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Exhibit R-2, RDT&E Budget Item Justification: PB 2024 Navy **Date:** March 2023

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 2: Applied Research</i>	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>
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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
Total Program Element	0.000	114.681	121.707	74.722	-	74.722	76.773	76.152	76.440	76.908	Continuing	Continuing
0000: <i>Warfighter Sustainment Applied Res</i>	0.000	68.102	70.957	74.722	-	74.722	76.773	76.152	76.440	76.908	Continuing	Continuing
9999: <i>Congressional Adds</i>	0.000	46.579	50.750	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	97.329

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.

UNCLASSIFIED

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B. Program Change Summary (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Previous President's Budget	117.738	70.957	71.592	-	71.592
Current President's Budget	114.681	121.707	74.722	-	74.722
Total Adjustments	-3.057	50.750	3.130	-	3.130
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	50.750			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.057	0.000			
• Program Adjustments	0.000	0.000	3.130	-	3.130
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: *Congressional Adds*

- Congressional Add: *Polymer coatings for reduced ice and fouling adhesion*
- Congressional Add: *Health and Safety Research of Underground Fuel Storage Facilities*
- Congressional Add: *Hypersonics Material Acceleration*
- Congressional Add: *Physics Based Neutralization of Threats to Human Tissues and Organs*
- Congressional Add: *Advanced nanocomposite coatings*
- Congressional Add: *Anticorrosion nanotechnology*
- Congressional Add: *Development of chromate-free corrosion inhibitor coatings for marine application*
- Congressional Add: *Engineered systems to preserve and restore hearing*
- Congressional Add: *Human digital twin*
- Congressional Add: *High mobility ground robots to assist dismounted infantry in urban operations*
- Congressional Add: *Biomaterial exterior for hypersonic projectable*
- Congressional Add: *Wearable sensors for injury prediction*
- Congressional Add: *Long-term underwater autonomy*
- Congressional Add: *Ultra-compact heat exchangers*

	FY 2022	FY 2023
	4.827	5.000
	4.827	0.000
	4.827	5.000
	4.827	10.000
	5.792	0.000
	7.240	10.000
	1.689	1.750
	4.827	0.000
	2.896	0.000
	4.827	0.000
	0.000	5.000
	0.000	5.000
	0.000	5.000
	0.000	4.000

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Congressional Add Details (\$ in Millions, and Includes General Reductions)

	FY 2022	FY 2023
Congressional Add Subtotals for Project: 9999	46.579	50.750
Congressional Add Totals for all Projects	46.579	50.750

Change Summary Explanation

Funding: The \$3.130M increase is in support of Grid Vulnerability and On-Base Power and Water Resilience research objectives.

Technical: No significant change.

Schedule: No significant change

UNCLASSIFIED

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COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
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A. Mission Description and Budget Item Justification

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
Title: Advanced Naval Materials	17.532	17.679	20.209	0.000	20.209
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 2023 Plans: Materials: - Continue research on Agile Manufacturing - Integrated Computational Materials Engineering (ICME) toolkit infrastructure to establish and fully utilize a naval laboratory based capability to develop and predict performance of materials and components in an agile and accelerated manor to speed technology delivery and reduce qualification costs. - 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.					

UNCLASSIFIED

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Continue research to develop advanced structural alloys and composites, joining and repair technologies.</p> <p>- 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 at improved resilience of naval systems and platforms and capabilities for producing novel, high performance components;</p> <p>- Complete development of new, advanced, environmentally benign Anti-Fouling (AF)/Anti-Corrosive (AC) coating systems for Navy platforms.</p> <p>- Advance materials, processes and capabilities. Current efforts are focused on development of a high thermal conductivity later for high power electronic device application to improve performance.</p> <p>Sustainment & Logistics:</p> <p>- 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.</p> <p>Naval Power Systems:</p> <p>- Continue to advance applied research efforts to support development of naval materials in support of naval power systems.</p> <p>Platform Design and Engineering:</p> <p>- Continue to advance applied research efforts to support development of naval materials in support of naval platforms.</p> <p>FY 2024 Base Plans:</p> <p>Materials:</p> <p>- 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.</p> <p>- Continue research to develop advanced structural alloys and composites, joining and repair technologies.</p> <p>- 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 at improved resilience of naval systems and platforms and capabilities for producing novel, high performance components.</p>					

