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 3: *Advanced Technology Development (ATD)*						**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*						

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	246.609	202.394	133.303	-	133.303	141.948	134.163	126.888	126.696	Continuing	Continuing
2480: *SSL-TM*	0.000	0.000	0.000	8.000	-	8.000	0.000	0.000	0.000	0.000	0.000	8.000
2481: *EMRG*	0.000	0.000	0.000	7.368	-	7.368	9.500	0.000	0.000	0.000	0.000	16.868
2958: *Cyberspace Activities*	0.000	0.000	0.000	14.498	-	14.498	16.489	15.939	0.000	0.000	0.000	46.926
3400: *Innovative Naval Prototypes (INP) Adv Tech Dev*	0.000	203.926	161.394	103.437	-	103.437	115.959	118.224	126.888	126.696	Continuing	Continuing
9999: *Congressional Adds*	0.000	42.683	41.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	83.683

Note

In FY 2020, three new stand alone project units were created for three INP major focus areas to better consolidate and coordinate the acceleration of these efforts. The three project units are: 2480 Solid State Laser Technology Maturation (SSL TM), 2481 the Electro-Magnetic Railgun, and 2958 Cyberspace Activities.

In FY 2020 a stand alone Artificial Intelligence (AI) R-2 Activity was established in Project Unit 3400 to consolidate and coordinate the acceleration of AI investments.

A. Mission Description and Budget Item Justification

The efforts described in this Program Element (PE) address the Advanced Technology Development 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 modified or established to support further development. These technology investments are selected by a process that involves senior leadership in the Department of the Navy.

Developing INPs requires the development of subsystems and components, and efforts to integrate these subsystems and components into system prototypes for field experiments and tests in an appropriate environment. The efforts funded within this Program Element (PE) include concept and technology demonstrations of components and subsystems, which may be form, fit and function prototypes or scaled models that serve the same demonstration purpose. The goal of these development efforts is to prove the technological feasibility and assessment of subsystem and component operability and producibility rather than the development of hardware for service use. By demonstrating the general military utility and direct relevance to identified military needs, the technology becomes available for transition and further development within an emerging or new Program of Record. INP investments do not necessarily lead to subsequent development or procurement phases, but they do have the goal of moving out of Science and Technology (S&T) and into the acquisition process within the Future Years Defense Program (FYDP).

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 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE. Because to the nature of these projects described, 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. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	108.285	161.859	86.898	-	86.898
Current President's Budget	246.609	202.394	133.303	-	133.303
Total Adjustments	138.324	40.535	46.405	-	46.405
• Congressional General Reductions	-	-0.465			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	41.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	99.195	0.000			
• SBIR/STTR Transfer	-4.917	0.000			
• Program Adjustments	0.000	0.000	45.941	-	45.941
• Rate/Misc Adjustments	0.000	0.000	0.464	-	0.464
• Congressional General Reductions Adjustments	-0.154	-	-	-	-
• Congressional Add Adjustments	44.200	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 9999: *Congressional Adds*		
Congressional Add: *Program Increase*	23.176	0.000
Congressional Add: *Solid State Laser Technology Maturation*	7.919	0.000
Congressional Add: *Ruggedized High Energy Laser*	11.588	0.000
Congressional Add: *Electromagnetic Railgun*	0.000	10.000
Congressional Add: *Railgun with Hypervelocity Projectile*	0.000	31.000
Congressional Add Subtotals for Project: 9999	42.683	41.000
Congressional Add Totals for all Projects	42.683	41.000

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 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	

Change Summary Explanation

Program changes for the FY 2020 President's Budget (PB) as compared to the FY 2019 PB 2020 baseline includes funds programmed for the HELCAP High Energy Laser Counter Anti-Ship Cruise Missile (ASCM) program. Additionally, in compliance with the Defense Planning Guidance (DPG) to increase Science and Technology funding to minimum levels, funding is programmed for ELEKTRA Non-Kinetic and EMW Capability; MINERVA - Air Enhanced Warfighter Decision Superiority Capability; Super Swarm; Advanced Long Range Targeting (ALRT); and additional funding for the High-power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) programs.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										**Date:** March 2019	

Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 2480 *I SSL-TM*

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
2480: *SSL-TM*	0.000	0.000	0.000	8.000	-	8.000	0.000	0.000	0.000	0.000	0.000	8.000

Note

Solid State Laser Technology Maturation (SSL TM) plans and associated resources are realigned from Project 3400 in PE 0603801N into this new Project 2480 within PE 0603801N effective FY 2020.

