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 0602123N *I Force Protection 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	337.898	142.148	120.716	-	120.716	134.372	147.687	155.045	161.599	Continuing	Continuing
0000: *Force Protection Applied Res*	0.000	126.535	142.148	120.716	-	120.716	134.372	147.687	155.045	161.599	Continuing	Continuing
3270: *Sec. 2912 Operational Energy Savings*	0.000	6.563	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.563
9999: *Congressional Adds*	0.000	204.800	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	204.800

A. Mission Description and Budget Item Justification

America is a maritime nation with global responsibilities that require U.S. naval forces be respected around the world and decisive when it matters. The Office of Naval Research (ONR) was established to guide ongoing research to ensure the technical superiority of the U.S. Navy and Marine Corps. This Program Element (PE) addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. This program supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. The goal is to provide the ability to deter, or avoid engagements, and if necessary, fight and win against adversary naval platforms or weapons. In the event of conflict, naval platforms must be able to resist and control damage while preserving operational capability. Research is focused on providing technologically superior defense of naval assets and delivering warfighting capabilities at reduced total ownership costs for surface and subsurface platforms through investments in applied research in: a) Power, Energy & Propulsion b) Platform Design and Engineering and c) new technology innovation from identification to prototype to scaling. . This program identifies and develops technologies for reduced observables technology and enhanced capability of naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. The program addresses innovation in technology development to provide substantial improvements in energetic material systems and subsystems, primarily in terms of performance, but also addressing safety, reliability, and affordability concerns. The program supports mission-driven design think problem solving within the Naval Research and Development Establishment (NR&DE) and academia in support of culture changes to agile and rapid prototyping development driven by well defined and effective innovation process and operations.

Today's Sailors and Marines are enabled by naval Science and Technology (S&T) and the business of innovation. 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, as well as the NavalX office, to ensure naval forces can effectively deter conflict, but when called upon, fight, win and come home safe. Current investments, combined with innovation operations, 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.

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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.

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	345.576	142.148	137.376	-	137.376
Current President's Budget	337.898	142.148	120.716	-	120.716
Total Adjustments	-7.678	0.000	-16.660	-	-16.660
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	3.363	0.000			
• SBIR/STTR Transfer	-11.041	0.000			
• Program Adjustments	0.000	0.000	-16.660	-	-16.660
• 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: *Alternative Energy Research*	28.961	0.000
Congressional Add: *Advanced Energetics Research*	5.789	0.000
Congressional Add: *Talent and technology for Navy power and energy systems*	10.137	0.000
Congressional Add: *Energy resilience efforts*	7.723	0.000
Congressional Add: *Coastal environmental research*	4.827	0.000
Congressional Add: *Direct Air Capture and Blue Carbon Removal Technology*	9.654	0.000
Congressional Add: *Additive Manufacturing of Unmanned Maritime Systems*	9.653	0.000
Congressional Add: *relative position of autonomous platforms*	4.826	0.000
Congressional Add: *Bonded metal matric composit repair*	4.827	0.000
Congressional Add: *Resilient innovative sustainable economies via university partnerships*	8.689	0.000

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Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *high speed/hypersonic test capability development*	3.862	0.000
Congressional Add: *Resilient autonomous systems research and diversity programs*	8.206	0.000
Congressional Add: *Seawater to jet fuel demo*	19.307	0.000
Congressional Add: *Arctic energy resiliency*	9.653	0.000
Congressional Add: *Cavitation erosion*	4.827	0.000
Congressional Add: *Corrosion control coating and material*	4.827	0.000
Congressional Add: *Cyberphysical security resilency*	6.757	0.000
Congressional Add: *Intelligent data managment for distributed Naval platforms*	10.136	0.000
Congressional Add: *Materials by design for Navy aircraft sustainment*	4.827	0.000
Congressional Add: *sUAS degraded enviorment facility*	12.212	0.000
Congressional Add: *Universal achemetal titanium process*	11.584	0.000
Congressional Add: *Unmanned surface vehicle*	4.827	0.000
Congressional Add: *High-entropy materials for hypersonics*	8.689	0.000
Congressional Add Subtotals for Project: 9999	204.800	0.000
Congressional Add Totals for all Projects	204.800	0.000

Change Summary Explanation

Funding: The 16.660M funding decrease to FY 2025 is due to a reduction for compliance with the Defense Planning Guidance for S&T Investments as well as a reduction in investments to Force Protection Applied Research areas of study: Aircraft Tech, Fleet Force Protection & Defense Against Undersea Threats, Advanced Energetics, Surface Ship and Submarine Hull Mechanical & Electrical and Naval Research Enterprise/Innovation operations.

Technical: not applicable

Schedule: not applicable

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 0602123N / *Force Protection Applied Res*	Project (Number/Name) 0000 / *Force Protection 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
0000: *Force Protection Applied Res*	0.000	126.535	142.148	120.716	-	120.716	134.372	147.687	155.045	161.599	Continuing	Continuing

A. Mission Description and Budget Item Justification

This project addresses applied research associated with providing the capability of Platform and Force Protection for the U.S. Navy. It supports the development of technologies associated with all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. Research is focused on providing technologically superior defense of naval assets and delivering warfighting capabilities at reduced total ownership costs for surface and subsurface platforms through investments in applied research in: a) Power, Energy, Propulsion, Engineering and Design. This project develops technologies for reducing detectable signatures, while enhancing the mission effectiveness of naval platforms (surface, subsurface, terrestrial, and air) through improvements in platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. The project addresses technology development that provides substantial performance improvements in energetic material systems and subsystems, while addressing safety, reliability, and affordability concerns.

This project is broken out into five primary areas of study: Aircraft Technology, Fleet Force Protection and Defense Against Undersea Threats, Advanced Energetics, Surface Ship and Submarine Hull Mechanical & Electrical (HM&E), and Naval Research Enterprise/Innovation Operations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Title: Aircraft Technology	33.694	36.317	31.813	0.000	31.813
Description: The Aircraft Technology activity develops technologies for reduced observables technology and enhanced capability of naval aviation aircraft platforms in terms of mission effectiveness, platform range, operational energy, expeditionary capability, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, saleable naval air vehicle technologies, such as - autonomous air vehicle command and control, helicopter and tilt rotor systems, aerodynamics, propulsion systems, materials, structures and flight controls for future and legacy air vehicles. The Sea-Based Aviation National Naval Responsibility (SBA NNR) Structures and Materials program will develop the next generation structural capability and material response science for aircraft technology in fixed and rotary wing, manned and unmanned airframe technology to achieve reduced weight, increased durability, strength, streamlined manufacturability, reduced life-cycle cost and maintenance/readiness gaps improvements. Program payoffs include increased availability/readiness, reduced sustainment requirements, fatigue/loads life enhancement, reduced weight and improved range, and advanced prognostics design tools.					