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- 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.</p> <p>Complete - Agile Manufacturing - Integrated Computational Materials Engineering (ICME) toolkit infrastructure development.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>- 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.</p> <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: The increase from FY 2023 to FY 2024 is due to increased investment Grid Vulnerability and On-Base Power and Water Resilience relevant research efforts.</p>					
<p>Title: Biocentric Technologies</p> <p>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</p>	8.228	9.328	9.668	0.000	9.668

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>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.</p> <p>FY 2023 Plans: Bio-Inspired Autonomous Systems: Continue: - Conduct applied research on bio-inspired underwater vehicle propulsion and control. - Mature advanced search behaviors for autonomous vehicles. - Applied research on bio-inspired cross-domain vehicles for amphibious and sea/air transitions. Complete: - Exploration of bio-inspired sonar integrated onto autonomous underwater vehicles for obstacle avoidance in congested waters. Initiate: - Integrate advanced flexible batteries into artificial muscle-based prototype underwater vehicle for field testing of speed and duration.</p> <p>Human Interaction with Autonomous Systems: (This thrust has been realigned to the Human Factors and Organizational Design Activity of this PE. The research has a human-machine teaming focus, which aligns better with the objectives of the Human Factors and Organizational Design Activity.)</p> <p>Naval Biosciences and Synthetic Biology for Naval Applications: (This thrust was previously part of the Biocentric Technology FY22 Plan. The name was changed to more accurately describe the research.) Continue: - Develop strategies to incorporate programmable microbial sensors for environmental monitoring into relevant Naval platforms. - Applied research focusing on deployment of self-burying, benthic microbial fuel cells at various depths to power new devices (e.g., a semi-submersible autonomous underwater vehicle (AUV)). Complete:</p>					

UNCLASSIFIED

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Conduct studies of prebiotic food additives/probiotics for effects on microbiome and performance enhancement in human subjects, including divers and combat swimmers.</p> <p>- Develop gut microbiome-based tools to predict individual response to prebiotics for stress resilience.</p> <p>- Efforts to scale up production of biogenic mineral nanomaterials.</p> <p>Initiate:</p> <p>- Applied research in bio/bio-inspired materials for multi-spectral camouflage.</p> <p>- Applied research in bioengineering systems for the bioproduction/biodegradation of military relevant materials.</p> <p>Bioengineering and Life Sciences:</p> <p>Continue:</p> <p>- 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, and implement dolphin vocalizations as a tool for diagnosing their well-being.</p> <p>Complete:</p> <p>- Development of a sandcastle worm inspired adhesive effective in seawater and transition it to a Future Naval Capability Program focused on seawater curing adhesive technologies for pier side replacement, or repair, of tiles on outer submarine hulls.</p> <p>- Applied research establishing highly efficient proton exchange membrane fuel cells for transportation applications, which improved their overall performance through catalyst and support engineering.</p> <p>Initiate: N/A</p> <p>Warfighter Augmentation and Resilience:</p> <p>Continue:</p> <p>- Conduct applied research in bio-inspired light polarization sensors and machine learning methods for predicting underwater geolocation and developing technology for underwater image dehazing.</p> <p>- Develop technologies to monitor and protect diver from environmental stressors by maturing and validating models that capture a human diver's heat loss and the ability of various wetsuit designs to provide thermal protection.</p> <p>- Support development of manned-unmanned teaming platforms to aide 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.</p> <p>Complete:</p>					

