Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy											**Date:** May 2017	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 3: *Advanced Technology Development (ATD)*						**R-1 Program Element (Number/Name)** PE 0603123N *I Force Protection Advanced Technology*						

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
Total Program Element	0.000	42.333	48.438	26.342	-	26.342	37.032	35.769	24.769	22.058	Continuing	Continuing
2912: *Force Protection Advanced Technology*	0.000	39.767	45.713	23.568	-	23.568	34.258	32.995	21.995	19.275	Continuing	Continuing
3049: *Force Protection*	0.000	2.566	2.725	2.774	-	2.774	2.774	2.774	2.774	2.783	Continuing	Continuing

Note

There are two new Leap Ahead initiatives starting in FY 2016 - Forward Deployed Energy & Communications Outpost (FDECO) Innovative Naval Prototype (INP) and Medium Displacement Unmanned Surface Vehicle (MDUSV) effort.

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) are based on investment directions as defined in the Naval S&T Strategic Plan approved by the S&T Corporate Board (20 Jan 2015). This strategy is based on needs and capabilities from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. The Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

This PE 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 all naval platforms (surface, subsurface, terrestrial and air) and the protection of those platforms.

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

Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy				**Date:** May 2017	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 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 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
Previous President's Budget	38.044	48.438	49.554	-	49.554
Current President's Budget	42.333	48.438	26.342	-	26.342
Total Adjustments	4.289	0.000	-23.212	-	-23.212
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	5.202	0.000			
• SBIR/STTR Transfer	-0.913	0.000			
• Program Adjustments	0.000	0.000	-23.212	-	-23.212

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

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

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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
2912: *Force Protection Advanced Technology*	0.000	39.767	45.713	23.568	-	23.568	34.258	32.995	21.995	19.275	Continuing	Continuing

Note

Two new Leap Ahead initiatives started in FY 2016 - Forward Deployed Energy & Communications Outpost (FDECO) INP and Medium Displacement Unmanned Surface Vehicle (MDUSV) effort.

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 all naval platforms (surface, subsurface, terrestrial, and air) and the protection of those platforms. For the new FY 2016 effort, Forward Deployed Energy and Communications Outpost (FDECO) INP, the project addresses advanced technology development associated with providing the undersea energy and communications infrastructure necessary to assure undersea dominance; extend the reach of undersea assets; enhance SA and standoff advantage without reducing forward presence and; provide endurance for unmanned systems necessary for force multiplication in an A2/AD environment. For the new FY 2016 effort, Medium Displacement Unmanned Surface Vehicle (MDUSV), the project will radically change the way the Navy does mine influence sweep, ASW and EW missions; it will introduce larger USVs to the Navy; and it will introduce advanced autonomy to the surface Navy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: SURFACE SHIP & SUBMARINE HULL MECHANICAL & ELECTRICAL (HM&E) *Description:* Activity includes: advanced technology demonstrations to evaluate emerging energy technologies and advanced technology development for Unmanned Sea Surface Vehicles in support of Naval S&T Focus Area on Autonomy and Unmanned Vehicles. The funding increase from FY2017 to FY2018 is due to added Vertical Launch System (VLS) reload at sea effort. The MDUSV and FDECO INP efforts are transferred to the new INP PE 0603801N Innovative Naval Prototypes effective FY2018. *FY 2016 Accomplishments:* - Continue all efforts of FY 2015. - Initiate the FDECO INP project. - Initiate Medium Displacement Unmanned Surface Vessel (MDUSV) effort to demonstrate the operational benefit of a highly autonomous, large USV with a modular payload capability and demonstrate at-sea three modular payloads. The activity will consist of advancements to autonomous control, payload integration, and at-	13.106	13.487	17.546	0.000	17.546