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 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
These efforts address unique attributes to propulsion, power and thermal management technologies for Naval Aviation, as well as those having higher importance to Naval Aviation and some that are more pervasive to all of military aviation. Related basic research efforts are addressed under 0601153N Defense Research Sciences. ***FY 2024 Plans:*** Research related to Sea Based Aviation National Naval Responsibility (SBA NNR) priorities in Aviation, Aerodynamics, Flight Dynamics & Control, Propulsion, Autonomy, and Structures & Materials. Research in Aircraft Science & Technology includes: Continuing Efforts - Advanced analytical methods for achieving guaranteed performance in multibody control systems. - Control law synthesis methods to expand the recovery envelope and reduce touchdown loads. - Advanced modeling and analysis methods for ship/aircraft aerodynamic interface. - Air vehicle flying qualities and control. - High lift aerodynamics and control. - Vertical/Short Take-off and Landing (V/STOL) science & technology. - Automated launch and recovery technology. - Mechanical/environmental failure prediction research. - Advanced dynamics and topology of coupled human/machine systems. - Precise relative navigation science & technology. - Integrated development environment for cyber secure avionics. - Infrastructure for rapid development, analysis, and experimentation with advanced flight science and technology across academia, government and industry. - Manned/unmanned teaming technology. Applied research in Flight Dynamics & Control will develop theory, analysis and experimental data to better understand and exploit the natural dynamics of both conventional and unconventional air vehicles operating in the marine environment. Continuing Efforts - Multibody control systems and the ability to demonstrate guaranteed performance relative to a desired end state.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Robust and precise control in the presence of highly turbulent flow fields to increase operational capability and reduce structural requirements for ship-based operations; - Algorithms and sensors to enable precise ship-relative navigation in GPS-denied environments; - Control effectors and vehicle configurations to enable platforms with VTOL utility and fixed-wing efficiency. - Collaborative research to improve our knowledge of control system interactions between piloted aircraft and human performance. Applied Aerodynamics research for aircraft and weapons platforms will include: Continuing Efforts - Advanced computational methods addressing the Navy-unique challenge of a fully coupled aerodynamic interface between ships and aircraft. - Advanced methods for reduced-order modeling of complex flow fields to enable real-time, high-fidelity simulations of ship-based aircraft operations. - Advanced methods for manipulating and more precisely controlling the flow fields around air vehicles operating in the maritime environment. - Novel diagnostics and techniques for in situ measurement ship airwake dynamics and its coupling to ship motions (sea states) and environmental flow field. - Advanced technologies for improved weapons aerodynamics enabling increased range and maneuverability. - Innovative concepts for compact, highly-integrated inlets for air-breathing weapons. - Innovative concepts for launch and recovery of unmanned aerial systems. - Understanding aerodynamics of novel air vehicle configurations, including the effects of multi-rotor systems and operational environments. Applied research in aircraft Propulsion, Power and thermal management concepts for high speed, long endurance and responsiveness include: Continuing Efforts - Cooling and thermal management for engines and auxiliary systems. - Diagnostics, prognostics and control for Integrated Power, Propulsion and Thermal Management. - Highly integrated Propulsion inlets, exhausts. - Sand, Salt and Dust Ingestion research: including modeling, separating, deposition, coatings and sensing.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Next Generation Propulsion Enablers includes applied research in propulsion, power and thermal management, advanced casing treatments, advanced compression system technologies and engine robustness in austere sand and salt environments. - Enabling the use of 'hot' fuels as a heat sink and provide additional energy. - Highly loaded efficient Turbomachinery with improved operability. - Advanced materials and coatings for austere environments. - Hybrid propulsion system component technologies for small to mid-size VTOL capable UAS. Initiating Efforts - Resin Transfer Molding for High Temperature Polyimide Composites - EMI mitigation for future electric generators - New Suite of Insulations for High Power Density Electrical Generators Research related to Autonomy includes the following efforts: Continuing Efforts - High confidence/Safe Autonomous single and multi-vehicle control in naval environments and human interaction with advanced autonomy such decentralized heterogeneous naval systems and interactive machine learning. - New theory-based methods and processes for rapid and safe adoption of new autonomy capabilities including Verification and Validation, safety, risk management, human systems integration, and robustness within complex naval, adversarial environments. - Safe perception based autonomous control in complex naval environments with limited communications and on autonomy to support combined unmanned and manned air systems/units. Aerospace Structures and Materials Research includes: Continuing Efforts - Structural remediation: development of materials and processes for extending and restoring operational life. - Lightweight flight and transparent armor - Transparent armor with improved performance than those currently fielded. - Lightweight multifunctional structures - Structural Power Research					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Thermoplastic composites - Out of Autoclave and Out of Oven Composites Manufacturing. - Automated Composites Manufacturing - AI/ML applications for reducing composites defects - High Fidelity/ Unitized/ Optimized Structures for Aircraft and Weapons. Completing Efforts - Hybrid nano-Composites - extend basic research investments in aligned carbon nano-tubes to develop damage tolerant composite structures for composites airframes Initiating Efforts - Repair development for bismaleimide (BMI) composite airframes - Improved design of skin/stringer joints for airframes - Post buckled aircraft subcomponent demo - Self-sealing technologies for fuel bladders					
FY 2025 Base Plans: Research related to Sea Based Aviation National Naval Responsibility (SBA NNR) priorities in Aviation, Aerodynamics, Flight Dynamics & Control, Propulsion, and Structures & Materials. Research in Aircraft Science & Technology includes: Continuing Efforts: - Advanced analytical methods for achieving guaranteed performance in multibody control systems. - Control law synthesis methods to expand the recovery envelope and reduce touchdown loads. - Advanced modeling and analysis methods for ship/aircraft aerodynamic interface. - Air vehicle flying qualities and control. - High lift aerodynamics and control. - Vertical/Short Take-off and Landing (V/STOL) science & technology. - Automated launch and recovery technology. - Mechanical/environmental failure prediction research. - Advanced dynamics and topology of coupled human/machine systems. - Precise relative navigation science & technology.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- Integrated development environment for cyber secure avionics. - Infrastructure for rapid development, analysis, and experimentation with advanced flight science and technology across academia, government and industry. - Manned/unmanned teaming technology. Applied research in Flight Dynamics & Control will develop theory, analysis and experimental data to better understand and exploit the natural dynamics of both conventional and unconventional air vehicles operating in the marine environment. Initiate: -Research to experimentally validate theoretical predictions of fluidic effector control forces coupled with free-body dynamics in extreme maneuvers. -Research to experimentally validate theory and models of human/machine coupling mechanisms and associated signatures for physiological events in flight. Continuing: -Multibody control systems and the ability to demonstrate guaranteed performance relative to a desired end state. -Robust and precise control in the presence of highly turbulent flow fields to increase operational capability and reduce structural requirements for ship-based operations. -Algorithms and sensors to enable precise ship-relative navigation in GPS-denied environments. -Control effectors and vehicle configurations to enable platforms with VTOL utility and fixed-wing efficiency. -Collaborative research to improve our knowledge of control system interactions between piloted aircraft and human performance. Applied Aerodynamics research for aircraft and weapons platforms will include: Initiate: -Revolutionary launch & recovery approaches for unmanned aerial systems. Continue: -Advanced computational methods addressing the Navy-unique challenge of a fully coupled aerodynamic interface between ships and aircraft.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
-Advanced methods for reduced-order modeling of complex flow fields to enable real-time, high-fidelity simulations of ship-based aircraft operations. -Advanced methods for manipulating and more precisely controlling the flow fields around air vehicles operating in the maritime environment. -Novel diagnostics and techniques for in situ measurement ship airwake dynamics and its coupling to ship motions (sea states) and environmental flow field. -Advanced technologies for improved weapons aerodynamics enabling increased range and maneuverability. -Innovative concepts for compact, highly-integrated inlets for air-breathing weapons. -Understanding aerodynamics of novel air vehicle configurations, including the effects of multi-rotor systems and operational environments. Applied research in aircraft Propulsion, Power and thermal management concepts for high speed, long endurance and responsiveness include: Initiating Efforts: -High-Bandwidth Aeromechanical Identification Methodology (AIM) Technology for Military Turbomachinery. -Development and Validation of a Fluidic Sweep Diverter. -Multifunctional Erosion Resistant, Icephobic, and Salt-Phobic Coating Systems for Inlet Applications. Continuing Efforts: -Resin Transfer Molding for High Temperature Polyimide Composites. -EMI mitigation for future electric generators. -New Suite of Insulations for High Power Density Electrical Generators. -Cooling and thermal management for engines and auxiliary systems. -Diagnostics, prognostics and control for Integrated Power, Propulsion and Thermal Management. -Highly integrated Propulsion inlets, exhausts. -Sand, Salt and Dust Ingestion research: including modeling, separating, deposition, coatings and sensing. -Next Generation Propulsion Enablers includes applied research in propulsion, power and thermal management, advanced casing treatments, advanced compression system technologies and engine robustness in austere sand and salt environments. -Highly loaded efficient Turbomachinery with improved operability. -Advanced materials and coatings for austere environments. -Hybrid propulsion system component technologies for small to mid-size VTOL capable UAS.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Completing Efforts: -Enabling the use of 'hot' fuels as a heat sink and provide additional energy. Research related to Autonomy includes the following efforts: Continue: -High confidence/Safe Autonomous single and multi-vehicle control in naval environments and human interaction with advanced autonomy such decentralized heterogeneous naval systems and interactive machine learning. -New theory-based methods and processes for rapid and safe adoption of new autonomy capabilities including Verification and ----Validation, safety, risk management, human systems integration, and robustness within complex naval, adversarial environments. -Safe perception based autonomous control in complex naval environments with limited communications and on autonomy to support combined unmanned and manned air systems/units. Aerospace Structures and Materials Research includes: Initiate: -Sustainment Technology Development and Demonstration. -In-situ / Multi-Cycle Repair Methods - Infinitely Repairable Airframes. -Deployable Depot - Point of Use/On-demand, Rapid Cert, Remote Expert. -Enhanced M&P for Durability. -Digital Manufacturing Tools - Integrated Data Capture / Analysis. Continue: -Improved design of skin/stringer joints for airframes. -Structural remediation: development of materials and processes for extending and restoring operational life. -Lightweight multifunctional structures. -Structural Power Research. -Thermoplastic composites. -Out of Autoclave and Out of Oven Composites Manufacturing. -Automated Composites Manufacturing. -AI/ML applications for reducing composites defects.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
-High Fidelity/ Unitized/ Optimized Structures for Aircraft and Weapons. Complete: -Lightweight flight and transparent armor. -Transparent armor with improved performance than those currently fielded. -Repair development for bismaleimide (BMI) composite airframes. -Self-sealing technologies for fuel bladders. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The decrease from FY24 to FY25 is due to the completion in Aircraft technology work in various areas.					
Title: Fleet Force Protection and Defense Against Undersea Threats	8.940	1.833	2.976	0.000	2.976
Description: Fleet Force Protection and Defense against Undersea Threats efforts include applied research for complementary sensor and processing technologies for platform protection. Current small platforms (surface, subsurface and airborne) have little to no situational awareness (SA) or self-protection against air, surface, and asymmetric threats. A goal of this activity is to provide these platforms with effective self-protection. The technology areas specific to platform protection will develop individual, multispectral electro-optical (EO), infrared (IR), radio frequency (RF), electro-magnetic (EM), visual and acoustic or chemical sensors/ biosensors and associated processing. To defend platforms from current and advanced threats in at-sea littoral environments and in port, these technologies must improve multispectral detection and distribution of specific threat information. ***FY 2024 Plans:*** Materials and Chemistry: - Continue developing real time, standoff, moving target, laser based detection for explosives and hazardous chemicals in littoral environment. - Continue developing chemical vapor sensing strategy for application in littoral environment. - Complete efforts into designing and developing inexpensive, miniaturized, low power electrochemical sensors for use in autonomous and distributed sensor networks in order to provide real-time, stand-off detection of explosive hazards in expeditionary missions. - Initiate efforts into organically modified chalcogenide (ORMOCHALC) Polymers for Next-Generation IR Optics.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Undersea Warfare: - Continue developing acoustics technology and associated signal processing to detect and track small-unmanned aerial vehicles for force and infrastructure protection. - Continue the development of a pressure tolerant, inexpensive hydrogen storage based on hydrogenated graphene to increase undersea storage capacity. - Complete the development technologies for active control of acoustic scattering to increase stealth and survivability of unmanned undersea vehicles.					
FY 2025 Base Plans: - Initiate efforts in Materials for Advanced Sensor Technology. The focus of these efforts is to demonstrate at pertinent scale and environment of the performance of advanced materials and innovative processing techniques, which include sensor and data analysis capabilities for enhanced situational awareness for platform protection. 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. The focus is on the demonstration above the laboratory bench level, including evaluation of operating limits and practicality of the methodologies. The work in this area also includes provisions for protection of human assets from chemical, explosive and biological threats, demonstrating improved sensitivity and response time. Specific focus of work in this area is the demonstration of advanced prototype of sensors and processing technologies for identification of trace levels of chemical sensors, including sensors for identification of trace levels of explosives. (NRL effort) - Initiate research into Next Generation Sensors. An essential element to maintaining maritime superiority depends on acoustic stealth. Currently, the U.S. Navy assesses and supports the acoustic signatures of its vessels (submarines or surface ships) through full-scale advanced measurement technology to quantify and diagnose noise sources. The scientists and engineers use this measurement data to calculate the vessel's vulnerability to improve operations, tactics, and ship design. The goal is to demonstrate an imaging capability for locating the acoustic radiation at the vessel's surface, which would be transitioned to the Navy's advanced measurement facilities. The proposed imaging capability is based on an NRL-developed signature technology, nearfield acoustical holography (NAH), where we propose to extend this technology to moving underwater vehicles. The acoustic community currently uses NAH to uncover the fundamental sound radiation mechanisms at the surface of the radiating stationary object. The Fleet has succeeded in making modern submarines moving at slow speeds (ultra-quiet mode) acoustically stealthy. Therefore, the Navy's primary focus for the next generation attack submarine SSN(X) (and beyond) is on maintaining the vessel's stealth while moving at faster					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
speeds. To enable this capability, the Navy needs advanced measurement technologies to understand the acoustic radiation mechanisms from a moving submarine. (NRL effort) - Complete developing real time, standoff, moving target, laser-based detection for explosives and hazardous chemicals in littoral environment. (NRL effort) - Complete developing chemical vapor sensing strategy for application in littoral environment. Initiate efforts into organically modified chalcogenide (ORMOCHALC) Polymers for Next-Generation IR Optics. (NRL effort) - Complete developing acoustics technology and associated signal processing to detect and track small-unmanned aerial vehicles for force and infrastructure protection. (NRL effort) - Complete the development of a pressure tolerant, inexpensive hydrogen storage based on hydrogenated graphene to increase undersea storage capacity. (NRL effort) ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding increase from FY2024 to FY2025 is due to increases in Power and Energy and Power Electronics Technologies thrusts. The focus of these increases is for Electronics area of applied research.					
Title: Advanced Energetics	5.126	5.446	4.770	0.000	4.770
Description: Advanced Energetics efforts address technology development to provide substantial improvements in energetic material systems and subsystems, primarily in terms of performance, but also addressing safety, reliability, and affordability concerns. Goals include: advanced energetic materials for warheads, propellants, and reactive material based subsystems for both defensive and offensive applications. Efforts include: development of new fuels, oxidizers, explosive ingredients and formulations; and reliable simulation tools and diagnostics to develop and design superior-performance, and/or reduced-vulnerability systems tailored to specific warfighter missions. ***FY 2024 Plans:*** Overall, continue applied advanced energetic materials research efforts focused on longer range, reduced time-to-target, enhanced lethality/target effects, and cost savings pertaining to kinetic weapons without sacrificing insensitive munitions requirements. Continuing Efforts:					

