Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy											Date: May 2021	
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 Innovative Naval Prototypes (INP) Adv Tec Dev*							
COST ($ in Millions)	**Prior Years**	**FY 2020**	**FY 2021**	**FY 2022 Base**	**FY 2022 OCO**	**FY 2022 Total**	**FY 2023**	**FY 2024**	**FY 2025**	**FY 2026**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	125.521	159.338	133.779	-	133.779	-	-	-	-	-	-
2480: *SSL-TM*	0.000	8.207	0.000	0.000	-	0.000	-	-	-	-	-	-
2481: *EMRG*	0.000	7.839	9.459	0.000	-	0.000	-	-	-	-	-	-
2731: *High Energy Laser Counter ASCM Project (HELCAP)*	0.000	0.000	29.372	13.960	-	13.960	-	-	-	-	-	-
2958: *Cyberspace Activities*	0.000	13.843	16.417	15.893	-	15.893	-	-	-	-	-	-
3400: *Innovative Naval Prototypes (INP) Adv Tech Dev*	0.000	87.909	0.000	0.000	-	0.000	-	-	-	-	-	-
3416: *HIJENKS*	0.000	0.000	14.402	7.634	-	7.634	-	-	-	-	-	-
3423: *LOCUST*	0.000	0.000	12.695	3.386	-	3.386	-	-	-	-	-	-
3450: *AMOS*	0.000	0.000	4.504	3.470	-	3.470	-	-	-	-	-	-
3451: *CLAWS*	0.000	0.000	15.234	14.298	-	14.298	-	-	-	-	-	-
3452: *ELEKTRA*	0.000	0.000	10.822	12.889	-	12.889	-	-	-	-	-	-
3454: *MDUSV*	0.000	0.000	1.115	0.000	-	0.000	-	-	-	-	-	-
3455: *MINERVA*	0.000	0.000	10.889	12.889	-	12.889	-	-	-	-	-	-
3457: *Long Range Targeting*	0.000	0.000	7.957	15.954	-	15.954	-	-	-	-	-	-
3458: *Undersea Warfare Efforts*	0.000	0.000	2.489	6.980	-	6.980	-	-	-	-	-	-
3459: *Super Swarm (SS)*	0.000	0.000	3.983	9.971	-	9.971	-	-	-	-	-	-
3461: *MASS*	0.000	0.000	0.000	3.491	-	3.491	-	-	-	-	-	-
3462: *DEALRS*	0.000	0.000	0.000	4.986	-	4.986	-	-	-	-	-	-
3463: *MATes*	0.000	0.000	0.000	3.989	-	3.989	-	-	-	-	-	-
3464: *REDCAT*	0.000	0.000	0.000	3.989	-	3.989	-	-	-	-	-	-
9999: *Congressional Adds*	0.000	7.723	20.000	0.000	-	0.000	-	-	-	-	-	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy	Date: May 2021
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 Innovative Naval Prototypes (INP) Adv Tec Dev*

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) portfolio includes efforts that solve problems and respond to mission requirements, as well as, exploratory research for new ideas and breakthrough capabilities. Larger in scope, scale and risk Innovative Naval Prototypes (INP) are selected for their high-payoff and potential to revolutionize operational concepts. The efforts described in this Program Element (PE) continue the Applied Research work in PE 0602792N for promising INPs with Advanced Technology Development activities. INP investments define the future of U.S. naval forces. Due to high technical risk, INPs often have long trial-and-error timeframes to work through challenges, but typically no more than three years between decision points. INP efforts mature technologies from a Technology Readiness Level (TRL) of 2 or 3 to a TRL of 6. As such, INPs require applied and advanced technology development funding to bridge from concept to working prototype. INPs prove technological and capability potential, validate production feasibility, and acquisition potential. ONR demonstrates INPs in relevant environments. Successful experimentation and demonstrations present the Department of the Navy with disruptive capabilities that may lead to a new acquisition programs. INPs are selected by senior leadership in the Department of the Navy.