UNCLASSIFIED

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Research on feasibility of sensor development for oxygen toxicity. This resulted from the ongoing FY22 and FY23 plan to continue identifying predictors of critical health and safety threats to divers through advanced physiological monitoring and algorithm development.</p> <p>Initiate:</p> <ul style="list-style-type: none"> - Create new oxygen-generating and carbon dioxide-disposing diving mask that would replace existing rebreathers. - Applied gas channel research in the context of respiratory fitness and/or potential mitigation strategies for targeted gas management. <p>FY 2024 Base Plans:</p> <p>Bio-Inspired Autonomous Systems</p> <p>Continue:</p> <ul style="list-style-type: none"> - 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. <p>Naval Biosciences and Synthetic Biology for Naval Applications</p> <p>Continue:</p> <ul style="list-style-type: none"> - 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. <p>Initiate:</p> <ul style="list-style-type: none"> - Applied research on understanding and building bioelectronics systems for use in computing, data storage, and materials development. <p>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.)</p> <p>Continue:</p>					

UNCLASSIFIED

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B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<ul style="list-style-type: none"> - 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. <p>Warfighter Augmentation and Resilience Continue:</p> <ul style="list-style-type: none"> - 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. <p>Complete:</p> <ul style="list-style-type: none"> - Development of technologies that protect divers from environmental stressors by monitoring their heat loss and, assess new wetsuit designs to provide enhanced thermal protection. <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: There is no significant funding change from FY2023 to FY2024.</p>					
<p>Title: Human Factors and Organizational Design</p> <p>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.</p>	5.829	6.018	6.130	0.000	6.130

UNCLASSIFIED

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p><i>FY 2023 Plans:</i></p> <p>Cognitive Science for Human-Machine Teaming and Computational Neuroscience: Continue:</p> <ul style="list-style-type: none"> - Incorporate realistic neural systems into autonomous systems for more robust on-board perception and intelligence. - Conduct applied research on system interface designs and human-machine interaction methodologies that enable or enhance Naval Warfighter performance and human-machine teaming. This includes psychoacoustics and audio-visual scene interpretation implemented in computational models that serve as the front end for cognitive architectures. - 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 self-learning. <p>Complete:</p> <ul style="list-style-type: none"> - Construct new perceptual models for intelligent autonomous systems. <p>Initiate:</p> <ul style="list-style-type: none"> - Integrate vision and language for learning and communication in human-agent systems. <p>Social Networks and Computational Social Science: Continue:</p> <ul style="list-style-type: none"> - Conduct applied research in information environment assessment, civil-military communications, humanitarian assistance / disaster relief, information operations and strategic communication. - Conduct research to support improved course of action guidance and capabilities to detect and defuse disinformation, social hysteria, and group polarization campaigns. - Refine studies to develop effective tactics, techniques and procedures for military personnel operating in the information environment to discover, monitor and counter adversarial maneuvers in digital and social media. <p>Complete:</p> <ul style="list-style-type: none"> - Course of action guidance to detect and defuse disinformation, social hysteria and group polarization campaigns. <p>Initiate:</p>					

