Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy											Date: March 2019	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602792N *I (U)Innovative Naval Prototypes(INP) Applied Res*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	160.884	154.085	153.062	-	153.062	160.537	163.711	166.933	170.290	Continuing	Continuing
0000: *(U)Innovative Naval Prototypes(INP) Applied Res*	0.000	160.884	154.085	114.427	-	114.427	132.026	137.650	166.933	170.290	Continuing	Continuing
2481: *EMRG*	0.000	0.000	0.000	7.632	-	7.632	0.000	0.000	0.000	0.000	0.000	7.632
2958: *Cyberspace Activities*	0.000	0.000	0.000	31.003	-	31.003	28.511	26.061	0.000	0.000	0.000	85.575

Note

In FY 2020, the Applied Research Electro-Magnetic Railgun (EMRG) high-power, kinetic energy weapon prototype development effort was realigned from Project Unit 0000 to Project Unit 2481 within this PE.

In FY 2020 a stand alone Artificial Intelligence (AI) R-2 Activity was established in Project Unit 0000 to consolidate and coordinate the acceleration of AI investments.

The FY 2017 Appropriation Act encouraged the services to realign Cyberspace Activity (CA) resources into individual cost codes, projects or program elements (PEs) in order to provide additional clarity and enhanced oversight of cyberspace resources. Within this PE, cyber funding was moved from Proj 0000 Innovative Naval Protoypes (INP) Applied Research to Proj 2958 Cyberspace Activities beginning in FY20, which was established to isolate and identify cyberspace activities.

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) address the Applied Research associated with the Innovative Naval Prototypes (INP) Program. These investments represent game-changing technologies with the potential to revolutionize operational concepts. They are disruptive in nature as they would dramatically change the way naval forces fight. INPs push the imagination of our nation's technical talent to deliver transformational warfighting capabilities. The projects in this portfolio are high risk, technically challenging development efforts that offer the potential of high warfighting payoff in the future. The goal of these investments is to develop and demonstrate the viability of new technological capabilities via experimental prototypes that prove the new capability could be implemented if an acquisition program were to be established to support further development. These investments are selected by a process that involves senior leadership in the Department of the Navy.

Developing INPs requires a systematic expansion and application of knowledge to develop useful materials, devices, and systems oriented toward the design and development of prototypes applicable to specific mission area requirements. The efforts funded within this PE translate promising basic research into solutions for broadly defined military needs. These efforts include developing breadboard hardware and algorithms that establish the initial feasibility and practicality of proposed solutions to technological challenges, such as concept exploration efforts, studies, investigations, and non-system specific technology efforts.

Due to the nature of these projects, technology development plans have been written with limited details due to information security concerns. Specific information on each project will be provided separately to the Congressional oversight committees.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602792N *I (U)Innovative Naval Prototypes(INP) Applied Res*

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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	171.146	159.697	161.381	-	161.381
Current President's Budget	160.884	154.085	153.062	-	153.062
Total Adjustments	-10.262	-5.612	-8.319	-	-8.319
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-5.612			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.262	0.000			
• Program Adjustments	0.000	0.000	-0.776	-	-0.776
• Rate/Misc Adjustments	0.000	0.000	-7.543	-	-7.543
• Congressional Directed Reductions Adjustments	-7.000	-	-	-	-

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	Project (Number/Name) 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
0000: *(U)Innovative Naval Prototypes(INP) Applied Res*	0.000	160.884	154.085	114.427	-	114.427	132.026	137.650	166.933	170.290	Continuing	Continuing

Note

Beginning in FY 2020, the Applied Research Electro-Magnetic Railgun (EMRG) high-power, kinetic energy weapon prototype development effort was realigned from Project Unit 0000 to Project Unit 2481 within PE 0602792N.