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

INP 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. Due to high technical risk, INPs typically have long duration but have no more than three years between decision points. INPs do not develop hardware for service use, rather they prove technological and production feasibility, and show naval utility and acquisition potential. The Office of Naval Research (ONR) demonstrates INPs in relevant environments. Successful experimentation and demonstrations present the Department of the Navy with disruptive capabilities that may lead to the obsolescence of existing capabilities and acquisition programs. The Department of the Navy would have to make significant acquisition decisions to integrate the new technological capabilities into naval warfighting systems. INPs are selected by a process that involves senior leadership in the Department of the Navy.

Information security concerns preclude fully detailed descriptions of project efforts, research activities, and technology development plans. Specific information on each project and activity will be provided separately to the Congressional oversight committees.

Exhibit R-2, RDT&E Budget Item Justification: PB 2022 Navy	Date: May 2021
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 Innovative Naval Prototypes (INP) Adv Tec Dev*

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	129.003	141.948	134.163	-	134.163
Current President's Budget	125.521	159.338	133.779	-	133.779
Total Adjustments	-3.482	17.390	-0.384	-	-0.384
• Congressional General Reductions	-	-0.610			
• Congressional Directed Reductions	-	-2.000			
• Congressional Rescissions	-	-			
• Congressional Adds	-	20.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-3.482	0.000			
• Rate/Misc Adjustments	0.000	0.000	-0.384	-	-0.384

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: 9999: *Congressional Adds*		
Congressional Add: *Electromagnetic Railgun*	0.000	20.000
Congressional Add: *Advanced thermal and power technology for improved DEW SWAP*	7.723	0.000
Congressional Add Subtotals for Project: 9999	7.723	20.000
Congressional Add Totals for all Projects	7.723	20.000

Change Summary Explanation

funding: no significant change.

Schedule: not applicable.

Technical: not applicable

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 2480 / *SSL-TM*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
2480: *SSL-TM*	0.000	8.207	0.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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 the Navy's Innovative Naval Prototypes (INP) Program. 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. The project will conduct at-sea testing on the full laser weapon system demonstrator (i.e., prototype) from a representative test platform for a naval surface combatant.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Solid State Laser Technology Maturation (SSL TM)	8.207	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: Solid State Laser Technology Maturation (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) swarms. ***FY 2021 Plans:*** N/A ***FY 2022 Base Plans:*** N/A ***FY 2022 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	8.207	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2480 / *SSL-TM*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0603382N/2480: *SSL-TM*	4.649	11.857	5.342	-	5.342	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 2481 / *EMRG*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
2481: *EMRG*	0.000	7.839	9.459	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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 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, EMRG provides multi-mission potential for hypersonic missile defense, anti-air & surface warfare, and naval surface fire support. The Activity identified in Project Unit 2481 specifically addresses Advanced Technology Development in support of the EMRG high-power, kinetic energy weapon prototype development Innovative Naval Prototype (INP) effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Electro-Magnetic Railgun (EMRG)	7.839	9.459	0.000	0.000	0.000
Articles:	-	-	-	-	-
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 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, EMRG provides multi-mission potential for hypersonic missile defense, anti-air & surface warfare, and naval surface fire support.					
FY 2021 Plans: Complete Anti-Air Warfare (AAW) demonstrations to prove capability of Hyper Velocity Projectile (HVP) when fired from a railgun to engage stressing air threats. Complete risk reduction activities started in FY 2020 to document requirements for a future tactical shipboard Railgun Weapon System (RGWS). Complete system functional requirements and performance specifications for a shipboard RGWS.					
FY 2022 Base Plans: N/A					
FY 2022 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2481 / *EMRG*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease in funding from FY 2021 to FY 2022 is due to the completion of Advanced Technology Development efforts under this Activity.					
Accomplishments/Planned Programs Subtotals	7.839	9.459	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/2481: *EM Railgun (EMRG)*	7.403	0.000	0.000	-	0.000	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
2731: *High Energy Laser Counter ASCM Project (HELCAP)*	0.000	0.000	29.372	13.960	-	13.960	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

High Energy Laser Counter ASCM Project (HELCAP): Defeating Anti-Ship Cruise Missiles (ASCMs) with a laser weapon system presents several technical challenges. The High Energy Laser Counter ASCM Project HELCAP will assess, develop, experiment, and demonstrate the various laser weapon system technologies and methods of implementation required to defeat ASCMs.