A. Mission Description and Budget Item Justification

Solid State Laser Technology Maturation (SSL TM) 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. SSL-TM will develop a maritime laser weapons system prototype and test it on a representative test platform for a naval surface combatant, and conduct the required laser weapon system engineering, design, integration and testing necessary to have a testable, experimental prototype. This system will be capable of supporting missions such as defense against small boat and Unmanned Aerial Vehicle (UAV) swarms and Intelligence, Surveillance and Reconnaissance (ISR) disruption and defeat. At-sea testing will be conducted on the full laser weapon system demonstrator (i.e., prototype) from a representative test platform for a naval surface combatant.

Innovative Naval Prototypes (INP) and LA-Tech investments are typically 4-8 years in duration. They provide a continuance of basic research by maturing Innovative Naval Prototype technologies from a Technology Readiness Level
(TRL) of 2 or 3 to a TRL of 6. It is intended that prototypes developed within the INP portfolio, requiring both Budget Activity (BA) 2 and BA3 funding, are demonstrated in a relevant environment to prove the feasibility of the new
technological capability. Successful experimentations 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 and significant decisions as to the path forward for integrating the new technological capabilities into the warfighting systems of the future. Project 2480 SSL-TM contains the resources and associated program justification for the Directed Energy/Electric Weapons capability oriented Solid State Laser Technology Maturation (SSL TM) INP program.

Because to the nature of these efforts and research activities, technology development plans have been written with limited details due to information security concerns. Specific information on each project and activity 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: Solid State Laser Technology Maturation (SSL TM)	0.000	0.000	8.000	0.000	8.000
Description: SSL-TM is a multi-year effort to develop a maritime laser weapons system prototype and test it on a representative test platform for a naval surface combatant, and conduct the required laser weapon system engineering, design, integration and testing necessary to have a testable, experimental prototype. This system will be capable of supporting missions such as defense against small boat and Unmanned Aerial Vehicle (UAV)					

Exhibit R-2A, **RDT&E Project Justification:** PB 2020 Navy		**Date:** March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev	**Project (Number/Name)** 2480 / SSL-TM

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
swarms and Intelligence, Surveillance and Reconnaissance (ISR) disruption and defeat. At-sea testing will be conducted on the full laser weapon system demonstrator (i.e., prototype) from a representative test platform for a naval surface combatant. **_FY 2019 Plans:_** N/A **_FY 2020 Base Plans:_** At-sea testing and experimentation will be conducted with full laser weapon system demonstrator (i.e. prototype) on an active duty navy surface combat ship. During this period the technical performance will be evaluated in various atmospheric and sea state conductions while conducting operational missions and exercises. Lessons learned from operations and maintenance will be documented to inform development of future laser weapons systems development efforts. **_FY 2020 OCO Plans:_** N/A **_FY 2019 to FY 2020 Increase/Decrease Statement:_** The FY19-FY20 Solid State Laser Technology Maturation (SSL TM) plans and associated resources are realigned from Project 3400 in PE 0603801N into this new Project 2480 within PE 0603801N effective FY 2020. Increase funding was provided in FY20 to further testing and experimentation in order to complete the S&T development and transition as planned.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	8.000	0.000	8.000

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 PE support the Department of the Navy (DON) INP Program and are managed at the Office of Naval Research (ONR). The primary technological metrics used in this PE involve experiments and tests that demonstrate proof of concept for the technological capability being

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		**Date:** March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 2480 *I SSL-TM*

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 (CNR). DON leadership is briefed on the portfolio's status by the CNR.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										**Date:** March 2019	

Appropriation/Budget Activity 1319 / 3				R-1 Program Element (Number/Name) PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev				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	7.368	-	7.368	9.500	0.000	0.000	0.000	0.000	16.868

Note

Electro-Magnetic Railgun (EMRG) plans and associated resources are realigned from Project Unit 3400 in PE 0603801N into this new Project Unit 2481 effective FY 2020.