A. Mission Description and Budget Item Justification

Innovative Naval Prototypes (INP) investments are typically 4-8 years in duration. They provide a continuance of basic research by maturing technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. It is intended that prototypes developed within this program, requiring both Budget Activity 2 (BA2) and Budget Activity 3 (BA3) funding, are demonstrated in a relevant environment to prove the feasibility of the new technological capability. The portfolio is periodically refreshed through the selection of new INPs as existing ones are completed. Successful experiments and demonstrations are intended to present the Department of the Navy with a programmatic challenge as these new capabilities can lead to the obsolescence of existing capabilities, requiring significant decisions as to the path forward for integrating the new technological capabilities into the warfighting systems of the future. INPs have been collectively grouped into R-2 Activities that include Unmanned and Autonomous Systems, Directed Energy/Electric Weapons, Electromagnetic Maneuver Warfare, Cyber, Undersea Warfare and Artificial Intelligence.

Due to the nature of these projects, technology development plans have been written with limited details due to information security concerns. Specific information on each project will be provided separately to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Cyber	17.567	23.535	0.000	0.000	0.000
FY 2019 Plans: Continue Applied Research effort to develop leap-ahead resilient cybersecurity tools that will enable our warfighting platforms to fight through current and future cyber intrusions.					
FY 2020 Base Plans: N/A					
FY 2020 OCO Plans: N/A					
FY 2019 to FY 2020 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
The FY 2019 to FY 2020 decrease reflects the realignment of funding within this PE from Proj 0000 Innovative Naval Protoypes (INP) Applied Res to Proj 2958 Cyberspace Activities.					
Title: Directed Energy / Electric Weapons	56.333	45.788	29.531	0.000	29.531
Description: This R-2 Activity contains all Applied Research Innovative Naval Prototype (INP) investments that are developing new technologies for directed energy, electric weapons, and hypersonic cruise and air launch booster technology. Future adversaries will seek to neutralize U.S. conventional advantages by capitalizing on asymmetric capabilities that incorporate mobility, range, speed and deception. Naval platforms will be on the front line of our national integrated defensive capabilities to defeat these emerging threats that are proliferating. At the same time, the fleet/force must be able to effectively strike targets with survivable, scalable and cost-effective weapons that have sufficient range, speed and accuracy to complete a variety of missions while reducing risk to our warfighters and without creating unnecessary collateral damage or loss of life. Technologies within this activity will provide scalable lethality through enabling multi-domain, integrated, scalable kinetic and non-kinetic systems for offensive of defensive purposes. ***FY 2019 Plans:*** Continue Applied Research development addressing the unique technical challenges inherent in the construction, assembly and operation of a high-power, kinetic energy weapon prototype capable of repeatedly launching long range, precision guided projectiles using electricity instead of chemical propellants. Conduct a full-scale, rep-rate composite barrel structural demonstration for this project. Continue Applied Research efforts to develop a radio frequency effects payload (a joint USAF/USN project) with scalable electromagnetic effects. Conduct payload shock/vibration testing at the subsystem level. Initiate development of a government laboratory laser testing environment that is representative of a shipboard environment. Conduct the applied research associated with a land-based test at White Sands Missile Range that will involve ship integration and sea testing on an LPD ship. ***FY 2020 Base Plans:*** Conduct development efforts for a radio frequency effects payload (a joint USAF/USN project) with scalable electromagnetic effects. Conduct the Applied Research supporting initial lab and integration testing.					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Conduct research to develop a hypersonic cruise missile that is affordable and effective to mature critical technologies. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The decrease from FY 2019 to FY 2020 is due to a planned ramp down in Directed Energy/Electric Weapons Applied Research as some of the difficult technology challenges are being achieved, and the realignment of Applied Research Electro-Magnetic Railgun (EMRG) high-power, kinetic energy weapon prototype development effort to a newly created Project Unit 2481 in PE 0602792N. Specific information on each project will be provided separately to the Congressional oversight committees.					
Title: Electromagnetic Maneuver Warfare	23.607	11.072	7.056	0.000	7.056
Description: This R-2 Activity contains all Applied Research Innovative Naval Prototype (INP) investments that are developing new technologies for Electromagnetic Maneuver Warfare (EMW). The electromagnetic spectrum is a key operational maneuver space enabled by continuous, real-time awareness of all spectrum activity. This R-2 Activity supports spectrum dominance, which included efforts that focus on communications, surveillance, EMW and electronics to understand and shape the battle space. The ability to assure access to the full spectrum is essential for battle space awareness and threat surveillance/weapon sensor engagement. Technologies within this activity will provide for integrated and distributed forces capable of dynamic synchronized actions through interoperable forces by incorporation of autonomous/ disaggregated systems to increase flexibility and reach within the electromagnetic spectrum. ***FY 2019 Plans:*** Continue Applied Research efforts to develop technology which will enable a strike group to work cooperatively in the Electromagnetic Spectrum (EMS) to optimize EW, Information Operations (IO), communications, and radar performance. Conduct the Applied Research supporting an at-sea Flexible Distributed Array Radar demonstration. ***FY 2020 Base Plans:*** Develop efforts to enable a strike group to work cooperatively in the electromagnetic spectrum by optimizing electronic warfare, information operations, communications and radar performance. Conduct the Applied					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Research associated with the final design for a Low-band Radio Frequency Intelligent Distribution Resource (LowRIDR) for the EMC2 prototype. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The decrease from FY 2019 to FY 2020 is due to a planned ramp down in applied research as work in this technology area is approaching completion. Specific information on each project will be provided separately to the Congressional oversight committees.					
Title: INP Management ***Description:*** This R-2 Activity was discontinued in FY 2019. ***FY 2019 Plans:*** N/A ***FY 2020 Base Plans:*** N/A ***FY 2020 OCO Plans:*** N/A	1.470	0.000	0.000	0.000	0.000
Title: Undersea Warfare ***Description:*** This R-2 Activity contains all Applied Research Innovative Naval Prototype (INP) investments that are developing new technologies for Undersea Warfare. This R-2 Activity explores development of technologies to achieve and maintain undersea dominance in the areas of Anti-Submarine Warfare (ASW) and mine warfare, and to improve environmental sensing capabilities which support the Undersea Warfare domain. Technologies within this activity will dramatically improve sensing and sense-making, provide integrated and distributed autonomy to forces, and provide scalable lethality through development of kinetic and non-kinetic effects payloads. ***FY 2019 Plans:*** Affordable Mobile ASW Surveillance System (AMASS)	14.439	13.602	14.046	0.000	14.046

