deployed overseas locations (Asia, Europe, South America, and Australia) to engage with international scientists and engineers through visits to research institutions and actively foster international collaboration by awarding research grants. Maintain and report on global technical awareness. - Support international meetings and agreements with ten partner nations, three multi-lateral groups, and the North Atlantic Treaty Organization (NATO), in order to increase collective Naval capability, capacity, and interoperability. ***FY 2025 OCO Plans:*** Not applicable ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding increase from FY 2024 to FY 2025 is due to additional Science Advisors to support U.S. European Command (EUCOM) and Fleet Information Warfare Command Pacific (FIWC PAC), specific Bilateral Technology Challenges, and increasing international projects.					
Title: Training Technologies ***Description:*** Applied research to enhance the ability to develop Naval forces from time of recruitment through separation from the military capable of competing and succeeding against novel threats and using novel, rapidly-fielded, technologies. This includes use of modern approaches for evaluation of knowledge, skills, and aptitude in school houses, field training, and point-of-need. Improved effectiveness is achieved by applying psychometric theory, data science, cognitive science, operations research, modeling and simulation, and computer sciences to	5.003	5.118	4.957	0.000	4.957

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
the development, delivery, evaluation, and execution of training and education. Emphasis is on approaches that are robust at scale and can be implemented in a resource-constrained environment. ***FY 2024 Plans:*** Technologies for Naval Training Continue: - Applied research on using immersive environments (multi-player game) to train unit commanders in decision making, tactics, and strategies. - Assess methods and techniques to identify individual differences to optimize training. - Study use of game technology and augmented reality to enhance job-performance and support decision making. - Applied research on learning-based techniques to improve decision-making and develop warfighters who are able to integrate and adapt to new technologies and threats. - Investigate new methods to use artificial intelligence to tailor training to the individual warfighter's needs. - Assess new techniques for obtaining and sharing of knowledge to improve individual and team performance in Naval environments. - Investigate approaches that enable digital intelligent tutor technologies to characterize and diagnose students errors and provide appropriate real-time remediation. - Assess feasibility of incorporating models of Naval social/cultural norms to enhance leadership training. Complete: - Expand new methods and techniques for enhancing problem solving ability of autonomous, artificial intelligence agents. Findings have supported associated applied research in AI. Advanced Integrated Maritime Mission Modeling Continue: - Assess feasibility of training technologies to mitigate the effects of denied / degraded environments as well as cyber incursions on combat effectiveness. - Investigate Live, Virtual, and Constructive simulation-based training technologies for Naval Expeditionary Advanced Based Operations (EABO). - Applied research on adaptive/individualized training techniques for shore and ship-based Live, Virtual, and Constructive Anti-Submarine Warfare and Navigation Team Training. Complete:					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Studies on Live, Virtual, and Constructive simulation-based training technologies for Anti-Submarine Warfare to include a greater range of simulated target types, behaviors, and scenarios, transitioning to OPNAV N96/Fleet Training Wholeness Program. Initiate: - Applied research to understand performance metrics, data collection techniques, and analysis approaches that can be used to assess warfighter readiness across Carrier Strike Groups. - Investigate individualized cyber training in Live, Virtual, and Constructive shipboard environments. Learning to Integrate and Adapt to New Naval Technologies and Threats Continue: - Applied research on tailorable and scalable capabilities to improve decision-making and develop warfighters who are able to integrate and adapt to new Naval technologies and threats.					
FY 2025 Base Plans: Technologies for Naval Training - Complete applied research on using immersive environments (multi-player game) to train unit commanders in decision making, tactics, and strategies. - Complete the assessment of methods and techniques to identify individual differences to optimize training. - Complete the use of game technology and augmented reality to enhance job-performance and support decision making. - Complete applied research on learning-based techniques to improve decision-making and develop warfighters who are able to integrate and adapt to new technologies and threats. - Complete the investigation of new methods to use artificial intelligence to tailor training to the individual warfighter's needs. - Complete research that assess new techniques for obtaining and sharing of knowledge to improve individual and team performance in Naval environments. - Complete approaches that enable digital intelligent tutor technologies to characterize and diagnose students' errors and provide appropriate real-time remediation. - Complete feasibility assessment of incorporating models of Naval social/cultural norms to enhance leadership training. Advanced Integrated Maritime Mission Modeling					