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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 focused on development, scale up, and evaluation of novel explosive, propellant, and reactive composite ingredients and energetic formulations, in addition to dynamic diagnostic experimental and multi-scale theoretical efforts for development of next generation higher performing weapon systems. - Expanding research focused on ingredient chemistry and chemical processing technologies. This work includes: synthesis, scale up, and evaluation of new energetic (i.e. explosives, oxidizers, fuels) and other formulation-enabling ingredients (i.e. polymer binders, plasticizers), and exploration and adaptation of innovative mixing, formulation, and other novel manufacturing processes for agile progression of enhanced energetic formulations. - Expanding research in development and application of experimental diagnostics of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target for air, surface, and underwater warhead and propulsion applications. This work includes: explosive blast, reactive materials, and propulsion relevant combustion science, shock-wave/energetic formulation studies, advanced tactical propulsion concepts, and ingredient specific structure/property studies. - Expanding research in development and application of modeling, simulation, and computation to predict dynamic response and effects of energetic processes such as ignition, combustion/deflagration, shock, fragmentation, and detonation in order to predict weapon performance, lethality, and lifecycle for air, surface, and underwater weapon applications. Completing Efforts: - Discontinuing minor efforts in ingredient development, experimental diagnostics, and modeling that do not show promise. Initiating Efforts: - Research focused on new reactive material formulations and configurations for warhead use. New consolidated effort towards high performing explosive oxidizer materials, polymer binders, and new energetic material molecular configurations for simplistic, cost effective synthesis of potentially high temperature explosives. New compliant commodity ingredients, and new scale-up and formulation processes will be transitioned to the industrial base as appropriate. - Novel dynamic experimentation in support of design, evaluation and progression of enhanced lethality warhead concepts with focus on smaller form-factor without sacrificing effect on target; and advanced solid rocket motor, air-breathing, and other novel tactical propulsion concepts for extended range and reduced time-to-target with additional focus on throttling capability for extended range.					