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. This multi-year effort will build a Railgun Weapon System (RGWS) by designing, fabricating and integrating Electromagnetic Railgun (EMRG) subsystems and components into a weapon system that brings 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 Advanced Technology Development 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: Electro-Magnetic Railgun (EMRG) **Description:** The Electro-Magnetic Railgun (EMRG) is a high-power, kinetic energy weapon capable of launching precision guided projectiles using electricity instead of chemical propellants. This multi-year effort will build a Railgun Weapon System (RGWS) by designing, fabricating and integrating Electromagnetic Railgun (EMRG) subsystems and components into a weapon system that brings new capabilities, increased capacity and improved operational economy to fleet operations at sea. With its increased velocity and extended range,	0.000	0.000	7.368	0.000	7.368

Exhibit R-2A, **RDT&E Project Justification:** PB 2020 Navy		**Date:** March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev	**Project (Number/Name)** 2481 / EMRG

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
the EM Railgun provides multi-mission potential for hypersonic missile defense, anti-air & surface warfare, and naval surface fire support. ***FY 2019 Plans:*** N/A ***FY 2020 Base Plans:*** Design, fabricate and integrate Electro Magnetic (EM) railgun subsystems and components into a system prototype including fully trainable, elevatable mount capable of rep-rate operations. Continue developing and testing prototype rep-rate railgun launcher that is suitable for installation in a prototype railgun gun mount. Conduct system level assessments of a Railgun Weapon System that is capable of closing the fire control loop. Demonstrate integration and use of Hyper Velocity Projectile (HVP) in a fixed elevation Railgun located at White Sands Missile Range. Conduct preliminary prototype system tests and demonstrations to prove the technological feasibility of the EMRG capability and assess sub-system and component operability under stressing rep-rate conditions. Develop next generation pulsed power (NGPP) system performance specifications for shipboard applications. Perform full-scale testing of long-life railgun launcher material solutions inserted in laboratory launchers. Design, build, test, and evaluate iterative electromagnetic railgun composite launcher prototypes to demonstrate the technological feasibility, performance, multi-shot life, and suitable firing rate of the system. ***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 Electro-Magnetic Railgun (EMRG) effort from Project Unit 3400 in PE 0603801N into this new Project Unit 2481.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	7.368	0.000	7.368

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 **/** 3	**R-1 Program Element (Number/Name)** PE 0603801N **/** *(U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 2481 **/** *EMRG*

E. Performance Metrics

In all cases, the technologies being developed within this PE support the Department of the Navy (DON) INP Program and are managed at the Office of Naval Research (ONR). 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 (CNR). DON leadership is briefed on the portfolio's status by the CNR.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019	
Appropriation/Budget Activity 1319 / 3				**R-1 Program Element (Number/Name)** PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev					**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	14.498	-	14.498	16.489	15.939	0.000	0.000	0.000	46.926

Note

Project 2958 was established separately in this PE beginning in FY 2020 to better isolate and identify Innovative Naval Prototype (INP) efforts addressing Cyberspace INP advanced technology development.

A. Mission Description and Budget Item Justification

This Project contains all Advanced Technology Development 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 R2 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.

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	14.498	0.000	14.498

Description: This R2 Activity contains all Advanced Technology Development 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 R2 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.

FY 2019 Plans:
N/A

FY 2020 Base Plans:

Exhibit R-2A, **RDT&E Project Justification:** PB 2020 Navy		**Date:** March 2019
Appropriation/Budget Activity 1319 **/** 3	**R-1 Program Element (Number/Name)** PE 0603801N **/** (U) Innovative Naval Prototypes (INP) Adv Tech Dev	**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**
Conduct Advanced Technology Development of tools and techniques to achieve an automated, systematic reduction of any computing system's attack surface across all its layers of computing. Continue development and demonstration 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 cyber attack surface for both known and unknown vulnerabilities.					
FY 2020 OCO Plans: N/A					
FY 2019 to FY 2020 Increase/Decrease Statement: The effort was moved from the Cyber R-2 Activity in Project 3400 Innovative Naval Prototypes(INP) Advanced Technology Development and placed into this separate Project 2958 for FY20. The $1.8 million increase from the FY19 Cyber R-2 Activity ($12.656 million) in Project 3400 to $14.498 million here in FY20 is due to Advanced Technology Development 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	14.498	0.000	14.498

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 PE support the Department of the Navy (DON) INP Program and are managed at the Office of Naval Research (ONR). 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,

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		**Date:** March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval* *Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 2958 *I Cyberspace Activities*

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 (CNR). DON leadership is briefed on the portfolio's status by the CNR.

Exhibit R-2A, **RDT&E Project Justification:** PB 2020 Navy	**Date:** March 2019

Appropriation/Budget Activity 1319 *I* 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 3400 *I Innovative Naval Prototypes (INP) Adv Tech Dev*

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
3400: *Innovative Naval Prototypes (INP) Adv Tech Dev*	0.000	203.926	161.394	103.437	-	103.437	115.959	118.224	126.888	126.696	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 3400 to Project Unit 2481 within PE 0603801N.