HELCAP will leverage the knowledge gained in the Navy Laser Family of Systems (NLFoS) efforts that include:
- Alternative Laser Sources for higher powers, also known as the Ruggedized High Energy Laser (RHEL) activities;
- Solid State Laser Tech Maturation activities that provides initial key enabling technical solutions in high power lasers and beam control, and will provide opportunities for single ship operational and sustainment learning;
- Surface Navy Laser Weapon System Increment 1 (SNLWS Inc. 1) project that provides the initial combat system integration and installation knowledge for Aegis platforms, and multi-ship battle force operations knowledge;
- Optical Dazzling Interdictor Navy (ODIN) that provides Counter-ISR technical and fleet operational knowledge.

This leveraged knowledge and new HELCAP technical solutions to the C-ASCM problem will enable a fully informed decision to rapidly field an integrated, fleet ready, HEL Weapon.

HELCAP activities being conducted in this project include technology assessments, laser lethality investigations, and advanced beam control. This project passes technology to follow on HELCAP activities being conducted under Program Element (PE) 0603925N Directed Energy and Electric Weapon Systems.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: HELCAP	0.000	29.372	13.960	0.000	13.960
Articles:	-	-	-	-	-
Description: The High Energy Laser Counter ASCM Project (HELCAP) will expedite the development, experimentation, integration and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) by addressing the remaining technical challenges, e.g.: atmospheric turbulence, automatic target identification and aim point selection, precision target tracking with low jitter in high clutter conditions, advanced beam control, and higher power HEL development. HELCAP will assess, develop, experiment, and					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
demonstrate the various laser weapon system technologies and methods of implementation required to defeat ASCMs in a crossing engagement. ***FY 2021 Plans:*** - Continue in the development phase and enter the integration phase of an overall multi-year effort whose objective is to conduct development, experimentation, and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) including laser lethality, advanced beam control, and high energy laser sources. Continue ASCM defeat analysis and assessments including lethality, engagement modeling, atmospheric propagation characterization, and beam control. Complete fabrication and factory acceptance testing of a beam control testbed. Implement testbed technology insertion, and perform additional laser/materiel component interaction testing - Related FY 2021 HELCAP project plans in with BA 04 funds under Program Element (PE) 0603925N Directed Energy and Electric Weapon Systems Project 2731 include systems engineering, mission analysis, and the design completion, fabrication, and integration of major components of a HELCAP prototype system. Planning and preparations for FY 2022-FY 2023 system experimentation and demonstrations utilizing the prototype system will also continue. ***FY 2022 Base Plans:*** - Continue in the integration phase of an overall multi-year effort whose objective is to conduct development, experimentation, and demonstration of critical technologies to defeat crossing Anti-Ship Cruise Missiles (ASCM) including laser lethality, advanced beam control, and high energy laser sources. Continue ASCM defeat analysis and assessments including lethality, engagement modeling, atmospheric propagation characterization, and beam control. Continue to implement beam control testbed technology insertion. Continue laser/materiel component interaction testing and support beam control tracker and adaptive optics verification experimentation. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease in funding from FY 2021 to FY 2022 is due to the maturation of the advanced technology development in this activity and the planned ramp-up into a prototype demonstration phase funded under Program Element (PE) 0603925N Directed Energy and Electric Weapons Systems Project 2731 for systems engineering, mission analysis, and the design completion, fabrication, and integration of major components of a					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2731 / *High Energy Laser Counter ASCM Project (HELCAP)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
HELCAP prototype system, as well as for planning and preparations for FY 2022/2023 system experimentation and demonstrations.					
Accomplishments/Planned Programs Subtotals	0.000	29.372	13.960	0.000	13.960