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 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
- New methods toward applied theory and model development for shock interactions. New experimental and physics based sub-model development for incorporating novel damage effects into lethality codes.					
FY 2025 Base Plans: Overall, continue applied advanced energetic materials research efforts focused on longer range, reduced time-to-target, enhanced lethality/target effects, and cost savings pertaining to kinetic weapons without sacrificing insensitive munitions requirements. Initiating Efforts: -Computational studies of reaction pathways in terms of mechanistic and kinetic details to guide energetic materials synthesis and scale up development. Continuing Efforts: -Research focused on new reactive material formulations and configurations for warhead use. New consolidated effort towards high performing explosive oxidizer materials, polymer binders, and new energetic material molecular configurations for simplistic, cost effective synthesis of potentially high temperature explosives. New compliant commodity ingredients, and new scale-up and formulation processes will be transitioned to the industrial base as appropriate. -Novel dynamic experimentation in support of design, evaluation and progression of enhanced lethality warhead concepts with focus on smaller form-factor without sacrificing effect on target; and advanced solid rocket motor, air-breathing, and other novel tactical propulsion concepts for extended range and reduced time-to-target with additional focus on throttling capability for extended range. -New methods toward applied theory and model development for shock interactions. New experimental and physics based sub-model development for incorporating novel damage effects into lethality codes. -Applied research focused on development, scale up, and evaluation of novel explosive, propellant, and reactive composite ingredients and energetic formulations, in addition to dynamic diagnostic experimental and multi-scale theoretical efforts for development of next generation higher performing weapon systems. -Research focused on ingredient chemistry and chemical processing technologies. This work includes: synthesis, scale up, and evaluation of new energetic (i.e. explosives, oxidizers, fuels) and other formulation-enabling ingredients (i.e. polymer binders, plasticizers), and exploration and adaptation of innovative mixing, formulation, and other novel manufacturing processes for agile progression of enhanced energetic formulations. -Research in development and application of experimental diagnostics of novel energy conversion concepts to enhance performance, more efficiently exploit available energy, and more effectively couple energy to target for					

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 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 0000 / *Force Protection Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
air, surface, and underwater warhead and propulsion applications. This work includes: explosive blast, reactive materials, and propulsion relevant combustion science, shock-wave/energetic formulation studies, advanced tactical propulsion concepts, and ingredient specific structure/property studies. -Research in development and application of modeling, simulation, and computation to predict dynamic response and effects of energetic processes such as ignition, combustion/deflagration, shock, fragmentation, and detonation in order to predict weapon performance, lethality, and lifecycle for air, surface, and underwater weapon applications. Completing Efforts: -Particular modeling efforts with respect to reactive materials breakup, fragmentation and reactions. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant change from FY2024 to FY2025.					
Title: Surface Ship and Submarine Hull Mechanical and Electrical (HM&E) ***Description:*** Technology programs focused on providing technologically superior warfighting capabilities at reduced total ownership costs for surface and subsurface platforms through investments in applied research and advanced technology development of programs in: a) Power, Energy, Propulsion, Engineering and Design. This element also includes the National Naval Responsibility in Naval Engineering (NNR-NE). Specific research themes are: Power and Energy Technology: Efforts address electrical and auxiliary system and component technology to dramatically improve naval capabilities by providing energy and power resiliency through applied research into energy and power density, control, operating efficiency, operational endurance, recoverability from casualties, and design tools. A major investment focus is providing the power, energy, and thermal management required for directed energy weapons and advanced sensor systems on current and future surface combatants. Significant investments are also focused on improving the energy performance of unmanned systems for the next generation surface fleet, subsea and seabed warfare, and expeditionary forces wherein the limited availability of power and energy are critical.	69.921	89.161	71.788	0.000	71.788