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Complete feasibility assessment of training technologies to mitigate the effects of denied / degraded environments as well as cyber incursions on combat effectiveness. - Complete applied research on adaptive/individualized training techniques for shore and ship-based Live, Virtual, and Constructive Anti-Submarine Warfare and Navigation Team Training. - Continue to investigate Live, Virtual, and Constructive simulation-based training technologies for Naval Expeditionary Advanced Based Operations (EABO). - Continue applied research to understand performance metrics, data collection techniques, and analysis approaches that can be used to assess warfighter readiness across Carrier Strike Groups. - Continue to investigate individualized cyber training in Live, Virtual, and Constructive shipboard environments. - Initiate research and validate computational approaches for automated compression, synchronization and distribution of training data across Live, Virtual, and Constructive training. - Initiate design an engineering solution that provides a web-based "game server" for Live, Virtual, and Constructive training content delivery. Learning to Integrate and Adapt to New Naval Technologies and Threats - Continue applied research on tailorable and scalable capabilities to improve decision-making and develop warfighters who are able to integrate and adapt to new Naval technologies and threats. 21st Century Learning - Initiate research to examine submarine SONAR operator knowledge and ability within simulated training scenarios. - Initiate design and development of learning technologies to improve delivery and assessment of submarine SONAR learning ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant funding change from FY 2024 to FY 2025.					
Accomplishments/Planned Programs Subtotals	69.554	74.722	76.379	0.000	76.379

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

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COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
9999: *Congressional Adds*	0.000	48.992	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	48.992

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
Congressional Add: Polymer coatings for reduced ice and fouling adhesion ***FY 2023 Accomplishments:*** Analyze solids shedding mechanisms resulting in an improvement to ice release capabilities of Navy topside coatings and the biofouling release capabilities of Navy below the water line antifouling coatings. ***FY 2024 Plans:*** N/A	4.826	0.000
Congressional Add: Hypersonics Material Acceleration ***FY 2023 Accomplishments:*** Conduct Hypersonics Material Acceleration research. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: Physics Based Neutralization of Threats to Human Tissues and Organs ***FY 2023 Accomplishments:*** Research multiscale, physics-based approach to understanding traumatic brain injury. This research is essential for preventing and mitigating both mild traumatic brain injury (mTBI), directed energy TBI (DE-TBI) and blast TBI (bTBI). ***FY 2024 Plans:*** N/A	9.653	0.000
Congressional Add: Anticorrosion nanotechnology ***FY 2023 Accomplishments:*** Conduct applied research supporting anticorrosion nanotechnology. ***FY 2024 Plans:*** N/A	9.653	0.000
Congressional Add: Development of chromate-free corrosion inhibitor coatings for marine application ***FY 2023 Accomplishments:*** Conduct applied research for development of chromate-free corrosion inhibitor coatings for marine application. ***FY 2024 Plans:*** N/A	1.689	0.000
Congressional Add: Biomaterial exterior for hypersonic projectable	4.826	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2025 Navy		Date: March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Conduct biomaterial exterior for hypersonic projectable research. ***FY 2024 Plans:*** N/A		
Congressional Add: Wearable sensors for injury predicition ***FY 2023 Accomplishments:*** Research wearable sensors for injury prediction. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: Long-term underwater autonomy ***FY 2023 Accomplishments:*** Conduct long-term underwater autonomy research. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: Ultra-compact heat exchangers ***FY 2023 Accomplishments:*** Conduct research on ultra-compact heat exchangers. ***FY 2024 Plans:*** N/A	3.864	0.000
Congressional Adds Subtotals	48.992	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A