Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy											Date: February 2018	
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 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	0.000	171.146	159.697	-	159.697	161.381	161.309	164.499	167.844	Continuing	Continuing
0000: *(U)Innovative Naval Prototypes(INP) Applied Res*	0.000	0.000	171.146	159.697	-	159.697	161.381	161.309	164.499	167.844	Continuing	Continuing

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.

This PE was new for FY 2018 and it consolidated all Navy 6.2 investments funding INPs into a single Navy 6.2 PE. In FY 2017, these investments were spread across 4 separate 6.2 PEs: 0602114N Power Projection Applied Research, 0602123N Force Protection Applied Research, 0602271N Electromagnetic Systems Applied Research, and 0602747N Undersea Warfare Applied Research. Accordingly, the projects in the portfolio are no longer distinguished as INPs or Leap Ahead Technologies. Rather, they are now referred to simply as INPs.

Due to the nature of these projects, starting in FY19, 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 2019 Navy					Date: February 2018
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*		
B. Program Change Summary ($ in Millions)	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**
Previous President's Budget	0.000	171.146	160.349	-	160.349
Current President's Budget	0.000	171.146	159.697	-	159.697
Total Adjustments	0.000	0.000	-0.652	-	-0.652
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Rate/Misc Adjustments	0.000	0.000	-0.652	-	-0.652

Change Summary Explanation

Technical: Not applicable.

Schedule: Not applicable.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
0000: *(U)Innovative Naval Prototypes(INP) Applied Res*	0.000	0.000	171.146	159.697	-	159.697	161.381	161.309	164.499	167.844	Continuing	Continuing

A. Mission Description and Budget Item Justification

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 BA2 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 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 and Undersea Warfare.

Due to the nature of these projects, starting in FY19, 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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Cyber	0.000	24.923	29.147	0.000	29.147
Description: This R-2 Activity contains all BA2 Innovative 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. ***FY 2018 Plans:*** Total Platform Cyber Protection (TPCP) Continue the TPCP project, previously funded predominantly in PE 0602123N Force Protection Applied Research. Develop leap-aheadresilient cybersecurity tools that will enable our warfighting platforms to fight					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
through current and future unauthorized cyber intrusions and assure command and control of any naval platform (submarine, surface, and air platforms) providing an adaptive cyber toolkit and real time cyber sensors. This project develops cyber sensors and automated vulnerability assessment cyber tools that deliver comprehensive defense-in-depth cyber capabilities to monitor, detect, mitigate, and recover from cyber threats in near real-time. This project will develop software based capabilities and a compact and affordable computing appliance applicable to any aircraft, surface vessel, submarine or ground vehicle. The technical development will leverage dynamic and active sensing and cyber vulnerability prevention science and technology approaches, including formal methods, model checking, and static/dynamic analyses which reduce cyber platform attack surfaces, prevent the exploitation of system vulnerabilities, shorten detection timelines, and perform other mitigation functions. Commercial off-the-shelf software components will be leveraged to develop technology for de-bloating and delayering so as to reduce the attack surface and ensure platform resiliency against unauthorized cyber intrusions. ***FY 2019 Base Plans:*** Continue BA2 effort to develop leap-ahead resilient cybersecurity tools that will enable our warfighting platforms to fight through current and future cyber intrusions. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The FY18 to FY19 increase is due to an increase in funding applied to the development of capabilities to provide cyber protection for two of the program's eight identified common layers of cyber platform functionality, in an effort to improve overall naval platform cyber resiliency and warfighting effectiveness.					
Title: Directed Energy / Electric Weapons ***Description:*** This R-2 Activity contains all BA2 Innovative 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	0.000	57.475	45.788	0.000	45.788