UNCLASSIFIED

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B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Applied research to explore socio-technical techniques and social decision making to affect stance, perception, identity and behavior of target audiences.</p> <p>Command Decision Making: Continue:</p> <ul style="list-style-type: none"> - Research to automate and display recommendations and characterize uncertainty, derived from Machine Learning (ML) algorithms. <p>Complete:</p> <ul style="list-style-type: none"> - Applied research for a knowledge/skill brokering system that can detect individual knowledge weaknesses / gaps related to task performance and deliver tailored training tutorials as job aids. - Conduct applied research to assist with curation of community generated multi-media content and fusion with authoritative sources. <p>Initiate:</p> <ul style="list-style-type: none"> - Research automation algorithms for managing Man-Machine teaming & Scalability of Control to large numbers of autonomous entities (robots / swarms). - Applied research for a Collaborative Artificial Intelligence (Collaborative AI) decision support tool that allows AI to learn from human command and control tasks. <p>Human Interaction with Autonomous Systems: (This thrust has been realigned from the Biocentric Technologies to the Human Factors and Organizational Design Activity of this PE. This research has a human-machine teaming focus, which aligns better with the objectives of the Human Factors and Organizational Design Activity.)</p> <p>Continue:</p> <ul style="list-style-type: none"> - Conduct applied research to develop agile humanoid and quadruped robot teammates. This includes incorporation of computer vision, acoustic localization, reasoning and human communication. - Applied research on training mission-capable robots to perform complex manipulation skills essential for shipboard and urban operations. - Conduct applied research to develop technology to enhance diver performance with small autonomous underwater vehicle (AUV) assistants. This effort was previously described under Cognitive Science for Human-Machine Teaming and Computational Neuroscience, but aligns more closely to the objectives of Human Interaction with Autonomous Systems. <p>Initiate:</p>					

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<p>- Incorporate cognitive architectures and visual reasoning on robotic teammates to enable enhanced cooperative behaviors.</p> <p>Naval Team Performance and Design: (This thrust was previously part of the Command Decision Making FY22 plan.) Continue:</p> <ul style="list-style-type: none"> - Conduct research on team composition and social decision-making in order to design Naval decision tools that have reduced risk of human decision biases (e.g., implicit bias, preconceived notions, and social pressure). - Conduct Human System Integration research activities in areas of human factors engineering and physical design layout (habitability, safety, personnel survivability) of naval platforms in order to understand best possible conditions for effective decision-making Naval settings. <p>Complete: N/A Initiate:</p> <ul style="list-style-type: none"> - Conduct research on team composition, human factors, and decision making in order to design naval decision tools and processes that have reduced risk of human decision biases and heuristics as well as human performance errors related to combat/operational stress. <p><i>FY 2024 Base Plans:</i> Cognitive Science for Human-Machine Teaming and Computational Neuroscience Continue:</p> <ul style="list-style-type: none"> - 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. <p>Social Networks and Computational Social Science</p>					

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Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>Continue:</p> <ul style="list-style-type: none"> - 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. <p>Complete:</p> <ul style="list-style-type: none"> - Applied research in humanitarian assistance / disaster relief information collection. <p>Initiate:</p> <ul style="list-style-type: none"> - Research in new techniques to address military concerns in digital and social media. <p>Command Decision Making</p> <p>Continue:</p> <ul style="list-style-type: none"> - 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). - Applied research to develop collaborative artificial intelligence (AI) decision support tools that learn from human command and control tasks. <p>Initiate:</p> <ul style="list-style-type: none"> - Study manned-unmanned teaming Command and Control (C2) solutions across different command echelons. <p>Human Interaction with Autonomous Systems</p> <p>Continue:</p> <ul style="list-style-type: none"> - 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. <p>Complete: N/A</p> <p>Initiate:</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Evaluations of mobility and manipulation ability of advanced humanoid robot prototypes on shipboard maintenance and urban building inspection tasks.</p> <p>Naval Team Performance and Design Continue:</p> <ul style="list-style-type: none"> - 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. <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: There is no significant funding change from FY2023 to FY2024.</p>					
<p>Title: Human Research Protection Program (HRPP)</p> <p>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 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).</p> <p>FY 2023 Plans:</p>	2.711	2.798	2.850	0.000	2.850