A. Mission Description and Budget Item Justification

Innovative Naval Prototypes (INP) and LA-Tech 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 (BA) 2 and 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 and LA-Tech investments as existing ones are completed. Successful experimentations 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 and significant decisions as to the path forward for integrating the new technological capabilities into the warfighting systems of the future. INPs and LA-Tech investments have been collectively grouped into R2 Activities that include Unmanned and Autonomous Systems, Directed Energy/Electric Weapons, Electromagnetic Maneuver Warfare, Cyber and Undersea Warfare.

Because to the nature of these efforts and research activities, 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	5.066	12.656	0.000	0.000	0.000
Description: This R2 Activity contains all Advanced Technology Development 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 R2 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					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019	

Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev	Project (Number/Name) 3400 / Innovative Naval Prototypes (INP) Adv Tech Dev

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
guidance. Technologies within this activity will foster operational endurance and enable sustained operations and resiliency for warfighters and platforms through enhanced cyber security/protection. *FY 2019 Plans:* Continue developing the Technology to support enhanced Fleet/Force cyber protection and mitigation. Continue the Advanced Technology Development effort to develop 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:* The FY19 to FY20 decrease is due to the movement of this effort into Project 2958 Cyberspace Activities in this PE.					
Title: Directed Energy / Electric Weapons *Description:* This R-2 Activity contains all Advanced Technology Development Innovative Naval Prototype (INP) investments that are developing new technologies for directed energy and electric weapons. 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 Advanced Technology Development and studies focused on marinizing an operational laser weapon system, expanded efforts supporting and conducting sea-based developmental testing, and research supporting future systems integration of surface ship laser weapons.	133.558	98.463	37.225	0.000	37.225

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy				Date: March 2019	
Appropriation/Budget Activity 1319 I 3		**R-1 Program Element (Number/Name)** PE 0603801N I (U) Innovative Naval Prototypes (INP) Adv Tech Dev		**Project (Number/Name)** 3400 I Innovative Naval Prototypes (INP) Adv Tech Dev	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Initiate Advanced Technology Development efforts to evaluate the potential performance of an alternative laser source for future Surface Navy Laser Weapons System increments. Continue conducting Advanced Technology Development addressing the unique technical challenges inherent in the construction, assembly and operation of a high-power, kinetic energy weapon prototype capable of launching long range projectiles repeatedly. Continue Advanced Technology Development efforts to develop a radio frequency effects payload (a joint USAF/ USN project) with scalable electromagnetic effects. ***FY 2020 Base Plans:*** Develop technology for High Energy Laser Counter Anti-Ship Cruise Missile (ASCM) Project (HELCAP) by conducting development, experimentation, and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM). This Applied Technology Development effort will include the following activities: assess development requirements including ASCM lethality and engagement parametric analysis, atmospheric propagation characterization, and beam control; design and fabricate a beam control testbed; and perform laser/materiel component interaction testing. HELCAP activities being conducted with 6.3 funds in this PE are focused on the assessment, development, and experimentation associated with lethality, advanced beam control, and laser sources. Related HELCAP project plans in PE 0603925N Directed Energy and Electric Weapon System Project 2731 include technology integration to support automated laser weapon control in integrated detect to defeat demonstrations. Continue Advanced Technology Development efforts associated with a Radio Frequency (RF) effects payload (a joint USAF/USN project) that has scalable electromagnetic effects. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The FY19 to FY20 decrease is due to the completion in FY19 of BA3 development associated with the Ruggedized High Energy Laser (RHEL) Phase I project and the realignment of the Electro-Magnetic Railgun (EMRG) high-power, kinetic energy weapon prototype effort and the Solid State Laser Technology Maturation (SSL-TM) effort from this Project to Projects 2480 (SSL-TM) and 2481 (EMRG) in this same PE. While funds					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 I 3	**R-1 Program Element (Number/Name)** PE 0603801N I (U) Innovative Naval Prototypes (INP) Adv Tech Dev	**Project (Number/Name)** 3400 I Innovative Naval Prototypes (INP) Adv Tech Dev

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
decreased for the overall R-2 Activity, resources were provided to continue development of technology for High Energy Laser Counter Anti-Ship Cruise Missile (ASCM) Project (HELCAP), previously known as RHEL PH II, and increase funding for HIJENKS.					
Title: Electromagnetic Maneuver Warfare	16.286	16.046	18.666	0.000	18.666

Description: This R-2 Activity contains all 6.3 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, Electronic Warfare (EW) 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 Advanced Technology Development to develop technology which will enable a strike group to work cooperatively in the Electromagnetic Spectrum (EMS) to optimize Electronic Warfare (EW), Information Operations (IO), communications, and radar performance.

