Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Navy	Date: April 2022
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603123N *I Force Protection Advanced Technology*

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
Total Program Element	0.000	26.648	36.161	16.933	-	16.933	17.262	17.621	17.920	18.248	Continuing	Continuing
2912: *Force Protection Advanced Technology*	0.000	24.280	19.150	14.374	-	14.374	14.662	14.956	15.256	15.562	Continuing	Continuing
3049: *Force Protection*	0.000	2.368	2.511	2.559	-	2.559	2.600	2.665	2.664	2.686	Continuing	Continuing
9999: *Congressional Adds*	0.000	0.000	14.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.500

A. Mission Description and Budget Item Justification

This PE addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This program supports the development of technologies associated with mission capable, persistent and survivable Naval platforms (surface, subsurface, terrestrial and air) in the areas of Platform Design & Engineering, Power, Energy & Propulsion, and Materials. The program develops technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scalable Naval air vehicle technologies. The program also develops advanced technologies, critical to protecting naval installations, to provide seamless full spectrum protection against asymmetric attack by improving the ability to: detect and identify developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident.

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 Advanced Technology Development (ATD) that includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment. Efforts in this PE generally have Technology Readiness Levels TRL) of 4 (component and/or breadboard validation in laboratory environment.), 5 (component and/or breadboard validation in relevant environment.), or 6 (system/subsystem model or prototype demonstration in a relevant environment).

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2023 Navy	Date: April 2022
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603123N *I Force Protection Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Previous President's Budget	24.305	21.661	0.000	-	0.000
Current President's Budget	26.648	36.161	16.933	-	16.933
Total Adjustments	2.343	14.500	16.933	-	16.933
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	14.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	2.779	0.000			
• SBIR/STTR Transfer	-0.436	0.000			
• Program Adjustments	0.000	0.000	0.000	-	0.000
• Rate/Misc Adjustments	0.000	0.000	0.000	-	0.000
• Adjustments to Budget Year	-	-	16.933	-	16.933

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2021	FY 2022
Project: 9999: *Congressional Adds*		
Congressional Add: *Power electronics building block*	0.000	6.000
Congressional Add: *Carbon nanotube energy storage flywheel*	0.000	4.000
Congressional Add: *Laser peening of jet engines*	0.000	4.500
Congressional Add Subtotals for Project: 9999	0.000	14.500
Congressional Add Totals for all Projects	0.000	14.500

Change Summary Explanation

Funding: no significant change

Technical: no significant change

Schedule: no significant change

FY 2023 funding increase reflects the fact that the FY 2022 President’s Budget request did not include out-year funding.

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy			Date: April 2022
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603123N / *Force Protection Advanced Technology*	Project (Number/Name) 2912 / *Force Protection Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
2912: *Force Protection Advanced Technology*	0.000	24.280	19.150	14.374	-	14.374	14.662	14.956	15.256	15.562	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with mission capable, persistent and survivable Naval platforms (surface, subsurface, terrestrial, and air) in the areas of Platform Design & Engineering, Power, Energy & Propulsion, and Materials. This project develops technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scalable Naval air vehicle technologies.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Surface Ship and Submarine Hull Mechanical and Electrical (HM&E)	22.497	12.908	8.051	0.000	8.051
Articles:	-	-	-	-	-
Description: This project addresses advanced technology development associated with providing the capability of Platform and Force Protection for the U.S. Navy. This project supports the development of technologies associated with mission capable, persistent and survivable naval platforms (surface, subsurface and terrestrial) in the areas of Platform Design & Engineering, Power, Energy & Propulsion and Materials. The primary research efforts within this activity are focused on Development of Advanced Manufacturing & Sustainment Technologies, Advanced Naval Power Systems Development, and Advanced Platform Development.					
FY 2022 Plans: - Continue Autonomous Unmanned Surface Vessel (USV): conduct advance research related to the development of planing hull platforms. The technologies resulting from these efforts are being further developed for use on unmanned surface vessels. - Continue At-Sea Rearm of Vertical Launch System (ASRV): completion task and efforts will focus on demonstrating the ASRV capability in Sea State 4. - Complete Energy Systems Technology Evaluation Program (E-STEP): project efforts focus on assessing advanced energy technologies, developing cyber-physical security for energy networks, and utilizing					