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
Platform Design and Engineering Technology: This research area seeks to further the applied physics and mathematics necessary to increase force effectiveness by improving platform hydrodynamics, platform structures, platform resiliency/survivability, autonomy, and enabling digital technologies needed to improve naval warfighting capabilities as they relate to platforms/capabilities for use in expeditionary, surface and subsurface warfare. - Hydrodynamics: Critical design for naval platform hydrodynamics that is focused on the applied sciences, computation, laboratory experiments, and at-sea experimentation to develop the understanding and prediction capabilities for all hydrodynamic phenomena associated with naval sea-going platforms including, surface ships, submarines, unmanned vessels and manned small craft. Key research goals are to fully understand the physics of hydrodynamics of wakes, ship dynamics/control, propulsors and their effects on vessel performance and associated energy dissipation into the environment to provide science-based metrics for the evaluation of new design concepts to improve efficiency, signatures, and overall capabilities. - Platform Structures: Focused on all timescales of varying reliability of naval structures. Key applied research is focused on the analysis and prediction for a ship structural system with uncertainty quantification and propagation based on real world usage. - Unmanned Vehicles (UxV): Autonomy for UxVs and related mission functions aligned with Naval S&T strategic focus on autonomy and unmanned vehicles in support of surface, submarine, subsea/seabed naval warfare. - Sea Platform Resiliency: Aligned with survivability S&T strategic focus area, research investigates susceptibility, survivability, and recoverability of all naval platforms. Work in susceptibility of naval platforms concentrates on signature reduction across the acoustic and non-acoustic spectrums. Applied research on survivability seeks to improve the ability of naval platforms to survive under stressing combat conditions, before, during, and after being affected by adversarial actions from kinetic and/or non-kinetic effectors. Research in recoverability of naval platforms seeks to better understand the complex nature of modern damage control measures necessary to enable platforms to recover to capability states necessary to avoid mission kill. - Digital Engineering: Naval engineering and platform design efforts to increase the speed to field and capability resiliency in the engineering process across platform lifecycles through the enablement of virtual design/monitor/usage models to be better informed through improved modeling and data science. Concentration of effort is placed on digitally linking all aspects of a platform lifecycle from ideation to destruction with identifiable metrics of military utility enabling fuller solution trade-space exploration.					
FY 2024 Plans: Power, Energy and Propulsion Technology:					

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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 efforts associated with superconducting cables for flexible ship degaussing system design and sustainable deployment for new and existing surface ship and submarine programs. Continue applied superconductivity research in support of future Naval HM&E and mission systems. - Continue research efforts on the Naval Enterprise Partnership Teaming with Universities for National Entrepreneurship (NEPTUNE) program. The effort is derived from previous efforts in the areas of advanced energy systems research, which was focused on enhancing collaborations across academia, industry and DON beneficiaries. The NEPTUNE program is focused on conducting research that provides Navy Energy Education & Training for students. - Continue applied research in Thermal Management to address directed energy, environmental control needs, and update Navy design tools to include advanced thermal modeling capability. - Continue applied research in Medium Voltage Direct Current (MVDC) electrical architectures to reduce risk on future platforms. - Continue research efforts in support of climate resiliency and clean energy to include applied research on low Global Warming Potential (GWP) refrigerants & environmentally friendly refrigeration cycles. Conduct research to study impact of climate on system performance. Address the areas of climate-informed decision-making, training and equipping for climate resilience, resilient built and natural infrastructure, supply chain resilience and innovation, and enhanced mitigation and adaptation through collaboration. - Continue electromechanical machinery applied research to reduce energy demand and improve component and power system energy conversion efficiencies. - Continue research on local generation of sustainable, net-zero, and zero-carbon fuels to include design tool development to understand the impact of alternative fuels on platforms and operational missions. - Complete DDG(X) advanced propulsion research, and improvement of fuel efficiencies in the DDG-51 fleet - Initiate research in support of safely integrating large-scale embedded energy storage onto Naval platforms. This includes containment and non-propagation research, and development of the knowledge needed to certify technologies. Electronics: - Continue research to develop and explore new high voltage, high efficiency wide bandgap and ultra-wide bandgap power switches for electric propulsion and electric weapons. Current plans are to focus efforts on High-Voltage Ultra-Fast SiC Semiconductor Closing Switches. - Complete research on Pioneering Vertical GaN High Power Switches and Ultra-Wide Bandgap Gallium Oxide Power. - Initiate research on High-Voltage Planar Low Damage GaN Power Switch.					

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
Platform Design and Engineering Technology: - Continue applied research in hydrodynamics of surface and subsurface platforms and propulsion focusing on the prediction of innovative propulsion concepts and platform designs that improve control of dynamic behaviors to improve efficiency, speed, maintainability, and maneuverability, while reducing overall associated platform signatures, weight, and lifecycle cost - Continue applied research into resilient platform materials and structures focusing efforts on innovative that improve performance and lifecycle reliability in harsh marine environments that improve platform survivability in hostile environments - Continue applied research into general acoustic and electromagnetic signature prediction tools for ground, sea-surface, and subsurface platforms - Continue applied research in technologies to reduce exploitable acoustic signatures from manned and unmanned platforms ground, sea-surface, and subsurface platforms - Continue research efforts in Hull, Mechanical, and Electrical (HM&E) Technologies focusing on digital and data sciences as applied to naval platforms in support of naval objectives in its Digital Transformation, to include work in Digital Engineering, Digital Twins, Digital Threads, Machine Learning and Artificial Intelligence to increase the availability, reliability, and resiliency of all naval platforms across all domains and manning configurations. - Continue research efforts in support of on the Tactical Submarine Evolution Plan (TSEP) S&T, Submarine Detectability, Integrated Permanent Magnet Motors, and Submarine Future Technologies -Complete efforts in Top-Side signature control for undersea platforms -Initiate research on broad based countermeasures and signature improvement technologies associated with Non-Acoustic Undersea Warfare (NAUSW) -Initiate applied research program on Total Platform Resiliency that seeks to improve the resiliency and extensibility of complex platforms and systems of systems throughout their lifecycle -Initiate efforts in applied research of manned platform autonomous systems, as well as autonomous surface (USV) and undersea platforms (UUV) focusing on the Resiliency of systems and system of systems for extended time between needed human intervention to extend range, time on station, signature reduction, warfighter efficiency, damage control, and adaptability in uncertain adversarial environments Spectrum Superiority:					