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Continue AMASS, a three year project that will verify our understanding of the physical phenomenon postulated to give superior performance. Complete Design source and receiver configurations suitable for future spiral development as an autonomous deployable system. The first of three units will be fabricated and assembled, and fabrication and assembly of the second and third unit will begin. Develop software for real time control of the source and post-test control of the receiver. Develop software to analyze data that will be collected. Initiate Applied Research efforts to develop the technology required to operate an unmanned environmental observing system in strategically important locations in support of persistent monitoring of environmental conditions. ***FY 2020 Base Plans:*** Conduct applied research associated with the development of an Arctic Mobile Observing System (AMOS), a prototype mobile sensing system incorporating Arctic-capable unmanned underwater vehicles that can be deployed anywhere in the Arctic using a central, ice-based buoy node to provide the critical infrastructure (power, communication, navigation, and environmental intelligence). AMOS will provide the Navy with a persistent Arctic presence and environmental Arctic domain awareness at a lower cost and less risk than manned platforms. The combination of Unmanned Underwater Vehicle (UUV) assets included in an AMOS node will determine the range, sensing capability and persistence of each node, and can be chosen based on need and Arctic location. Work under this effort will involve understanding the trade-offs and capabilities for the prototype system. Affordable Mobile ASW Surveillance System (AMASS) Complete Applied Research efforts to verify performance of components to enable next generation Anti-Submarine Warfare (ASW) capability. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** No significant change from FY 2019 to FY 2020					
Title: Unmanned and Autonomous Systems	47.468	60.088	48.925	0.000	48.925