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 2912 / *Force Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
autonomous systems, artificial intelligence and advanced manufacturing to address operational challenges in logistics and readiness. Program goals include: advance dual-use and naval-unique technologies that increase operational capabilities and efficiencies; leverage commercial technologies and private investments to provide warfighter capability at reduced cost; and evaluate innovative technologies from naval laboratories and startup companies. - Complete Quality Metal Additive Manufacturing (Quality MADE): complete research and demonstration for accelerated qualification of materials and manufacturing processes for structural components. ***FY 2023 Base Plans:*** - Complete Autonomous Unmanned Surface Vessel (USV): expand advanced research related to the development of planing hull platforms. The technologies resulting from these efforts are being further developed for use on unmanned surface vessels. - Initiate development of Advanced Manufacturing & Sustainment Technologies: Next-Gen Naval Platforms will require new materials, at a high manufacturing readiness level, to meet the required platform performance requirements and power and energy density for advanced systems, as well as cost, manufacturability, resiliency, and to reduce the sustainment burden. - Initiate development of Advanced Naval Power Systems: New Naval Platforms will require very high energy density, integrated power systems that require very low maintenance (people and cost), as well as operate in a resilient fashion. - Initiate development of Advanced Platforms: This effort will focus on developing a framework and integrating component technologies into a mature platform design capability and subsystems for next generation fully autonomous platforms and reduced crew size to reduce the logistics burden and increase warfighting capability. ***FY 2023 OCO Plans:*** N/A ***FY 2022 to FY 2023 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 2912 / *Force Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
The funding decrease from FY 2022 to FY 2023 is due to completion of the Vertical Launch System (VLS) Reload at Sea effort earlier than scheduled (FY22) and realignment of the E-STEP effort to PE 0603758N, Project 2918 as part of the Swampworks activity.					
Title: Aircraft Technology	1.783	6.242	6.323	0.000	6.323
Articles:	-	-	-	-	-
Description: The Aircraft Technology activity develops technologies for enhanced capability of Naval aviation aircraft platforms in terms of mission effectiveness, platform range, responsiveness, survivability, observability, readiness, safety and life cycle cost. It also develops new Naval air vehicle concepts and high impact, scalable Naval air vehicle technologies, such as helicopter and tiltrotor rotor drive systems, aerodynamics, propulsion systems, materials and structures for future and legacy air vehicles. This activity directly supports the Naval Research and Development Framework Priorities of Operational Endurance and Scalable Lethality. ***FY 2022 Plans:*** - Complete further development of advanced technology for the Navy's (NGAD) carrier aircraft enabling technologies. NGAD Critical Technology development efforts are focused on major engine manufacturers developing highest priority, long lead propulsion system turbine engine technologies. - Initiate technology development and maturation through Next Generation Propulsion - Enablers (NGP-E) with major engine manufacturers on the highest priority, long lead propulsion, power and thermal management technologies, including: - Advanced, adaptive and modular controls. - Increased temperature capable Ceramic Matrix Composites (CMC) and Polymer Matrix Composites (PMC). - Advanced casing treatments and compression systems for increased operability and efficiency. - More compact combustion and augmentation systems. - More thermally efficient pumping systems. ***FY 2023 Base Plans:*** Continue					

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 2912 / *Force Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Conduct technology development and maturation through Next Generation Propulsion Enablers (NGP-E) with major engine manufacturers on the highest priority, long lead propulsion, power and thermal management technologies, including: - Advanced, adaptive and modular controls. - Advanced casing treatments and compression systems for increased operability and efficiency. - More compact combustion and augmentation systems, utilizing rotating detonation combustion. - More thermally efficient variable displacement fuel pumps - Enable "hot" fuels as an additional heat sink and provide improved energy. Complete Due to unanticipated schedule delays, efforts to further develop future Navy carrier aircraft enabling technologies are being extended into and will complete in FY23. Critical Technology development efforts are focused on major engine manufacturers developing highest priority, long lead propulsion system turbine engine technologies." ***FY 2023 OCO Plans:*** N/A ***FY 2022 to FY 2023 Increase/Decrease Statement:*** There is no significant funding change from FY 2022 to FY 2023.					
Accomplishments/Planned Programs Subtotals	24.280	19.150	14.374	0.000	14.374