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 research efforts for passive and active long-range high-resolution detection and imaging for increased survivability and situational awareness even in degraded/contested environments. - Continue research efforts into coherent combination of optical, infrared, and mm-wave imagers for increased resolution and longer-range detection. - Continue research efforts to demonstrate portable sensor technology and machine learning based algorithms capable of identifying and recognizing emitters based off of unique RF characteristics in a complex EM environment. - Continue research efforts exploring simultaneous full-spectrum (RF and optical) effects to enable full operations and signature control across the entire electromagnetic spectrum and conduct laboratory-based sub-system demonstrations of component technologies. - Continue development of microelectronics system on a transient glass substrate for controlled destruction, which will allow sensitive software application use in hostile operations. - Continue development of machine learning techniques for automated signal identification in order for own-forces to understand and adjust electromagnetic spectrum signature. Explosive Hazard Defeat in Expeditionary Warfare: - Continue designing and developing inexpensive, miniaturized, low power electrochemical sensors for use in autonomous and distributed sensor networks in order to provide real-time, stand-off detection of explosive hazards in expeditionary missions; developing real time, standoff, moving target, laser based detection for explosives and hazardous chemicals in littoral environment; and developing chemical vapor sensing strategy for application in littoral environment. - Continue the development of high bandwidth modularized airborne ground penetrating radar array and related components as well as integrated near-real-time ground tracking and detection algorithm. - Continue research and development of modular compact sensors and automated algorithms to rapidly assess, analyze, and report damage to infrastructure for repair following an attack or natural disaster particularly damage to runways, roads, piers, utilities, and buildings. - Continue work on a low-cost, high performance, broadband infrared optics solution utilizing new materials. - Initiate research and development on the scalable precision neutralization of threat explosive hazards, mines, and kill chain components with lethal or non-lethal force from standoff distances to enable in-stride littoral movement and maneuver, designated ground corridors, at forward aviation points, littoral transition points, and in designated areas of interest.					
FY 2025 Base Plans:					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Power and Energy (formerly Power, Energy and Propulsion Technology): - Continue research efforts associated with superconducting cables for flexible ship degaussing system design and sustainable deployment for new and existing surface ship and submarine programs. - Continue applied superconductivity research in support of future Naval HM&E and mission systems. - Continue research efforts on the Naval Enterprise Partnership Teaming with Universities for National Entrepreneurship (NEPTUNE) program. The effort is derived from previous efforts in the areas of advanced energy systems research, which was focused on enhancing collaborations across academia, industry and DON beneficiaries. The NEPTUNE program is focused on conducting research that provides Navy Energy Education & Training for students. - Continue applied research in Thermal Management to address directed energy, environmental control needs, and update Navy design tools to include advanced thermal modeling capability. - Continue applied research in Medium Voltage Direct Current (MVDC) electrical architectures to reduce risk on future platforms. - Continue research efforts in support of climate resiliency and clean energy to include applied research on low Global Warming Potential (GWP) refrigerants & environmentally friendly refrigeration cycles. Conduct research to study impact of climate on system performance. Address the areas of climate-informed decision-making, training and equipping for climate resilience, resilient built and natural infrastructure, supply chain resilience and innovation, and enhanced mitigation and adaptation through collaboration. - Continue electromechanical machinery applied research to reduce energy demand and improve component and power system energy conversion efficiencies. - Continue research on local generation of sustainable, net-zero, and zero-carbon fuels to include design tool development to understand the impact of alternative fuels on platforms and operational missions. - Continue research in support of safely integrating large-scale embedded energy storage onto Naval platforms. This includes containment and non-propagation research, and development of the knowledge needed to certify technologies. - Initiate Naval installation microgrid resilience via adoption of shipboard zonal distribution. Naval Engineering (formerly Platform Design and Engineering Technology): - Continue applied research in hydrodynamics of surface and subsurface platforms and propulsion focusing on the prediction of innovative propulsion concepts and platform designs that improve control of dynamic behaviors to improve efficiency, speed, maintainability, and maneuverability, while reducing overall associated platform signatures, weight, and lifecycle cost.					

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 applied research into resilient platform materials and structures focusing efforts on innovative that improve performance and lifecycle reliability in harsh marine environments that improve platform survivability in hostile environments. - Continue applied research into general acoustic and electromagnetic signature prediction tools for ground, sea-surface, and subsurface platforms. - Continue applied research in technologies to reduce exploitable acoustic signatures from manned and unmanned platforms ground, sea-surface, and subsurface platforms. - Continue research efforts in Hull, Mechanical, and Electrical (HM&E) Technologies focusing on digital and data sciences as applied to naval platforms in support of naval objectives in its Digital Transformation, to include work in Digital Engineering, Digital Twins, Digital Threads, Machine Learning and Artificial Intelligence to increase the availability, reliability, and resiliency of all naval platforms across all domains and manning configurations. - Continue research efforts in support of on the Tactical Submarine Evolution Plan (TSEP) S&T, Submarine Detectability, Integrated Permanent Magnet Motors, and Submarine Future Technologies. - Continue research on broad based countermeasures and signature improvement technologies associated with Non-Acoustic Undersea Warfare (NAUSW). - Continue applied research program on Total Platform Resiliency that seeks to improve the resiliency and extensibility of complex platforms and systems of systems throughout their lifecycle. - Continue efforts in applied research of manned platform autonomous systems, as well as autonomous surface (USV) and undersea platforms (UUV) focusing on the Resiliency of systems and system of systems for extended time between needed human intervention to extend range, time on station, signature reduction, warfighter efficiency, damage control, and adaptability in uncertain adversarial environments. Spectrum Superiority: - Continue research efforts for passive and active long-range high-resolution detection and imaging for increased survivability and situational awareness even in degraded/contested environments. - Continue research efforts into coherent combination of optical, infrared, and mm-wave imagers for increased resolution and longer-range detection. Explosive Hazard Defeat in Expeditionary Warfare: - Continue design and development of inexpensive, miniaturized, low power electrochemical sensors for use in autonomous and distributed sensor networks in order to provide real-time, stand-off detection of explosive hazards in expeditionary missions; developing real time, standoff, moving target, laser based detection for					