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
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 2018 Plans:*** Electro-Magnetic Railgun (EMRG) Continue EMRG, previously funded in PE 0602114N Power Projection Applied Research and PE 0602123N Force Protection Applied Research. The EMRG capability will support Naval Surface Fires, Integrated Air and Missile Defense (IAMD), Fast Attack Craft and Fast Inshore Attack Craft (FAC/FIAC) defense and Anti-Surface Warfare (ASuW) missions. 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 repeatedly, many times per minute. 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 developed to assess design options, analyze system concepts and inform experimental hardware design and testing. Develop and test next generation battery energy storage and pulsed power components to assess performance and applicability towards future 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. Develop modeling and simulation tools that support electromagnetic launch, multi-shot life development, testing, and assessments, and Anti-Surface Warfare (ASuW) missions. The capability will electromagnetically launch a projectile with sufficient kinetic energy to travel significantly farther than traditional Naval gunfire. High-power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) Continue HIJENKS, a joint USAF/USN project previously funded as a FY17 jump-start effort in PE 0602114N Power Projection Applied Research. Develop a High Power Radio Frequency (HPRF) technology payload integrated on an air platform capable of engaging multiple electronic targets with a single, scalable effects weapon across a variety of warfighting missions. This effort will culminate in a live-fire demonstration of a multi-mission/multi-target HPRF payload integrated into a demonstration platform. The operational impacts include decreased cost exchange ratios, non-kinetic counter electronic effects, reduced collateral damage, and the ability to engage multiple targets with a single weapon. This effort 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. During FY18, the following applied research development efforts are planned:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
investigate Radio Frequency (RF) effects on complex electronic systems with the goal being to finalize an RF waveform specification; investigate HPRF weapons effects for non-kinetic counter electronics to include the prediction model improvements required for mission planning of Directed Energy Weapons (DEW); perform Modeling and Simulation (M&S) to capture RF antenna output, RF propagation, RF interaction with complex enclosures, and RF interaction with electronic circuits to characterize DEW performance to the maximum extent possible; conduct research into the time-out of action or recuperation time for complex electronics, exploring Battle Damage Indicators (BDI)for electronic disruption; determine the critical pulsed power and RF components required to reduce the HPRF payload's Size, Weight, and Power (SWaP); perform a trade-off analysis of the technology alternatives, their maturity, and their suitability for this application; develop the most promising component technologies, such as conformal antenna designs for high power, advanced high power RF source technologies, pulsed power components with higher energy densities, and advanced architectures and magnetic materials for high voltage power electronics systems; conduct risk reduction research for the RF source and antenna subsystems by examining high risk, high payoff technology alternatives to improve output power while simultaneously reducing system size and weight, and examine the efficiency of each subsystem and the impact of overall payload prime power requirements. Solid State Laser Technology Maturation (SSL TM) Complete the BA2 portion of SSL TM, which was previously funded in PEs 0602114N Power Projection Applied Research. Complete development of the maritime laser weapons system prototype components and test them in the prototype system on a representative test platform for a naval surface combatant. Complete the required laser weapon system component engineering, design, integration and testing necessary to have a testable, experimental prototype. ***FY 2019 Base Plans:*** Continue conducting BA2 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. Continue BA2 efforts to develop a radio frequency effects payload (a joint USAF/USN project) with scalable electromagnetic effects.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Initiate development of a government laboratory laser testing environment that is representative of a shipboard environment. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The FY18 to FY19 decrease is due primarily to the completion of operational laser weapon system applied research. The majority of the laser work in this effort continues or is being conducted in BA3 PE 0603801N Innovative Naval Prototypes Advanced Technology Development.					
Title: Electromagnetic Maneuver Warfare ***Description:*** This R-2 Activity contains all BA2 Innovative 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, 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 2018 Plans:*** Electromagnetic Maneuver & Control Capability (EMC2) Continue the EMC2 project, previously funded in PE 0602271N Electromagnetic Systems Applied Research, by conducting applied research efforts that will enable a battle group to work cooperatively in the Electromagnetic Spectrum (EMS) to optimize Electronic Warfare (EW), Information Operations (IO), Communications and Radar performance. EMC2 will develop technology that optimizes Radio Frequency (RF) resources in order to meet the commander's intent across multiple warfare areas simultaneously within a single platform and across a strike group. It will complete technology development and design that will be used for a Low-band RF Intelligent Distribution Resource (LowRIDR) prototype. In addition, EMC2 will conduct studies and continue the technology development and design for a wideband, multifunction airborne system that will be integrated with ship-based, wideband multifunction systems.	0.000	24.086	11.072	0.000	11.072