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy			Date: April 2022
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603123N / *Force Protection Advanced Technology*	Project (Number/Name) 3049 / *Force Protection*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
3049: *Force Protection*	0.000	2.368	2.511	2.559	-	2.559	2.600	2.665	2.664	2.686	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Develop advanced technologies, critical to protecting naval installations, to provide seamless full spectrum protection against asymmetric attack by improving the ability to: detect and identify developing and immediate threats; shape our responses through improved situational awareness and decision making; shield personnel, mission critical facilities, infrastructure, and operating fleet assets; maintain essential functions; and sustain and restore critical services in the aftermath of an incident. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission, improving performance and reducing costs for the Navy.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
Title: Emerging Threats	2.368	2.511	2.559	0.000	2.559
Articles:	-	-	-	-	-
Description: Naval Installations are a critical component in support of Navy global force projection. These installations, and the Navy ships, submarines, and aircraft located on them, are under increasing risk from asymmetric attack, including from new threat vectors such as unmanned air, surface, and subsurface vehicles. This project is focused on the development advanced technologies necessary for the protection of Naval Installations. Technical efforts address the detect -to-engage-to-assess requirements for Naval Installations by improving the ability to: sense and identify threats; support improved situational awareness and decision making; and develop effective countermeasures. Technologies developed will also seek to reduce the required manpower and skill levels devoted to the force protection mission.					
FY 2022 Plans: - Continue Autonomous Maritime Asset Protection System (AMAPS): conduct interim demonstration of autonomous assessment and response UAS capability to evaluate Unauthorized Access events on naval installation land and waterside perimeters. - Continue Day/night all weather sensors: conduct final demonstration of capability to detect, track, and identify small unmanned air threats using multi-static radar, Active Millimeter Wave (AMMW) and Dual Band Infrared electro-optic sensors. Optimize sensor performance and operator effectiveness using Automated Target Recognition algorithms.					

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 3049 / *Force Protection*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total
- Continue Automated Target Recognition algorithms: develop and demonstrate improved harbor security sonar capabilities to detect Unmanned Underwater Vehicles (UUVs) to include; increased volumetric coverage, passive detection and tracking algorithms, and new classification algorithms to address more capable threats. - Develop and demonstrate a kinetic response capability to interdict threat Unmanned Underwater Vehicles (UUV) detected in naval installation harbors. ***FY 2023 Base Plans:*** - Continue Autonomous Maritime Asset Protection System (AMAPS): conduct final demonstration of autonomous assessment and response UAS capability to evaluate Unauthorized Access events on naval installation land and waterside perimeters. - Continue Day/night all weather sensors: conduct final demonstration of capability to detect, track, and identify small unmanned air threats using multi-static radar, Active Millimeter Wave (AMMW) and Dual Band Infrared electro-optic sensors. Optimize sensor performance and operator effectiveness using Automated Target Recognition algorithms. - Continue Automated Target Recognition algorithms: develop and demonstrate improved harbor security sonar capabilities to detect Unmanned Underwater Vehicles (UUVs) to include; increased volumetric coverage, passive detection and tracking algorithms, and new classification algorithms to address more capable threats. Develop capability to track and assess multiple simultaneous threat UUVs in harbors and approach channels. - Complete development and conduct final demonstration of the RPG-S kinetic response capability to interdict threat Unmanned Underwater Vehicles (UUV) detected in naval installation harbors. ***FY 2023 OCO Plans:*** N/A ***FY 2022 to FY 2023 Increase/Decrease Statement:*** No significant change from FY 2022 to FY 2023.					
Accomplishments/Planned Programs Subtotals	2.368	2.511	2.559	0.000	2.559

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy		Date: April 2022
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N / *Force Protection Advanced Technology*	**Project (Number/Name)** 3049 / *Force Protection*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2023 Navy			Date: April 2022
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603123N / *Force Protection Advanced Technology*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2021	FY 2022	FY 2023 Base	FY 2023 OCO	FY 2023 Total	FY 2024	FY 2025	FY 2026	FY 2027	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	14.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.500
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2021	FY 2022
Congressional Add: Power electronics building block ***FY 2021 Accomplishments:*** N/A ***FY 2022 Plans:*** Conduct power electronics building block advanced technology development	0.000	6.000
Congressional Add: Carbon nanotube energy storage flywheel ***FY 2021 Accomplishments:*** N/A ***FY 2022 Plans:*** Conduct carbon nanotube energy storage flywheel advanced technology development	0.000	4.000
Congressional Add: Laser peening of jet engines ***FY 2021 Accomplishments:*** N/A ***FY 2022 Plans:*** Conduct Laser peening of jet engines advanced technology development	0.000	4.500
Congressional Adds Subtotals	0.000	14.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A