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/ 0603925N/2731: *High Energy Laser Counter ASCM Project*	6.480	30.897	25.964	-	25.964	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 2958 / *Cyberspace Activities*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
2958: *Cyberspace Activities*	0.000	13.843	16.417	15.893	-	15.893	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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 Project 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, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Cyber	13.843	16.417	15.893	0.000	15.893
Articles:	-	-	-	-	-
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 2021 Plans: - Continue 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 to mature the suite of tools and techniques that enable a powerful tailoring of an end-system computing environment to reduce					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
cyber attack surface. Conduct rapid demonstrations of the technologies in various systems within the Navy to evaluate the efficacy of the tools. - Complete initial debloat tool feasibility analysis. Early results of the analysis have validated technological feasibility of the approaches and are beginning to quantify the highly compelling operational impact for cyber protection. - Initiate advanced capability analysis of software debloat projects for Java, compiled C/C++, and low-level system firmware. This task is necessary to study system integration techniques for the tooling and to demonstrate capabilities for acquisition programs. - Continue development of communications protocol subsetting and automated dialect generation to reshape cyber attack surface. - Continue development of non-destructive microelectronics inspection methods that would provide a critical new capability for scalable cyber supply chain protection. ***FY 2022 Base Plans:*** - Complete Advanced Technology Development of tools and techniques that enable compelling new cyber capabilities for automated, systematic reduction and dynamic reshaping of any computing system's attack surface. Continue conducting rapid demonstrations of the technologies in multiple Naval combat and C4I systems to evaluate tool efficacy, study system integration and workflow techniques, and to demonstrate inventive new capabilities for acquisition programs. - Complete advanced capability analysis of software debloat projects for Java, compiled C/C++, and low-level system firmware. This task is necessary to study system integration techniques for the tooling and to demonstrate capabilities for acquisition programs. - Complete development of communications protocol subsetting and automated dialect generation to reshape cyber attack surface. - Complete development of non-destructive microelectronics inspection methods that would provide a critical new capability for scalable cyber supply chain protection.stem integration and workflow techniques, and to demonstrate inventive new capabilities for acquisition programs. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** No significant change from FY 2021 to FY 2022.					
Accomplishments/Planned Programs Subtotals	13.843	16.417	15.893	0.000	15.893

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 2958 / *Cyberspace Activities*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/2958: *CYBERSPACE ACTIVITIES*	26.339	28.387	25.988	-	25.988	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3400 / *Innovative Naval Prototypes (INP) Adv Tech Dev*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3400: *Innovative Naval Prototypes (INP) Adv Tech Dev*	0.000	87.909	0.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The efforts described in this Project address the Advanced Technology Development associated with INPs. Starting in FY2021, to provide additional acquisition oversight, fiscal clarity, and adherence to financial management practices, the following stand-alone projects were created:

- Proj 3416: HIJENKS
- Proj 3423: LOCUST
- Proj 3450: AMOS
- Proj 3451: CLAWS
- Proj 3452: ELEKTRA
- Proj 3453: Hypersonic Booster
- Proj 3454: MDUSV
- Proj 3455: MINERVA
- Proj 3457: Long Range Targeting
- Proj 3458: Undersea Warfare Efforts
- Proj 3459: Super Swarm (SS)

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Directed Energy / Electric Weapons	31.968	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2021 Plans: N/A					
FY 2022 Base Plans: N/A					
FY 2022 OCO Plans: N/A					
Title: Electromagnetic Maneuver Warfare	15.521	0.000	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3400 / *Innovative Naval Prototypes (INP) Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Articles:	-	-	-	-	-
FY 2021 Plans: N/A ***FY 2022 Base Plans:*** N/A ***FY 2022 OCO Plans:*** N/A					
Title: Undersea Warfare	4.334	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2021 Plans: N/A ***FY 2022 Base Plans:*** N/A ***FY 2022 OCO Plans:*** N/A					
Title: Unmanned and Autonomous Systems	23.781	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2021 Plans: N/A ***FY 2022 Base Plans:*** N/A ***FY 2022 OCO Plans:*** N/A					
Title: Artificial Intelligence	12.305	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2021 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3400 / *Innovative Naval Prototypes (INP) Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
N/A ***FY 2022 Base Plans:*** N/A ***FY 2022 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	87.909	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3416 / *HIJENKS*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3416: *HIJENKS*	0.000	0.000	14.402	7.634	-	7.634	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The HIgh-power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) INP effort is a non-kinetic High Power Microwave (HPM) payload integrated on an airborne platform will enable the prosecution of multiple targets with area coverage across each target and open targets previously restricted due to collateral damage. HIJENKS increases operational access by disrupting land-based infrastructure facilities tied to adversary systems, decreases cost exchange ratios through non-kinetic engagement, and addresses targets previously restricted due to collateral damage concerns/moral hardening. It expands the competitive space in the electromagnetic spectrum to disrupt, degrade, and destroy critical electronic targets. The Activity identified in Project Unit 3416 specifically addresses Advanced Technology Development in support of the HIJENKS INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: HIJENKS	0.000	14.402	7.634	0.000	7.634
Articles:	-	-	-	-	-