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Nemesis Complete the Nemesis project, previously funded in PE 0602271N Electromagnetic Systems Applied Research, by finishing research efforts to develop and mature technologies in multiple areas that will be used to assess the feasibility of Nemesis to coordinate Electronic Warfare (EW) operations across distributed EW systems. Technologies being matured include swarming vehicle operations, distributed resource mission control, multi-domain coordinated operations and advanced RF component and subsystems technologies. These emerging technologies are being designed and developed for prototype Nemesis systems which will be capable of performing coordinated EW operations across distributed EW systems ***FY 2019 Base Plans:*** Continue BA2 efforts 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 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The FY18 to FY19 decrease is due primarily to the completion of Nemesis, a distributed EW systems project.					
Title: INP Management ***Description:*** This R-2 Activity was discontinued in FY19. ***FY 2018 Plans:*** INP Management Continue INP Management Support/OPS Analysis, previously funded in PE 0602747N Undersea Warfare Applied Research. Conduct applied research and analysis, including technology management of Innovative Naval Prototypes (INP) investments supporting Department of the Navy priorities for emerging technologies of a disruptive and game changing nature. ***FY 2019 Base Plans:*** N/A ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:***	0.000	1.500	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
The FY18 to FY19 decrease was due to movement of the funds into the Directed Energy / Electric Weapons Activity.					
Title: Undersea Warfare	0.000	14.732	13.602	0.000	13.602
Description: This R-2 Activity contains all BA2 Innovative 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 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 2018 Plans:*** Forward Deployed Energy & Communications Outpost (FDECO) Complete the FDECO project, previously funded in PE 0602747N Undersea Warfare Applied Research. Complete the FDECO architecture planning study to analyze distributed, open, adaptable, and scalable architectures suitable to future naval demands. Conduct limited objective experiments of component technologies for docking, energy transfer, communications and control. The docking task will focus on developing and testing technologies and approaches that are vehicle agnostic (type & size), reliable and repeatable. The energy task will focus on developing and testing technologies and approaches that maximize the availability and efficiency to transfer electrical energy to/from various networked energy sources and sinks (FDECO batteries, vehicle batteries, communication systems and sensors). The communications task will focus on developing interface control definitions that support plug-and-play operation, federated network protocols, multiple communication modalities, dynamic latencies, various bandwidths, and adaptive command & control structures. Anti-Submarine Warfare Mission Packages (ASW MP) Complete ASW MP, previously funded in PE 0602747N Undersea Warfare Applied Research. The ASW MP is developing a set of ASW sensors and autonomy algorithms. Affordable Mobile ASW Surveillance System (AMASS) Initiate AMASS, a two year project that will verify our understanding of the physical phenomenon postulated to give superior performance. Design source and receiver configurations suitable for future spiral development as					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
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. ***FY 2019 Base Plans:*** Complete BA2 efforts to verify performance of components to enable next generation ASW capability. Initiate BA2 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 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The FY18 to FY19 decrease is due primarily to the completion of an undersea warfare project for sustained USV operations, offset by the initiation of an undersea warfare environmental observing system.					
Title: Unmanned and Autonomous Systems	0.000	48.430	60.088	0.000	60.088
Description: This R-2 Activity contains all BA2 Innovative 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 2018 Plans:*** Autonomous Aerial Cargo/Utility System (AACUS) Complete the AACUS project, which was previously funded in 0602123N Force Protection Applied Research. The AACUS project will complete research efforts to develop and mature technologies that perform autonomous take-off, conduct en-route navigation, classify the terrain of landing zones, detect and avoid ground-based obstacles, and safely operate in degraded visual environments. In addition to maturing these individual technologies, specific attention will be directed toward the task of integrating them into a full scale autonomous platform to increase their technology readiness level.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Claws Continue Claws. Claws, which was previously funded in 0602747N Undersea Warfare applied Research will develop the autonomy required to operate large and extra-large Unmanned Undersea Vehicles (UUVs) in an anti-access, area-denial environment. To support large and extra-large UUV operations further forward and farther from the battle group, the technology will be evolved to allow operations with limited navigational fixes and limited communication opportunities. During FY18, research will be conducted and technology will be matured in the areas of precision navigation, obstacle avoidance, robust communications, on-board vulnerability assessment, and payload autonomy. Applied research efforts in advanced undersea autonomy will also be initiated. Large Displacement Unmanned Undersea Vehicle (LDUUV) Complete the LDUUV project, which was previously funded in 0602747N Undersea Warfare Applied Research. The LDUUV INP is developing the critical technologies of energy, autonomy, endurance, and submarine launch and recovery. These critical technologies are needed to enable Large