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
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)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
sea demonstration of vessel autonomous control and payloads supporting mine warfare, anti-submarine warfare and electronic warfare. *FY 2017 Plans:* - Continue all efforts of FY 2016. *FY 2018 Base Plans:* - Conduct advanced research related to critical S&T for development of autonomous navigation for Unmanned Sea Surface Vehicles from host ship. - Expand research for conducting advanced technology demonstrations to evaluate emerging energy technologies using Navy and Marine Corps facilities as test beds and evolving the Medium Displacement Unmanned Surface Vessel (MDUSV) effort to demonstrate the operational benefit of a highly autonomous, large USV with a modular payload capability and demonstrate at-sea three modular payloads. Initiate efforts to fund a prototype and operational demonstration of At-Sea Rearm of Vertical Launch System (VLS) capability in a relevant environment *FY 2018 OCO Plans:* N/A					
Title: AIRCRAFT TECHNOLOGY *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 - autonomous air vehicle command and control, helicopter and tiltrotor rotor drive systems, aerodynamics, propulsion systems, materials, structures and flight controls for future and legacy air vehicles. This activity directly supports the Naval Aviation Enterprise Science and Technology Objectives and the Naval Science and Technology Strategic Plan, principally in the Autonomy and Unmanned Systems, Platform Design and Survivability, Power and Energy and Total Ownership Cost Focus Areas. The funding increase from FY 2016 to FY 2017 is due to the increase investment in the joint Tactically Exploited Reconnaissance Node (TERN) effort and to maturation of Autonomous Aerial Cargo/Utility System (AACUS) technology from advanced research to advanced development.	26.661	32.226	6.022	0.000	6.022

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603123N *I Force Protection Advanced Technology*	**Project (Number/Name)** 2912 *I Force Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
The funding decrease in FY 18 is due to movement of the AACUS and Tern programs into the new Prototype PE 0603801N Innovative Naval Prototypes.					

B. Accomplishments/Planned Programs ($ in Millions)

The funding decrease in FY 18 is due to movement of the AACUS and Tern programs into the new Prototype PE 0603801N Innovative Naval Prototypes.

FY 2016 Accomplishments:
- Continued demonstration of initial core software, sensor, air vehicle and capability applications for Autonomous Aerial Cargo/utility System (AACUS).
- Continued the advanced technology demonstration portion of the Variable Cycle Advanced Technology (VCAT) Program. Critical technology development efforts will begin with major engine manufactures and system contractors to develop/mature the highest priority, long lead propulsion system technologies, including variable/adaptive cycle engine components, for next generation carrier based Tactical Air (TACAIR) Intelligence, Surveillance and Reconnaissance(ISR) systems.
- Continued VCAT Phase I variable cycle engine/propulsion subsystem technology development efforts through completion.
- Demonstrated sensor improvements, capability expansion and technology maturation of the Autonomous Aerial Cargo/Utility System (AACUS).
- Initiated the joint TERN program to conduct an at sea demonstration of Vertical Take-Off and Landing (VTOL) enabling technologies in support of DDG-51 and LCS-2 based future long endurance Unmanned Air Vehicle (UAV) capabilities.
- Demonstrated portability to another rotary wing aircraft capability expansion and technology maturation of the Autonomous Aerial Cargo/Utility System.

FY 2017 Plans:
- Continue all efforts of FY 2016.
- Continue the AACUS program by demonstrating the capability to perform the assault support mission from mission request to final landing on a multiple delivery flight.

FY 2018 Base Plans:
- Continue the advanced technology development efforts and demonstrations of the Variable Cycle Advanced Technology (VCAT) Program. Critical technology development efforts continue with major engine manufactures and system contractors to develop/mature the highest priority, long lead propulsion system technologies, including variable/adaptive cycle engine components, for next generation carrier based Tactical Air (TACAIR) Intelligence, Surveillance and Reconnaissance (ISR) systems.

FY 2018 OCO Plans:

Exhibit R-2A, **RDT&E Project Justification:** FY 2018 Navy		**Date:** May 2017
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)	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**
N/A					
Accomplishments/Planned Programs Subtotals	39.767	45.713	23.568	0.000	23.568

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

E. Performance Metrics
The overall goals of this advanced technology program are the development of technologies which focus on the warfighter and providing the ability to win or avoid engagements with other platforms or weapons and, in the event of engagement, to resist and control damage, while preserving operational capability. Overall metric goals are to transition the advanced technology projects into acquisition programs. Each Activity within this PE has unique goals and metrics, some of which include classified quantitative measurements. Specific examples of metrics under this PE include: - Advanced technology demonstrations to evaluate emerging energy technologies.