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
explosives and hazardous chemicals in littoral environment; and developing chemical vapor sensing strategy for application in littoral environment. - Continue design and development of modular compact sensors and automated algorithms to rapidly assess, analyze, and report damage to infrastructure for repair following an attack or natural disaster particularly damage to runways, roads, piers, utilities, and buildings. - Continue design, development and prototyping scalable precision neutralization systems for threat explosive hazards, mines, and kill chain components with lethal or non-lethal force from standoff distances to enable in-stride littoral movement and maneuver, designated ground corridors, at forward aviation points, littoral transition points, and in designated areas of interest. - Complete development of high bandwidth modularized airborne ground penetrating radar array and related components as well as integrated near-real-time ground tracking and detection algorithm. -Initiate research to develop lightweight expendable munitions deployed from unmanned aerial systems to spot neutralize explosive hazards. Includes autonomous hazard identification, continually tracks, and maneuvers a warhead to the target to be neutralized. -Initiate research to develop compact detection flow cells for explosives. -Initiate applied research of a fluorescence scanning sensor to detect explosive hazards. -Initiate research to enhance the sensing of a small unmanned system capable of operating underwater and in the air to support finding and reacquiring explosive targets in expeditionary environments. This uses artificial intelligence techniques and pushes near-real time data into the common operating picture. - Initiate research to forward the timely information coming from new expeditionary antisubmarine warfare sensors with in-situ processing in the noisy littorals into the undersea warfare common operational picture. -Initiate research into optimized communications in the littoral environment using operational forecast models and coastal/terrestrial radio frequency propagation characteristics validated through field tests. -Initiate research to demonstrate a compact, solid-state, fully integrated polarimetric light detection and ranging sensor for a small unmanned aerial system with quad-polarization, demultiplexing metasurfaces, and mutipixel time of flight single-photon-counting array. - Initiate design and development of electronics for sensors and communications for multi-domain small unmanned aerial system that can reach underwater locations rapidly and provide bathymetry, detection, interrogation, neutralization and communications capabilities for the defeat of explosive hazards and other landing obstacles from the very shallow water zone to the inland objective. - Initiate efforts in Power and Energy Technology. Power and energy are central to modern warfare. Increased speed and endurance, and advanced weapons systems will strain power systems of all sizes from surface					

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
combatants to expeditionary base micro-grids, to devices smaller than handhelds. Consequently, efforts conducted in this thrust are aimed at enabling increasingly efficient, reliable, resilient, and abundant energy for Navy and Marine Corps infrastructure, platforms, systems, and equipment through optimization of power and energy density, energy efficiency, service life, reliability, low maintenance operation, safety, and cost. Power and energy generation and storage requirements often dictate the ultimate capabilities of naval systems and must do so reliably in extreme environments to meet the naval forces' needs. Low-maintenance, reliable power and energy solutions will enable longer missions. Operating, sustaining, and increasing the lethality of modern platforms and systems requires a focus on power and energy technologies. To achieve these objectives, this thrust encompasses research in materials for advanced naval platform and expeditionary power generation, distribution, and management. (NRL) - Continue the development of Power Electronics Technologies. The objective of this area is to increase the power density, reduce the volume, and reduce the weight of power converters, pulsed power components, and systems for applications. Those systems include but are not limited to electric propulsion for surface ships and submarines; power distribution on Navy ships and aircraft; powering weapons and sensors; and force protection. Solutions emphasizing efficiency and compactness are emphasized in order to address prime power constraints imposed on both large platforms and distributed autonomous systems operating solely or in a swarm environment. This is an expansion of the previous mentioned efforts to develop and explore new high voltage, high efficiency wide bandgap and ultra-wide bandgap power switches for electric propulsion and electric weapons as well as an expansion of the previous mentioned efforts to research High-Voltage Planar Low Damage GaN Power Switches. (NRL) ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** The funding decrease from FY 2024 to FY 2025 is due to completion of the Climate DDGX IPS and Support Equipment Electrification.					
Title: Naval Research Enterprise ***Description:*** The Naval Research Enterprise (NRE), through NavalX, supports mission-driven design think problem solving within the Naval Research and Development Establishment (NR&DE) and academia in support of culture changes to agile and rapid prototyping development driven by well defined and effective innovation process and operations. This will promote common innovation processes to stimulate effective NR&DEv and industry wide collaborations and facilitation to accelerate the delivery of innovative capabilities to the warfighter.	8.854	9.391	9.369	0.000	9.369

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Activities are based on three foundational principles: (1) utilize innovative technical and business pathways that accelerate technology acquisition and deployment to the warfighter and pilot potential efforts as a result of this investigation; (2) leverage the commercial market and attract private investments to accelerate and reduce the cost for defense acquisition and deployment of technologies that provide capabilities to the warfighter; and (3) employ innovative best-practices in contracting that accelerate awards and provide flexibility and speed in technology and acquisition. The Independent Applied Research (IAR) Program focuses on solving a wide range of Naval Science and Technology (S&T) fleet issues utilizing unique Naval Warfare Center (WC) laboratory capabilities. Efforts under this activity address the full spectrum of the Naval Research and Development Framework using focus areas which engage Naval aviation, sea surface, undersea, space, weapons, communication, information, and human systems. The IAR Program provides participating WCs with in-house funding for applied research to support the execution of their assigned missions by: (1) developing and maintaining a cadre of active researchers who can distill and extend results from worldwide research and apply them to solve Naval problems; (2) promoting the hiring and development of talented new scientists and engineers (S&E) with the assurance of proper mentoring with senior personnel; and (3) encouraging collaboration with universities, private industry, and other Navy and Department of Defense laboratories. Funded projects are chosen through rigorous internal competition by each WC's selection committee and typically last two to three years. IAR projects are generally designed to promote investment in high-risk/high- payoff research and also allow young S&Es to manage Navy relevant research projects. ***FY 2024 Plans:*** Independent Applied Research (IAR): Continue: - Further develop and maintain the Science and Engineering workforce by providing funding to Naval Warfare Centers and Laboratories to foster high risk/ high reward applied research initiatives of Naval interest. Each Naval site conducts peer reviews for existing research projects, assess the quality of the research, and determine if projects should continue. - Continue NIPA Challenges that solicit and expand the DON industrial base, especially small businesses, to solve					

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
warfighter problems. The Challenges will employ the NavalX Tech Bridge network to reach the widest possible industrial base and to promote collaborations across the Naval R&D community. - Expand Naval sustainment efforts across Warfare Centers through cross-community NIPA/H4D Challenges and Small Business Innovative Research (SBIR) topics. Complete: - Conclude two-year research topics that initiated in FY 2023. Assess opportunities for technology transition to larger programs through coordination with various resource sponsors. Transfer successful efforts to research, development, test, and evaluation-sponsored programs. Initiate: - The participating warfare centers or laboratories generate new two-year and three-year research topics where priority is given to warfighter needs, technology alignment, high quality research, and the recruitment and retention of outstanding scientists and engineers. Topics cover a broad range of Naval relevant research areas critical to the support of warfare center and laboratory missions. ***FY 2025 Base Plans:*** Independent Applied Research (IAR): - Continue to further develop and maintain the Science and Engineering workforce by providing funding to Naval Warfare Centers and Laboratories to foster high risk/ high reward applied research initiatives of Naval interest. Each Naval site conducts peer reviews for existing research projects, assess the quality of the research, and determine if projects should continue. - Complete the two-year research topics that initiated in FY 2024. Assess opportunities for technology transition to larger programs through coordination with various resource sponsors. Transfer successful efforts to research, development, test, and evaluation-sponsored programs. - Initiate efforts at the participating warfare centers or laboratories to generate new two-year and three-year research topics where priority is given to warfighter needs, technology alignment, high quality research, and the					