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>Continue:</p> <ul style="list-style-type: none"> - Establish five new human research protection programs (HRPP). - Program Management of the DON Research Protections Information Technology Management System 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-supported research involving human subjects. <p>Complete:</p> <ul style="list-style-type: none"> - Complete revisions of all DON-authored modules hosted on the Collaborative Institutional Training Initiative (CITI) Program. - Complete finalization of draft SECNAVINST 3900.39F and submit for coordination. The revised SECNAVINST 3900.39F will implement recent updates to the revised Common Rule and DoD Instruction 3216.02, thereby ensuring compliance across the navy and Marine Corps research enterprise. <p>Initiate:</p> <ul style="list-style-type: none"> - Develop the Research Protection Community of Excellence to share best practices across the DON research protection enterprise. <p>FY 2024 Base Plans:</p> <p>Continue:</p> <ul style="list-style-type: none"> - 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 					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>the Navy and in accordance with 32 CFR 219, DoD Instruction 3216.02, and Secretary of the Navy Instruction (SECNAVINST) 3900.39E CH-1.</p> <p>- 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.</p> <p>Initiate:</p> <p>- 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.</p> <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: There is no significant funding change from FY2023 to FY2024.</p>					
<p>Title: Medical and Human Performance Technologies</p> <p>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.</p> <p>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.</p> <p>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.</p>	8.518	8.790	8.953	0.000	8.953

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p><i>FY 2023 Plans:</i> Medical Technologies: Continue: - Explore use of novel technologies including: nanotechnologies, microelectronics, artificial intelligence, non-invasive sensors, multifunctional materials and systems and protective equipment for improved warfighter survivability. - Mature application and treatment methods for novel anti-infectives for improved wound care. - 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 to improve casualty care using autonomy and 'smart' systems with a focus on autonomous recovery of impaired/injured personnel during operations ashore and afloat. Complete: N/A Initiate: - Translate physics-based principles to prototypes for measuring material properties of biological tissues.</p> <p>Human Performance Technologies: Continue: - Conduct applied research to develop noise exposure and mitigation strategies, including communication technologies, sound localization, and noise mitigation strategies. - Applied research to determine biomedical effects of electromagnetic energy exposures. - Applied research to identify and validate countermeasures that prevent and mitigate the safety risks of decompression sickness, oxygen toxicity, and maintain a healthy metabolic balance for diver energy requirements to advance safe and optimized performance. - Applied research to develop novel biological sensors that autonomously monitor warfighter performance and physiology (e.g., analytes, blood pressure, heart rate, arterial saturation) in real-time. - Applied research to reduce high performance tactical jet noise through the evaluation of Noise Reduction Concepts. - Develop lab scale capability for the purpose of investigating jet noise at afterburner conditions. - Applied research to investigate approaches to excite natural instability wave of the jet flow. Complete: - The following effort resulted from the FY22 plan to continue applied research to develop countermeasures that prevent and mitigate the safety risks of decompression sickness, oxygen toxicity, and supplement metabolic</p>					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>diver energy requirements to advance safe and optimized performance. The completed portion of this effort includes research on the ketogenic diet and supplementation transitioned to advanced development.</p> <ul style="list-style-type: none"> - Research to develop diagnostic tools for identification of auditory injuries. - Transition successful novel biological and physiological sensor prototypes for performance and task-based outcomes to advanced development. <p>Initiate:</p> <ul style="list-style-type: none"> - Research on the feasibility of new underwater ultrasound devices to generate individualized and deterministic decompression profiles. - Applied research for the feasibility of providing spatial auditory information to enhance understanding of visual events occurring in operational settings. - Research to validate stress reactivity predictors in a military population to support the development of a performance prediction tool. - Explore large data sets of human biology and physiology to enhance algorithms underlying human performance sensor technologies. - Research studies on using the afterburner to reduce noise during take-off. <p>FY 2024 Base Plans:</p> <p>Medical Technologies</p> <p>Continue:</p> <ul style="list-style-type: none"> - 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. <p>Complete:</p> <ul style="list-style-type: none"> - Development of novel anti-infectives for improved wound care. <p>Initiate:</p> <ul style="list-style-type: none"> - 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. 					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>Human Performance Technologies</p> <p>Continue:</p> <ul style="list-style-type: none"> - 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. <p>Complete:</p> <ul style="list-style-type: none"> - 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. <p>Initiate:</p> <ul style="list-style-type: none"> -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. 					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Evaluation of active control of jet noise via bi-modal excitation. - Resonance prediction and mitigation in rectangular twin-jets.</p> <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: There is no significant funding change from FY2023 to FY2024.</p>					
<p>Title: The Office of Naval Research Global</p> <p>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.</p> <p>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 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.</p> <p>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</p>	20.417	21.321	21.794	0.000	21.794