Description: The High Power Joint Electromagnetic Non-Kinetic Strike (HIJENKS) program is a proof-of-concept demonstration of a multi-target, advanced airborne High Power Microwave (HPM) payload capable of disrupting electronic targets non-kinetically. HIJENKS is capable of disrupting land-based electronic system infrastructure and engaging multiple targets with a single airborne weapon, increasing operational access/ decreasing cost exchange ratios, providing area lethality with increased pulse rate, providing options to address limitations on collateral damage, increasing standoff range and expanding magazine depth. HIJENKS will advance the current state-of-the-art in HPM technology and demonstrate the near-term operational benefits of integrating HPM-based Electronic Warfare/Electronic Attack (EW/EA) into the current force structure.

FY 2021 Plans:

- Continue Joint USAF/USN project for High Powered Microwave (HPM) payload integration into an airborne platform to enable dynamic demonstration and testing of a multi-target HPM payload to provide non-kinetic strike options for electronic target degrade/disrupt/disable capability. Focus on payload integration and platform modifications to enable testing along with range development.

FY 2022 Base Plans:

- Complete effort to develop an integration-ready HPM payload and TDP to enable future platform integration. Continue development of HPM payload adaptable to multiple airborne systems, including system design studies

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3416 / *HIJENKS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
and modeling of alternative HPM payload technologies. Develop and deliver two duplicate payload pods for use by both Navy and AF in static and emulated dynamic flight testing. Complete full payload system integration and multiple test events to demonstration functionality of first payload unit. Complete system level test with builds of additional payload units. Complete environmental testing, shock and vibration testing, Electromagnetic Interference (EMI), and Weapon Effectiveness testing. Validate payload performance requirements including Effective Radiated Power (ERP), number of pulses-per-engagement, number of engagements, and Electronic Damage Battle Indication (EDBI). Complete static demonstration of the world's most advanced HPM payload - highest power level achieved for aperture size and system volume. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease in funding from FY 2021 to FY 2022 is due to the continued maturation of the advanced technology development in this activity which now has a reduced need for major test ranges activities (test asset procurement and payload hardware) related to full system demonstration efforts.					
Accomplishments/Planned Programs Subtotals	0.000	14.402	7.634	0.000	7.634

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3416: *HIJENKS*	0.000	22.223	9.916	-	9.916	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3423 / *LOCUST*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3423: *LOCUST*	0.000	0.000	12.695	3.386	-	3.386	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Adversary military modernization and increasing contested domains require a shift in approach "...to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms. This will include capabilities to enhance close combat lethality in complex terrain." LOCUST will develop and deliver autonomy, C2 architecture, and a series of modular payloads on a robust, scalable, flexible, multifunctional UAV system; employable from surface, sub-surface, airborne, and ground manned and un-manned systems to provide a dispersed, resilient, and adaptive capability to gain a competitive military advantage. LOCUST will provide ISR and precision loitering munitions capable of being launched from air, surface, ground, and sub-surface platforms to conduct both singular and swarm operations across battlespace in conjunction with Joint and manned operations. It will demonstrate multi-domain launch and strike operations, heterogeneous air platform payloads, unmanned from unmanned operations, distributed control of the strike mission, and refined cost elements for critical technologies that have supply chain assurance addressed. The Activity identified in Project Unit 3423 specifically addresses Advanced Technology Development in support of the LOCUST INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: LOCUST	0.000	12.695	3.386	0.000	3.386
Articles:	-	-	-	-	-

Description: Adversary military modernization and increasing contested domains require a shift in approach "...to strike diverse targets inside adversary air and missile defense networks to destroy mobile power-projection platforms. This will include capabilities to enhance close combat lethality in complex terrain." LOCUST will develop and deliver autonomy, C2 architecture, and a series of modular payloads on a robust, scalable, flexible, multifunctional UAV system; employable from surface, sub-surface, airborne, and ground manned and un-manned systems to provide a dispersed, resilient, and adaptive capability to gain a competitive military advantage. LOCUST will provide ISR and precision loitering munitions capable of being launched from air, surface, ground, and sub-surface platforms to conduct both singular and swarm operations across battlespace in conjunction with Joint and manned operations. It will demonstrate multi-domain launch and strike operations, heterogeneous air platform payloads, unmanned from unmanned operations, distributed control of the strike mission, and refined cost elements for critical technologies that have supply chain assurance addressed.