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Description: This R-2 Activity contains all Applied Research Innovative Naval Prototype (INP) investments that are developing new technologies for Unmanned and Autonomous Systems. Increased proliferation of inexpensive lethal threats targeting individual warfighters and high-value assets, combined with continued rapid advances in computing, power and energy, robotics, sensors and position guidance technologies, drives the requirement to augment expensive manned systems with less expensive, unmanned, fully autonomous systems that can operate in all domains. Technologies within this activity will provide integrated and distributed, autonomous and disaggregated systems to increase flexibility and reach. ***FY 2019 Plans:*** Continue applied research of autonomous payloads for large and extra-large unmanned undersea vehicles. Continue applied research of autonomy algorithms, the command and control architecture needed for swarm control (a flying ad-hoc network), effects payloads and sensing modalities. Continue applied research of autonomous control for medium displacement unmanned surface systems, focusing on research into common behaviors across multiple missions, advancements in route planning, and additional perception modalities. Complete applied research to include an at-sea demonstration of a fuel cell system on an available Unmanned Undersea Vehicle (UUV) of suitable size. Conduct applied research into small multi-Unmanned Surface Vehicle (USV) autonomous control, including research into common multi-USV behaviors across multiple missions, multi-USV task recognition/allocation/ execution and advanced perception. ***FY 2020 Base Plans:*** Conduct development of autonomous payloads for extra-large unmanned undersea vehicles. Conduct development of technologies that continue to support development of a scalable system of inexpensive Unmanned Aerial Vehicles (UAVs) in order to provide a disruptive capability in contested urban environments against anti-access area denial defenses.					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Conduct development of technologies that will enable a self-deploying, highly autonomous, multi-mission/multi-payload Unmanned Surface Vehicle (USV) capable of operating with carrier strike groups and surface action groups at a very low operating cost. Conduct development of an autonomous control system for multiple Unmanned Surface Vehicle (USVs) consisting of cooperative task allocation, cooperative route planning/behaviors, and shared situational awareness. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The FY 2019 to FY 2020 decrease is due to the completion of applied research associated with a fuel cell system for unmanned undersea vehicles. Funding realigned specific information on each project will be provided separately to the Congressional oversight committees.					
Title: Artificial Intelligence ***Description:*** This R-2 Activity contains coordinated AI investments for Applied Research Innovative Naval Prototype (INP) efforts that develop new technologies applying Artificial Intelligence. This Applied Research, being conducted in coordination with complimentary Advanced Technology Development investment in Program Element (PE) 0603801N INP, will create Artificial Intelligence applications for predictive mission-focused analytics that autonomously gather, analyze, compile, interpret, and visualize a fused tactical & national all source data picture to improve decision making speeds and enable a distributed Artificial Intelligence capability that can function in a harsh and adversarial environment and is able to determine an optimal response and accelerate reactions to real time. ***FY 2019 Plans:*** N/A ***FY 2020 Base Plans:*** Align Applied Research associated with the development of a prototype multi-domain integrated fires control capability enabled by Artificial Intelligence (AI) allowing for real-time, force-wide electromagnetic maneuver and soft-kill and hard-kill battle management. Thrust areas being explored include distributed combat data systems, AI battle management tools, and embedded machine learning.	0.000	0.000	14.869	0.000	14.869

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 0000 / *(U)Innovative Naval Prototypes(INP) Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Align Applied Research supporting the goal of demonstrating machine speed battle management tools to support continuous analysis and planning at the operational and tactical levels and dynamically synchronizing forces across intelligence, surveillance and reconnaissance, Command and Control and combat systems. Thrust areas being explored include distributed combat data systems, adaptive data analytics and a course of action and intentions assessment AI application. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The increase from FY 2019 to FY 2020 is due to the acceleration of aligned Artificial Intelligence R-2 Activity being initiated. This project is being initiated in response to the National Defense Strategy guidance for modernization of advanced autonomous systems. It will enable a broad array of autonomous functions, such as machine-speed decision making in Electromagnetic Warfare (EW) and Spectrum Management operations, through improvements in artificial intelligence. Specific information on each project will be provided separately to the Congressional oversight committees.					
Accomplishments/Planned Programs Subtotals	160.884	154.085	114.427	0.000	114.427