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>reduce the risk of potential technological surprise, and supports theater security cooperation goals to sustain cooperative relationships with an expanding set of international partners.</p> <p>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.</p> <p><i>FY 2023 Plans:</i> 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 overseas deployed locations (Asia, Europe, South America, and Australia) by continuing to engage with international scientists and engineers through liaison visits to research institutions and continue actively fostering international collaboration by awarding research grants. Maintain and report on global technical awareness. - Support international engagement with ten partner nations, three multi-lateral groups, and support to the Northern Atlantic Treaty Organization (NATO), in order to increase collective Naval capability, capacity, and interoperability.</p> <p><i>FY 2024 Base Plans:</i> 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.</p>					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- 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.</p> <p>FY 2024 OCO Plans: N/A</p> <p>FY 2023 to FY 2024 Increase/Decrease Statement: There is no significant funding change from FY2023 to FY2024.</p>					
<p>Title: Training Technologies</p> <p>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 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.</p> <p>FY 2023 Plans: Technologies for Naval Training: Continue: - Mature immersive environments (multi-player game) to train unit commanders in decision making, tactics, and strategies. - Expand new methods and techniques for enhancing problem solving ability of autonomous, artificial intelligence agents. - Develop methods and techniques to identify individual differences to optimize training. - Continue to mature game technology to build innovative job-performance and decision-aids using augmented reality. - Conduct 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 following efforts resulted from the investment described in the FY21 and FY22 plans for this program:</p>	4.867	5.023	5.118	0.000	5.118

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<ul style="list-style-type: none"> - Research on the design of an electronic tutor to be transitioned to a Navy nuclear power technical school. - Research to design a tool for Navy recruiting. - Efforts to map knowledge and skills required to fight and win in future conflicts with unmanned ground robotic systems. <p>Initiate:</p> <ul style="list-style-type: none"> - Apply new methods for tailored training that exploits artificial intelligence agents. - Develop new techniques for obtaining and sharing of knowledge to improve individual and team performance in Naval applications. - Mature digital intelligent tutor technologies (e.g., reading tutor) by enhancing tutors ability to characterize and diagnose students errors and provide appropriate real-time remediation. - Incorporate Naval social/cultural norms into senior leadership models to inform training. - Effort to develop immersive environments (multi-player game) to train unit commanders in decision making, tactics, and strategies. <p>Advanced Integrated Maritime Mission Modeling:</p> <p>Continue:</p> <ul style="list-style-type: none"> - Expand work on Live-Virtual-Constructive simulation-based training technologies for Anti-submarine Warfare to include a greater range of simulated target types, behaviors, and scenarios. - Create training technologies to mitigate the effects of denied / degraded environments as well as cyber incursions on combat effectiveness. <p>Complete:</p> <ul style="list-style-type: none"> - The following effort resulted from the FY22 plan to create training technologies to enhance the ability of shipboard operators, supervisors and crypto-technicians to rapidly detect cyber incursions into their radar, GPS, radio, and remote imaging systems, and to efficiently mitigate the effects of these incursions on combat effectiveness. The completed portion of this effort includes training tools to detect cyber incursions in radar, Global Positioning System (GPS), radio, and remote imaging systems for shipboard operators, supervisors and crypto-technicians. <p>Initiate:</p> <ul style="list-style-type: none"> - Leverage work on Live, Virtual, and Constructive simulation-based training technologies for coordinated United Stated Marine Corps and United States Navy Strike Warfare in Naval Expeditionary Advanced Based Operations (EABO). 					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Investigate the application of Adaptive Training methodologies into both shore and ship-based training curricula for Anti-Submarine Warfare.</p> <p>Learning to Integrate and Adapt to New Naval Technologies and Threats Initiate:</p> <ul style="list-style-type: none"> - Applied research for learning-based techniques to improve decision-making and develop warfighters who are able to integrate and adapt to new Naval technologies and threats. Focus is on the delivery of interventions to representative populations and evaluation of such interventions. Emphasis is on tailored and scalable strategies. <p>FY 2024 Base Plans: Technologies for Naval Training Continue:</p> <ul style="list-style-type: none"> - 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. <p>Complete:</p> <ul style="list-style-type: none"> - Expand new methods and techniques for enhancing problem solving ability of autonomous, artificial intelligence agents. Findings have supported associated applied research in AI. <p>Advanced Integrated Maritime Mission Modeling Continue:</p> <ul style="list-style-type: none"> - Assess feasibility of training technologies to mitigate the effects of denied / degraded environments as well as cyber incursions on combat effectiveness. 					