For the effort, Forward Deployed Energy and Communications Outpost (FDECO) INP, the overall goals of this advanced technology program are the development of technologies which focus on energy management and transfer technologies that enable persistent undersea operations by UxV Fleet; provide system architectures that are persistent, scalable and mission agile; provide communication and energy infrastructure available in degraded and contested environments and; provide a platform-agnostic solution that reduces development and maintenance costs. Overall metric goals are to transition the key advanced technology elements, Forward Deployed Energy (FDE), Forward Deployed Communications (FDC) and Forward Deployed Docking (FDD) into acquisition programs. Each Activity within this PE has unique goals and metrics, some of which include classified quantitative measurements. Specific examples of metrics include: - Advanced technology demonstrations to evaluate energy & data transmission and persistent connectivity.

Medium Displacement Unmanned Surface Vehicle (MDUSV), the objectives are to 1) Demonstrate, using specific payloads, the multi-mission versatility of MDUSV, and identify key interface requirements for future payloads. 2) Provide a robust assessment of MDUSV's COLREGs autonomy to build confidence in the reliability and safety of the autonomous control system and 3) Enable the evaluation of MDUSV's operational utility and design to support an acquisition transition decision.

UNCLASSIFIED

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

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 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
3049: *Force Protection*	0.000	2.566	2.725	2.774	-	2.774	2.774	2.774	2.774	2.783	Continuing	Continuing

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.

B. Accomplishments/Planned Programs ($ in Millions)

	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: EMERGING THREATS	2.566	2.725	2.774	0.000	2.774

Description: This activity includes development of advanced technologies critical to protecting naval installations, and will provide seamless, full spectrum protection against asymmetric terrorist attack by improving the ability to: sense 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.

FY 2016 Accomplishments:
- Continued development of lower cost/higher performance Force Protection sensors and automated detection algorithms, and decision support tools.
- Continued research to reduce force protection manpower and equipment costs through automation and predictive learning algorithms.
- Continued threat characterization research and perception experiments for sensor performance optimization and model development and validation.
- Continued development of all weather sensors optimized for installation of force protection.
- Continued research into sensors for use in counter-surveillance around protected facilities.
- Continued research to advance sensor fusion capabilities in high density networks with diverse sensor grids.
- Continued development of assessment algorithms and information analysis technologies to augment skills or replace persons in operations centers.
- Continued interim demonstration of acoustic sensors for perimeter and area surveillance in realistic environments.

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017	
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)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
- Continued development of protection technology for naval installation power and energy infrastructure. - Continued expansion of research into sensors and countermeasures for use against unmanned underwater to include surface swimmers, underwater divers, and underwater diver propulsion aids. - Continued demonstration of multi-band electro-optical sensors and fusion algorithms in adverse weather conditions. - Initiated demonstration of sensors and countermeasures for use against underwater to include surface swimmers, underwater divers, diver propulsion aids, and underwater unmanned vehicles. - Initiated research in non-acoustic detection, tracking, classification, engagement of underwater threats to naval installations. - Initiated development of autonomous unmanned harbor defense systems for perimeter patrol and threat interdiction. -Initiated research into automated vehicle entry control point monitoring, automatic vehicle classification, risk assessment and logic system decision making. - Initiated development of non-contact biometric verification technologies to support unmanned automated access control systems. ***FY 2017 Plans:*** - Continue all efforts of FY 2016. ***FY 2018 Base Plans:*** - Continue and expand development of Virtual Inductive Loop technology to include pedestrians, two wheeled vehicles, and multi-lane automated gates - Conduct interim demonstration of technologies for detection and classification of small unmanned threats to naval installations - Complete development and demonstration of electro-optic sensors and fusion algorithms for installation surveillance in adverse weather conditions. - Complete development and conduct demonstration of sensors and countermeasures for use against underwater threats to include surface swimmers, underwater divers, diver propulsion aids, and underwater unmanned vehicles. - Continue all other efforts not completed in FY 2017. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	2.566	2.725	2.774	0.000	2.774

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

E. Performance Metrics

 The overall goal of this program is to develop technologies which will provide protection for our naval installations against asymmetric attack. Specific metrics include:
 a 50% reduction of manpower required to perform force protection surveillance, situational awareness, and decision making, a 2x improvement in electro-optical sensor
 performance in adverse weather conditions, a 50% reduction in sensor cost per square or cubic meter of detection at a given resolution, and a 50% reduction in false
 alarm rates for automated detection and tracking algorithms both on, above and below water.