UUVs to be pier and ship launched, and recovered. The technologies will enable the completion of missions with long ranges, as well as those requiring over 60 days of endurance for Intelligence, Surveillance, and Reconnaissance (ISR) tasks. Continue development of the long endurance, air-independent energy source technology for large UUVs. Continue development of the autonomy technology that will support operation of the UUV in the littorals. Continue development of core UUV technologies that will extend the reliability and endurance of the UUV operating in the littorals. Conduct a UUV fuel cell systems technology analysis, which will be used to support a land-based demonstration. Low-Cost UAV Swarming Technology (LOCUST) Continue the LOCUST project, previously funded in PEs 0602114N Power Projection Applied Research and 0602123N Force Protection Applied Research. LOCUST will ultimately deliver a scalable system of inexpensive Unmanned Aerial Vehicles (UAVs) and payloads that will provide game-changing disruptive capabilities over a wide range of military operations and areas of operations. LOCUST will make advances in unmanned system collective autonomous behaviors, robust low probability of interception or detection ad hoc networks, and payload miniaturization and modularity breakthroughs to counter threats in constrained urban environments, as well as large-scale anti-access area denial defenses. This will be accomplished at greatly reduced cost and risk when compared to traditional manned platform target prosecution. The applied research effort in 2018 specifically will					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
conduct preliminary system design and technology developments within the three major LOCUST sub-systems: (1) the Distributed, Collaborative, Coordinated, & Cognitive autonomy system architecture; (2) the distributed Command & Control system architecture; and (3) a series of modular UAV payloads. Large Displacement UUV - Advanced Power and Energy Demonstration (LDUUV-APED) Continue LDUUV-APED, which was previously funded in PE 0602747N Undersea Warfare Applied Research. The LDUUV-APED Program is integrating the Aluminum Power System (ALPS) air-independent fuel cell system into an existing LDUUV vehicle and conducting at-sea testing to demonstrate a mission endurance capability that meets the Navy's UUV far-term objectives (up to 70 days) for a persistent forward presence. During FY18, the hull structural design and analysis will be completed and the energy section hull will be fabricated. Integration of ALPS into the energy section hull will begin. Modifications to the vehicle to accept the ALPS energy section will begin. The notional mission profiles will be finalized and development of the test plan will begin. The vehicle-level hazards analysis will be completed and the range approval process will continue to be supported. Medium Displacement Unmanned Surface Vehicle (MDUSV) Continue MDUSV, which was previously funded in 0602123N Force Protection Applied Research and PE 0602747N Undersea Warfare Applied Research. The MDUSV project will continue research efforts to develop and mature technologies in multiple areas that will be used to assess the feasibility of an MDUSV to perform Mine Countermeasures (MCM), Anti-Submarine Warfare (ASW) and Electronic Warfare (EW) mission area requirements. Autonomy technologies being matured include a robust perception approach using Electro-Optic/ Infrared (EO/IR) sensors and technologies that enable autonomous all-weather operations, detection of low radar cross section craft, reduced vulnerability to jamming, and operations with reduced Radio Frequency (RF) emissions. MCM technologies being developed include mine sweeping capabilities using High Temperature Superconductor (HTS) magnets in combination with acoustic sweep technologies. ASW technologies being developed include an advanced version of the Non-Traditional Sensor System (NTSS) to be assessed for its autonomous ASW track and trail capability. The project also includes development of an NTSS EW payload integrated with an MS3 Sonar. These emerging technologies are being designed and developed for an MDUSV prototype that will be capable of performing multiple autonomous missions over extended periods of time. Tern Complete Tern, a joint ONR and DARPA project, previously funded in 0602123N Force Protection Applied Research.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Continue airplane launch and recovery component and subsystem technology developments to enable medium size, long endurance, long-range Unmanned Aerial Vehicles (UAVs) to be launched and recovered on short deck ships. Complete the maturation of technology addressing integration challenges associated with developing a Vertical Take-Off and Landing (VTOL) UAV capability. USV Swarm Continue USV Swarm, which was previously funded in PE 0602271N Electromagnetic Systems Applied Research and PE 0602747N Undersea Warfare Applied Research. Conduct applied research into cooperative autonomy for unmanned surface vehicle swarms including task allocation, route planning and perception. ***FY 2019 Base 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 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 UUV of suitable size. Continue BA2 to conduct applied research into multi-USV autonomous control, including research into common multi-USV behaviors across multiple missions, multi-USV task recognition/allocation/execution and advanced perception. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** The overall FY18 to FY19 increase is due to the ramp up of funding in the second year of two FY18 new start INPs and an increase in funding for autonomy maturation efforts in support of unmanned surface craft					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
operations, countered by a reduction of funding levels associated with the completion of three unmanned and autonomous systems technology development projects.					
Accomplishments/Planned Programs Subtotals	0.000	171.146	159.697	0.000	159.697

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.