FY 2020 Base Plans:
Conduct Advanced Technology Development efforts, demonstrating continuous spectrum monitoring for real-time prioritization and use of the electro-magnetic spectrum for shipboard systems and information operations, electronic warfare, surface warfare, undersea warfare, and air warfare missions across the entire battlegroup in a contested environment. Conduct a final at-sea Flexible Distributed Array (FlexDAR) demonstration.

Conducts develop efforts of Advanced Long Range Targeting which directly accelerates and reduces risks to multiple programs.

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 *I* 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 3400 *I Innovative Naval Prototypes (INP) Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
The increase from FY19 to FY20 is due to increased investment to develop efforts of Advanced Long Range Targeting which directly accelerates and reduces risks to multiple programs.					
Title: Undersea Warfare	12.736	1.486	4.871	0.000	4.871

Description: This R-2 Activity contains all Advanced Technology Development Innovative Naval Prototype (INP) investments that are developing new technologies for Undersea Maneuver Warfare. This R-2 Activity explores development of technologies to achieve and maintain undersea dominance in the areas of 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:
Complete Advanced Technology Development efforts to develop next generation ASW capability.

FY 2020 Base Plans:
Initiate Advanced Technology Development advanced technology development efforts associated with a mobile sensing system that can be deployed anywhere in the Arctic via a sea ice-based buoy that enables the critical infrastructure necessary to support persistent sensing at a lower cost that via manned platforms. This Arctic Mobile Observing System (AMOS) will operate via a sea ice-based buoy that enables the critical infrastructure necessary to support persistent sensing at a lower cost and with less risk than deploying manned platforms in the Arctic. Activities include buoy node construction and testing, software development, vehicle acquisition, and Arctic-hardening of sensors and platforms. The project includes domain-specific engineering development, upgrading UUV platform designs for the Arctic environment, developing the power and communication buoy node for the Arctic domain, incorporating mature and maturing UUV sensing capabilities into vehicles and ensure suitability for Arctic operations. The project will also develop under-ice CONOPS for the autonomous UUV network, building on capabilities developed under previous efforts for vehicle autonomy, re-charging, sensing, communication, and Command, Control, Communication & Computers (C4I), and develop new capabilities for operating under sea ice. A key thrust will be to enable an under-ice acoustic navigation system for unmanned platforms, suitable for use in any GPS-denied operational area.

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 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / (U) Innovative Naval Prototypes (INP) Adv Tech Dev	**Project (Number/Name)** 3400 / Innovative Naval Prototypes (INP) Adv Tech Dev

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
The FY19 to FY20 increase is due to the initiation of Advanced Technology Development efforts for a mobile sensing system.					
Title: Unmanned and Autonomous Systems	36.280	32.743	26.729	0.000	26.729

Description: This R-2 Activity contains all Advanced Technology Development 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, reach, and heterogeneous swarms.

FY 2019 Plans:
Continue Advanced Technology Development of autonomous payloads for large and extra-large unmanned undersea vehicles.

Continue Advanced Technology Development of autonomy algorithms, the command and control architecture needed for swarm control (a flying ad-hoc network), effects payloads and sensing modalities.

Continue Advanced Technology Development and integration of autonomy systems and various mission area payloads onto unmanned surface vehicles.

FY 2020 Base Plans:
Conduct Advanced Technology Development efforts associated with:

- the development of autonomous payloads for extra-large unmanned undersea vehicles and complete first CLAWS autonomy/payload demo;

- a robust, scalable, flexible, multi-functional swarming unmanned UxS vehicle systems providing cross-domain capability, human-swarm interdependence/interaction that is employable from surface, sub-surface, airborne, and ground manned and unmanned systems;