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

In all cases, the technologies being developed within this Program Element (Applied Research associated with the Innovative Naval Prototypes (INP) Program) support the Department of the Navy INP Program and are managed at the Office of Naval Research. The primary technological metrics used in this PE involve experiments and tests that demonstrate proof of concept for the technological capability being developed. Technology development is informed by periodic interaction with Naval warfighters, resource sponsors and the acquisition community. At the lowest level, each project is evaluated against technical and financial milestones on a frequent basis. Annually, each project is reviewed in depth for technical performance and development status by the Chief of Naval Research. Department of the Navy leadership is briefed on the portfolio's status by the Chief of Naval Research.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy											Date: March 2019	
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*				Project (Number/Name) 2481 / *EMRG*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
2481: *EMRG*	0.000	0.000	0.000	7.632	-	7.632	0.000	0.000	0.000	0.000	0.000	7.632

Note

Beginning in FY 2020, the Applied Research Electro-Magnetic Railgun (EMRG) high-power, kinetic energy weapon prototype development effort was realigned from Project Unit 0000 to Project Unit 2481 within PE 0602792N.

A. Mission Description and Budget Item Justification

Electro-Magnetic Railgun (EMRG) is a high-power, kinetic energy weapon capable of launching precision guided projectiles using electricity instead of chemical propellants. When released into the railgun, an electric pulse launches the projectile at speeds up to Mach 6. EMRG will bring new capabilities, increased capacity and improved operational economy to fleet operations at sea. With its increased velocity and extended range, the EM Railgun provides multi-mission potential for hypersonic missile defense, anti-air & surface warfare, and naval surface fire support.

EMRG is a multi-year effort in various stages of research and development within with the Navy's Innovative Naval Prototypes (INP) family of RDT&E programs. INP investments are typically 4-8 years in duration. They provide a continuance of basic research by maturing technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. It is intended that prototypes developed within this program, requiring both Budget Activity 2 (BA2) and Budget Activity 3 (BA3) funding, are demonstrated in a relevant environment to prove the feasibility of the new technological capability. Successful experiments and demonstrations are intended to present the Department of the Navy with a programmatic challenge as these new capabilities can lead to the obsolescence of existing capabilities, requiring significant decisions as to the path forward for integrating the new technological capabilities into the warfighting systems of the future. The Activity identified in Project Unit 2481 specifically addresses Applied Research in support of the Electro-Magnetic Railgun (EMRG) high-power, kinetic energy weapon prototype development INP effort.

Due to the nature of these projects, technology development plans have been written with limited details due to information security concerns. Specific information on each project will be provided separately to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
Title: NewElectro-Magnetic Railgun (EMRG)	0.000	0.000	7.632	0.000	7.632
Description: EMRG is a high-power, kinetic energy weapon capable of launching precision guided projectiles using electricity instead of chemical propellants. When released into the railgun, an electric pulse launches the projectile at speeds up to Mach 6. EMRG will bring new capabilities, increased capacity and improved operational economy to fleet operations at sea. With its increased velocity and extended range, the EM Railgun provides multi-mission potential for hypersonic missile defense, anti-air & surface warfare, and naval surface fire support.					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 2481 / *EMRG*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2019 Plans: N/A ***FY 2020 Base Plans:*** Conduct applied research addressing the unique technical challenges inherent in the construction, assembly and operation of an Electro-Magnetic (EM) Railgun prototype capable of launching long range projectiles at a tactically relevant muzzle energy and repetition rate. Special materials and compact sub-system components will be developed that are capable of operating in harsh thermal and electromagnetic environments. Advanced modeling tools will be utilized to assess design options, analyze system concepts, and inform experimental hardware design and testing. Develop and test next generation pulsed power components to assess performance and applicability towards future shipboard designs. Develop and refine algorithms for controlling the precision timed electromagnetic pulse used to fire the railgun in the rep-rate mode. Conduct material, physics and thermal property research for long life, rep-rate electromagnetic launch systems and actively monitor performance to understand the high currents, elevated operating temperatures, and cooling of components, so as to improve designs and increase their reliability. Utilize modeling and simulation tools that support simulated operational scenarios to quantify the value of HVP fired from a Railgun. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The increase in FY 2020 is due to the realignment of the Applied Research Electro-Magnetic Railgun (EMRG) high-power, kinetic energy weapon prototype development effort from Project Unit 0000 to Project Unit 2481 within PE 0602792N.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	7.632	0.000	7.632