FY 2021 Plans:

Continue Advanced Technology Development efforts associated with development and flight testing of mission-oriented payloads in which cost, size, weight, and power reductions play a significant role in their utility. The

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3423 / *LOCUST*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
"swarm architecture facing" portion of each of these payloads is a significant departure from traditional payload development and will also be investigated through evaluations of ability of payloads to request or drive a behavior from the swarm in addition to more traditional payload utilization approaches. Integration onto a range of platforms will be considered and appropriate design and certifications will be addressed. ***FY 2022 Base Plans:*** Complete advanced technology development efforts associated with development and flight testing of mission-oriented payloads in which cost, size, weight, and power reductions play a significant role in their utility will complete. The primary focus of the efforts will be on conducting field swarm demonstration in an operationally relevant environment. This activity represents a significant component needed for the air element under the associated Super Swarm multi-domain activity. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease in funding from FY 2021 to FY 2022 is due to the completion of LOCUST advanced technology development.					
Accomplishments/Planned Programs Subtotals	0.000	12.695	3.386	0.000	3.386

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3423: *LOCUST*	0.000	21.950	8.031	-	8.031	-	-	-	-	-	-
• RDTEN/0603382N/3423: *LOCUST*	2.871	2.208	3.371	-	3.371	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3450 / *AMOS*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3450: *AMOS*	0.000	0.000	4.504	3.470	-	3.470	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Arctic Mobile Observing System (AMOS) INP effort will develop a prototype mobile sensing system that can be deployed anywhere in the Arctic via the development of a sea ice-based buoy node that will enable the critical infrastructure (power, communication, environmental intelligence) to provide the Navy with a persistent Arctic presence at lower cost than manned platforms. AMOS is a mobile observing system of systems node that enables 2-way communications, under-ice vehicle navigation, and extended-duration autonomy in the complex Arctic environment. AMOS will provide a persistent, mobile, autonomous capability to monitor the operational environment and maritime operations of potential adversaries in the Arctic Ocean. The Activity identified in Project Unit 3450 specifically addresses Advanced Technology Development in support of the AMOS INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: AMOS	0.000	4.504	3.470	0.000	3.470
Articles:	-	-	-	-	-
Description: The Arctic Mobile Observing System (AMOS) INP effort will develop a prototype mobile sensing system that can be deployed anywhere in the Arctic via the development of a sea ice-based buoy node that will enable the critical infrastructure (power, communication, environmental intelligence) to provide the Navy with a persistent Arctic presence at lower cost than manned platforms. AMOS is a mobile observing system of systems node that enables 2-way communications, under-ice vehicle navigation, and extended-duration autonomy in the complex Arctic environment. AMOS will provide a persistent, mobile, autonomous capability to monitor the operational environment and maritime operations of potential adversaries in the Arctic Ocean.					
FY 2021 Plans: Continue advanced technology development efforts associated with the following: - Integrating Command, Control, Communication and Computers (C4I) into the primary AMOS buoy node. - Constructing prototype nodes for deployment in Arctic field experiments. - Testing extended-duration survivability of AMOS nodes and platforms through year-long Arctic deployments. - Testing and evaluating UUV docking and recharge systems under sea ice in the Arctic. - Demonstrating domain-specific autonomous behaviors in a simulated environment to enable long-duration Arctic deployment.					
FY 2022 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3450 / *AMOS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Continue advanced technology development efforts associated with the following: - Constructing instrumented AMOS gliders and float prototypes for deployments - Constructing prototype nodes with meteorological sensors and command and for deployment in Arctic experiments. - Testing extended-duration of AMOS nodes and platforms through year-long Arctic deployments. - Demonstrating navigation and 2-way communications of AMOS platforms and vehicles ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease in funding from FY 2021 to FY 2022 is due to a reduced schedule of at-sea experimentation in FY 2022.					
Accomplishments/Planned Programs Subtotals	0.000	4.504	3.470	0.000	3.470