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 0000 / <i>Warfighter Sustainment Applied Res</i>

B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total
<p>- Investigate Live, Virtual, and Constructive simulation-based training technologies for Naval Expeditionary Advanced Based Operations (EABO).</p> <p>- Applied research on adaptive/individualized training techniques for shore and ship-based Live, Virtual, and Constructive Anti-Submarine Warfare and Navigation Team Training.</p> <p>Complete:</p> <p>- 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.</p> <p>Initiate:</p> <p>- Applied research to understand performance metrics, data collection techniques, and analysis approaches that can be used to assess warfighter readiness across Carrier Strike Groups.</p> <p>- Investigate individualized cyber training in Live, Virtual, and Constructive shipboard environments.</p> <p>Learning to Integrate and Adapt to New Naval Technologies and Threats</p> <p>Continue:</p> <p>- 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.</p> <p><i>FY 2024 OCO Plans:</i> N/A</p> <p><i>FY 2023 to FY 2024 Increase/Decrease Statement:</i> There is no significant funding change from FY2023 to FY2024.</p>					
Accomplishments/Planned Programs Subtotals	68.102	70.957	74.722	0.000	74.722

C. Other Program Funding Summary (\$ in Millions) N/A
Remarks
D. Acquisition Strategy N/A

UNCLASSIFIED

Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy										Date: March 2023		
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602236N / Warfighter Sustainment Applied Res				Project (Number/Name) 9999 / Congressional Adds			
COST (\$ in Millions)	Prior Years	FY 2022	FY 2023	FY 2024 Base	FY 2024 OCO	FY 2024 Total	FY 2025	FY 2026	FY 2027	FY 2028	Cost To Complete	Total Cost
9999: Congressional Adds	0.000	46.579	50.750	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	97.329

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2022	FY 2023
<p>Congressional Add: Polymer coatings for reduced ice and fouling adhesion</p> <p>FY 2022 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.</p> <p>FY 2023 Plans: 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.</p>	4.827	5.000
<p>Congressional Add: Health and Safety Research of Underground Fuel Storage Facilities</p> <p>FY 2022 Accomplishments: Develop plans and evaluate technologies to improve the health and safety of the underground Red Hill Fuel Storage Facility in Hawaii, and other underground fuel storage tanks in the Asia-Pacific AOR. Perform research for fuel tank inspect and repair protocols; advanced microscope analysis of tank corrosion products; concrete tank degradation inspection and retrofit; and advanced nanomaterials coating.</p> <p>FY 2023 Plans: Develop plans and evaluate technologies to improve the health and safety of the underground Red Hill Fuel Storage Facility in Hawaii, and other underground fuel storage tanks in the Asia-Pacific AOR. Perform research for fuel tank inspect and repair protocols; advanced microscope analysis of tank corrosion products; concrete tank degradation inspection and retrofit; and advanced nanomaterials coating.</p>	4.827	0.000
<p>Congressional Add: Hypersonics Material Acceleration</p> <p>FY 2022 Accomplishments: This funding is anticipated to use the membership and resources of the LIFT Institute to increase the manufacturing base for the US hypersonics industrial base. The work will focus on additive processing of large 3D structures, joining of dissimilar metals, establishment of powder supply chain for refractory metal alloys, and ICME tools leading to the development of new materials and processes, as well as characterization of existing materials and prediction of properties for future materials.</p> <p>FY 2023 Plans: Conduct Hypersonics Material Acceleration research.</p>	4.827	5.000
<p>Congressional Add: Physics Based Neutralization of Threats to Human Tissues and Organs</p>	4.827	10.000