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 2481 / *EMRG*

E. Performance Metrics

In all cases, the technologies being developed within this Program Element (Applied Research associated with the Innovative Naval Prototypes (INP) Program) support the Department of the Navy INP Program and are managed at the Office of Naval Research. The primary technological metrics used in this PE involve experiments and tests that demonstrate proof of concept for the technological capability being developed. Technology development is informed by periodic interaction with Naval warfighters, resource sponsors and the acquisition community. At the lowest level, each project is evaluated against technical and financial milestones on a frequent basis. Annually, each project is reviewed in depth for technical performance and development status by the Chief of Naval Research. Department of the Navy leadership is briefed on the portfolio's status by the Chief of Naval Research.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	Project (Number/Name) 2958 / *Cyberspace Activities*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
2958: *Cyberspace Activities*	0.000	0.000	0.000	31.003	-	31.003	28.511	26.061	0.000	0.000	0.000	85.575

Note

The FY 2017 Appropriation Act encouraged the services to realign Cyberspace Activity (CA) resources into individual cost codes, projects or program elements (PEs) in order to provide additional clarity and enhanced oversight of cyberspace resources. Within this PE, cyber funding was moved from Proj 0000 Innovative Naval Protoypes (INP) Applied Research to Proj 2958 Cyberspace Activities, which was established to isolate and identify cyberspace activities.

A. Mission Description and Budget Item Justification

This Project contains all Applied Research Innovative Naval Prototype (INP) investments that are developing new technologies for cyber warfare. Potential adversaries are investing in advanced technologies that will challenge our advantages in the critical information domain. Nation states and non-state actors seek to degrade our command and control capabilities, networks and computer systems. Cyber threats continue to grow and rapidly proliferate. Technologies developed in this R-2 Activity will enable the warfighter to take immediate, appropriate action at any time, against any desired adversary, target or network by assuring that autonomous, continuous analyses of intelligence, persistent surveillance and open information sources have, at all times, optimized the possible courses of action based on commander's guidance. Technologies within this activity will foster operational endurance and enable sustained operations and resiliency for warfighters and platforms through enhanced cyber security/protection.

This Project was formerly the Cyber R-2 Activity under Project 0000 (U)Innovative Naval Prototypes(INP) Applied Research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Cyber	0.000	0.000	31.003	0.000	31.003
FY 2019 Plans: N/A					
FY 2020 Base Plans: Conduct Applied Research addressing the unique technical challenges required to achieve a systematic reduction of any computing system's attack surface across all its layers of computing. Continue development of tools and techniques enabling powerful tailoring of an end-system computing environment to match the needs of deployed applications and users, removing software bloat and unused features, resulting in significantly reduced attack surface for both known and unknown vulnerabilities. Specific information on each project will be provided separately to the Congressional oversight committees.					
FY 2020 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602792N / *(U)Innovative Naval Prototypes(INP) Applied Res*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The FY 2019 to FY 2020 increase reflects the realignment of funding within this PE from Project 0000 Innovative Naval Prototypes (INP) Applied Research to Project 2958 Cyberspace Activities. The 6% increase from the FY 2019 Cyber R-2 Activity ($23.535M) in Project 0000 to $31.003M here in FY 2020 is due to Applied Research associated with the planned third phase of the TPCP project, which covers efforts to develop tools and techniques for automatically customizing a range of standard communications protocols used in closed shipboard environments, tailoring end-system network stacks to match the needs of deployed applications. Addressing this computing layer is essential for achieving total protection of Navy cyber infrastructure and drastically reducing attack surface.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	31.003	0.000	31.003

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

In all cases, the technologies being developed within this Program Element (Applied Research associated with the Innovative Naval Prototypes (INP) Program) support the Department of the Navy INP Program and are managed at the Office of Naval Research. The primary technological metrics used in this PE involve experiments and tests that demonstrate proof of concept for the technological capability being developed. Technology development is informed by periodic interaction with Naval warfighters, resource sponsors and the acquisition community. At the lowest level, each project is evaluated against technical and financial milestones on a frequent basis. Annually, each project is reviewed in depth for technical performance and development status by the Chief of Naval Research. Department of the Navy leadership is briefed on the portfolio's status by the Chief of Naval Research.