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 *I* 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 3400 *I Innovative Naval Prototypes (INP) Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
- a long endurance, unmanned surface vehicle with medium displacement that can be autonomously controlled in high sea states with a demonstrated multi-mission/multi-payload capability, including support for the Sea Hunter 2 builder's trial. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The FY19 to FY20 decrease is due primarily to the planned ramp down of Advanced Technology Development efforts associated with autonomy systems and various mission area payloads being developed for unmanned surface vehicles.					
Title: Artificial Intelligence ***Description:*** This R-2 Activity contains aligned Advanced Technology Development Innovative Naval Prototype (INP) investments that are accelerating development and deployment of new technologies using Artificial Intelligence. These advanced technology development efforts, being conducted in collaboration with related Applied Research investments in Program Element (PE) 0602792N INP, will create Artificial Intelligence technology 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 establish a distributed Artificial Intelligence capability that can function in a harsh and adversarial environment and is able to determine an optimal response and react in real-time. ***FY 2019 Plans:*** N/A ***FY 2020 Base Plans:*** In collaboration with the applied research supporting this same INP research, actions are being taken to rapidly mature the advanced technology development efforts required to demonstrate machine speed battle management tools to support continuous analysis and planning at the operational and tactical levels, enabling the dynamic synchronization of forces and actions across intelligence, surveillance and reconnaissance, and combat systems. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:***	0.000	0.000	15.946	0.000	15.946

Exhibit R-2A, **RDT&E Project Justification:** PB 2020 Navy		**Date:** March 2019
Appropriation/Budget Activity 1319 *I* 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 3400 *I Innovative Naval Prototypes (INP) Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
The FY19 to FY20 increase is due to the initiation of this R-2 Activity for FY20. 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 and Spectrum Management operations, through improvements in artificial intelligence.					
Accomplishments/Planned Programs Subtotals	203.926	161.394	103.437	0.000	103.437

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 PE support the Department of the Navy (DON) INP Program and are managed at the Office of Naval Research (ONR). 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 (CNR). DON leadership is briefed on the portfolio's status by the CNR.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy										Date: March 2019	

Appropriation/Budget Activity 1319 / 3				R-1 Program Element (Number/Name) PE 0603801N I (U) Innovative Naval Prototypes (INP) Adv Tech Dev					Project (Number/Name) 9999 I Congressional Adds		

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
9999: Congressional Adds	0.000	42.683	41.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	83.683

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Program Increase	23.176	0.000

FY 2018 Accomplishments: Supports slip ring testing, installation and operation of a Railgun test site at White Sands Missile Range (WSMR), Hyper Velocity Projectile compatibility testing, and requirements work for an articulating Railgun Mount. Specifically, funds planning, installation, and testing, including procurement of slugs, of a single shot Railgun at WSMR.

FY 2019 Plans: N/A

	FY 2018	FY 2019
Congressional Add: Solid State Laser Technology Maturation	7.919	0.000

FY 2018 Accomplishments: Development and integration of Laser Weapon Console, Hybrid Predictive Avoidance and Safety Subsystem, Energy Storage Module, and Thermal Storage Module with Tactical Laser Core Module; systems integration and test; planning and system modifications necessary for ship installation and sea testing.

FY 2019 Plans: N/A

	FY 2018	FY 2019
Congressional Add: Ruggedized High Energy Laser	11.588	0.000

FY 2018 Accomplishments: Conducted long lead procurement for the beam director required to support integrated laser weapons system testing, mission analysis, lethality and defeat of anti-ship cruise missile threats.

FY 2019 Plans: N/A

	FY 2018	FY 2019
Congressional Add: Electromagnetic Railgun	0.000	10.000

FY 2018 Accomplishments: N/A

FY 2019 Plans: These funds will advance development towards a tactical system with investment in the mount and Next Generation Pulsed Power (NGPP) required for shipboard operation. Funding will advance mount

Exhibit R-2A, **RDT&E Project Justification:** PB 2020 Navy		**Date:** March 2019
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N *I (U) Innovative Naval Prototypes (INP) Adv Tech Dev*	**Project (Number/Name)** 9999 *I Congressional Adds*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2018**	**FY 2019**
development to meet specifications for future shipboard application and develop modular concepts for evaluation and shipboard qualification testing.		
Congressional Add: Railgun with Hypervelocity Projectile *FY 2018 Accomplishments:* N/A *FY 2019 Plans:* Funds will be used in the development of the tactical Railgun mount; development and testing Hypervelocity Projectile (HVP) components and all up rounds in a Railgun launch; and to support simulated operational scenarios to quantify the value of HVP fired from a Railgun.	0.000	31.000
Congressional Adds Subtotals	42.683	41.000

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

D. Acquisition Strategy
 N/A

E. Performance Metrics
 Congressional Interest Items not included in other Projects.