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
recruitment and retention of outstanding scientists and engineers. Topics cover a broad range of Naval relevant research areas critical to the support of warfare center and laboratory missions. ***FY 2025 OCO Plans:*** N/A ***FY 2024 to FY 2025 Increase/Decrease Statement:*** There is no significant change from FY2024 to FY2025.					
Accomplishments/Planned Programs Subtotals	126.535	142.148	120.716	0.000	120.716

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602123N / *Force Protection Applied Res*				Project (Number/Name) 3270 / *Sec. 2912 Operational Energy Savings*			
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**
3270: *Sec. 2912 Operational Energy Savings*	0.000	6.563	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.563

A. Mission Description and Budget Item Justification

FY22 Section 2912 Operational Energy Savings Achieved in FY22

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Title: Sec 2912 Operataional Energy Savings	6.563	0.000	0.000	0.000	0.000
FY 2024 Plans: N/A					
FY 2025 Base Plans: N/A					
FY 2025 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	6.563	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

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 0602123N / *Force Protection Applied Res*				Project (Number/Name) 9999 / *Congressional Adds*			
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	204.800	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	204.800

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: Alternative Energy Research ***FY 2023 Accomplishments:*** Conduct Alternative Energy Research ***FY 2024 Plans:*** N/A	28.961	0.000
Congressional Add: Advanced Energetics Research ***FY 2023 Accomplishments:*** Continue research towards the advanced demonstration of energetic materials in a variety of weapon system applications to include: high performance solid rocket and air breathing propulsion, reactive materials demonstrations and effects in advanced lethality and effectiveness models, advanced warhead concepts to include novel reactive shaped charge configurations, hybrid reactive material warhead demonstrations, and the development and demonstration of any necessary modeling and simulation capabilities for quantification of damage effects on adversary weapon systems, and other potential energetic technologies. ***FY 2024 Plans:*** N/A	5.789	0.000
Congressional Add: Talent and technology for Navy power and energy systems ***FY 2023 Accomplishments:*** Continue efforts to develop autonomous command and control of ship power and energy systems, leveraging digital twin technology that protects the ship's power and energy grid. In addition, designed and built a digital twin testbed for physical experimentation with power and energy controls technologies. ***FY 2024 Plans:*** N/A	10.137	0.000
Congressional Add: Energy resilience efforts ***FY 2023 Accomplishments:*** Conduct applied research supporting energy resilience efforts. ***FY 2024 Plans:*** N/A	7.723	0.000
Congressional Add: Coastal environmental research	4.827	0.000

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 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Continue efforts to provided a complete, portable, and field-tested ocean electro-magnetic observatory capable of global deployment to observe the fluid dynamics and magnetic signature of the ocean in coastal environments. Installed, calibrated, and collected data for the Navy's Electro-Magnetic Observatory prototype. ***FY 2024 Plans:*** N/A		
Congressional Add: Direct Air Capture and Blue Carbon Removal Technology ***FY 2023 Accomplishments:*** This funding will support direct air capture and blue carbon technology development. Advancements in these technologies and their integration with next generation fuel producing and material producing technologies will enhance DoN & DoD fuel energy security. ***FY 2024 Plans:*** N/A	9.654	0.000
Congressional Add: Additive Manufacturing of Unmanned Maritime Systems ***FY 2023 Accomplishments:*** This work will develop advanced composite structures for an unmanned surface vessel (USV) using additive manufacturing techniques. The final USV enabled is expected to provide higher performance, lower weight, lower cost and faster manufacturing times than achievable with conventional technologies. This contract will deliver the USV design, hull manufacturing process demonstrations, full scale hull sections and a sub-scale complete hull. ***FY 2024 Plans:*** N/A	9.653	0.000
Congressional Add: relative position of autonomous platforms ***FY 2023 Accomplishments:*** Conduct applied research in relative position of autonomous platforms. ***FY 2024 Plans:*** N/A	4.826	0.000
Congressional Add: Bonded metal matric composit repair ***FY 2023 Accomplishments:*** Conduct applied research in bonded metal matric composite repair. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: Resilient innovative sustainable economies via university partnerships	8.689	0.000

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 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Conduct applied research for resilient innovative sustainable economies via university partnerships. ***FY 2024 Plans:*** N/A		
Congressional Add: high speed/hypersonic test capability development ***FY 2023 Accomplishments:*** Conduct high speed/hypersonic test capability development. ***FY 2024 Plans:*** N/A	3.862	0.000
Congressional Add: Resilient autonomous systems research and diversity programs ***FY 2023 Accomplishments:*** Conduct resilient autonomous systems and diversity programs research. ***FY 2024 Plans:*** N/A	8.206	0.000
Congressional Add: Seawater to jet fuel demo ***FY 2023 Accomplishments:*** Conduct seawater to jet fuel demo. ***FY 2024 Plans:*** N/A	19.307	0.000
Congressional Add: Arctic energy resiliency ***FY 2023 Accomplishments:*** Conduct arctic energy resiliency research. ***FY 2024 Plans:*** N/A	9.653	0.000
Congressional Add: Cavitation erosion ***FY 2023 Accomplishments:*** Conduct cavitation erosion research. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: Corrosion control coating and material ***FY 2023 Accomplishments:*** Conduct corrosion control coating and material research. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: Cyberphysical security resilency ***FY 2023 Accomplishments:*** Conduct cyberphysical security resiliency research. ***FY 2024 Plans:*** N/A	6.757	0.000
Congressional Add: Intelligent data managment for distributed Naval platforms	10.136	0.000

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 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Conduct intelligent data management for distributed Naval platforms research. ***FY 2024 Plans:*** N/A		
Congressional Add: Materials by design for Navy aircraft sustainment ***FY 2023 Accomplishments:*** Conduct Materials by design for Navy aircraft sustainment research. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: sUAS degraded enviorment facility ***FY 2023 Accomplishments:*** A new facility (Unmanned Systems Degraded Environment Facility (UxSDEF)) supporting research, development, and test of unmanned systems in challenging environments will be built at Naval Surface Warfare Center, Carderock Division's Memphis Detachment. This facility will enable large and full-scale testing of unmanned systems and autonomy technologies in a controlled environment. ***FY 2024 Plans:*** N/A	12.212	0.000
Congressional Add: Universal achemetal titanium process ***FY 2023 Accomplishments:*** Conduct universal achemetal titanium process research. ***FY 2024 Plans:*** N/A	11.584	0.000
Congressional Add: Unmanned surface vehicle ***FY 2023 Accomplishments:*** Conduct unmanned surface vehicle research. ***FY 2024 Plans:*** N/A	4.827	0.000
Congressional Add: High-entropy materials for hypersonics ***FY 2023 Accomplishments:*** Conduct research in high-entropy materials for hypersonics. ***FY 2024 Plans:*** N/A	8.689	0.000
Congressional Adds Subtotals	204.800	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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 0602123N / *Force Protection Applied Res*	**Project (Number/Name)** 9999 / *Congressional Adds*

D. Acquisition Strategy

Not applicable.