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Exhibit R-2A, RDT&E Project Justification: PB 2024 Navy		Date: March 2023
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>
B. Accomplishments/Planned Programs (\$ in Millions)	FY 2022	FY 2023
FY 2022 Accomplishments: Conduct research into a multiscale, physics-based approach to for use in preventing and mitigating both mild traumatic brain injuries (mTBIs) and blast-induced traumatic brain injuries (bTBIs). Preventing and mitigating bTBI and mTBI requires advancing the understanding of injury at a cellular level, as the exact force magnitudes and directions that initiate TBI at the cellular scale are still unknown. Knowledge of neuronal TBI thresholds is a critical and currently missing component of developing improved protective equipment, as well as equipment that addresses the full range of injury.		
FY 2023 Plans: 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).		
Congressional Add: Advanced nanocomposite coatings	5.792	0.000
FY 2022 Accomplishments: Conduct applied research in advanced nanocomposite coatings		
FY 2023 Plans: N/A		
Congressional Add: Anticorrosion nanotechnology	7.240	10.000
FY 2022 Accomplishments: Conduct applied research supporting anticorrosion nanotechnology		
FY 2023 Plans: Conduct applied research supporting anticorrosion nanotechnology.		
Congressional Add: Development of chromate-free corrosion inhibitor coatings for marine application	1.689	1.750
FY 2022 Accomplishments: Conduct applied research for development of chromate-free corrosion inhibitor coatings for marine application		
FY 2023 Plans: Conduct applied research for development of chromate-free corrosion inhibitor coatings for marine application.		
Congressional Add: Engineered systems to preserve and restore hearing	4.827	0.000
FY 2022 Accomplishments: Conduct applied research in engineered systems to preserve and restore hearing		
FY 2023 Plans: N/A		
Congressional Add: Human digital twin	2.896	0.000
FY 2022 Accomplishments: Conduct applied research supporting human digital twin		
FY 2023 Plans: N/A		
Congressional Add: High mobility ground robots to assist dismounted infantry in urban operations	4.827	0.000

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Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / <i>Warfighter Sustainment Applied Res</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>	
B. Accomplishments/Planned Programs (\$ in Millions)		FY 2022	FY 2023
FY 2022 Accomplishments: Conduct applied research for high mobility ground robots to assist dismounted infantry in urban operations			
FY 2023 Plans: N/A			
Congressional Add: Biomaterial exterior for hypersonic projectable		0.000	5.000
FY 2022 Accomplishments: N/A			
FY 2023 Plans: Conduct biomaterial exterior for hypersonic projectable research.			
Congressional Add: Wearable sensors for injury prediction		0.000	5.000
FY 2022 Accomplishments: N/A			
FY 2023 Plans: Research wearable sensors for injury prediction.			
Congressional Add: Long-term underwater autonomy		0.000	5.000
FY 2022 Accomplishments: N/A			
FY 2023 Plans: Conduct long-term underwater autonomy research.			
Congressional Add: Ultra-compact heat exchangers		0.000	4.000
FY 2022 Accomplishments: N/A			
FY 2023 Plans: Conduct research on ultra-compact heat exchangers.			
Congressional Adds Subtotals		46.579	50.750
C. Other Program Funding Summary (\$ in Millions)			
N/A			
Remarks			
D. Acquisition Strategy			
N/A			