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3450: *AMOS*	0.000	8.365	6.446	-	6.446	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3451 / *CLAWS*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3451: *CLAWS*	0.000	0.000	15.234	14.298	-	14.298	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The CLAWS INP effort will develop an autonomous unmanned undersea weapon system capable of providing offensive effects to the Combatant Commanders beyond Phase 0 inside the first island chain. It will clandestinely extend the reach of large UUVs and increase the mission areas into kinetic effects. CLAWS will deliver algorithms to enable all families of UUVs to operate in complex, dynamic and degraded environments. CLAWS will demonstrate autonomous missions in denied waters, develop and demonstrate autonomous technologies for survivability of large UUVs, and develop autonomy and launch capabilities for special mission payloads. CLAWS will be able to complete missions 1&2 against near peer adversary defenses, maintain critical communication with Navy C2/Fires and provide critical ISR information. The Activity identified in Project Unit 3451 specifically addresses Advanced Technology Development in support of the CLAWS INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: CLAWS	0.000	15.234	14.298	0.000	14.298
Articles:	-	-	-	-	-
Description: The CLAWS INP effort will develop an autonomous unmanned undersea weapon system capable of providing offensive effects to the Combatant Commanders beyond Phase 0 inside the first island chain. It will clandestinely extend the reach of large UUVs and increase the mission areas into kinetic effects. CLAWS will deliver algorithms to enable all families of UUVs to operate in complex, dynamic and degraded environments. CLAWS will demonstrate autonomous missions in denied waters, develop and demonstrate autonomous technologies for survivability of large UUVs, and develop autonomy and launch capabilities for special mission payloads. CLAWS will be able to complete missions 1&2 against near peer adversary defenses, maintain critical communication with Navy C2/Fires and provide critical ISR information.					
FY 2021 Plans: Continue Adv Tech Dev effort in CLAWS autonomy development: - Conduct an autonomy/payload demonstration for an extra-large unmanned undersea vehicle. - Develop and mature the autonomy and payload technology for contested littoral environments.					
FY 2022 Base Plans: Continue the advanced development of autonomy for classified payload 2. Develop adaptive mission planning for swarm of payload to create kinetic effects. Complete Advanced Technology Development effort in autonomy development for classified payload 1:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3451 / *CLAWS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Conduct final demonstration with OSD Hydra JCTD - Develop and mature the autonomy for classified payload 1 ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease from from FY 2021 to FY 2022 is due to completion of classified payload 1 effort					
Accomplishments/Planned Programs Subtotals	0.000	15.234	14.298	0.000	14.298

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3451: *CLAWS*	0.000	21.353	25.871	-	25.871	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3452 / *ELEKTRA*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3452: *ELEKTRA*	0.000	0.000	10.822	12.889	-	12.889	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Complex multi-domain threats can overwhelm the operator and individual platforms ability to defend the force. The ELEKTRA INP effort is developing "Human on the Loop" Artificial Intelligence (AI) enabled algorithms to perform force level kinetic/non-kinetic kill chain optimization and coordination across multiple domains at machine to machine speeds to increase the lethality and survivability of the Force. ELEKTRA will demonstrate AI/ML ability to coordinate kinetic/non kinetic effects autonomously with heterogeneous platforms, the ability to operate in degraded environments for hours and the ability to coordinate and execute domain kill chains simultaneously. It will deploy artificial intelligent (AI) and machine learning (ML) architecture, neural networked computing and large data handling to enable real time, force level effects assignment, coordination and resource management. The Activity identified in Project Unit 3452 specifically addresses Advanced Technology Development in support of the ELEKTRA INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: ELEKTRA	0.000	10.822	12.889	0.000	12.889
Articles:	-	-	-	-	-
Description: Complex multi-domain threats can overwhelm the operator and individual platforms ability to defend the force. The ELEKTRA INP effort is developing "Human on the Loop" Artificial Intelligence (AI) enabled algorithms to perform force level kinetic/non-kinetic kill chain optimization and coordination across multiple domains at machine to machine speeds to increase the lethality and survivability of the Force. ELEKTRA will demonstrate AI/ML ability to coordinate kinetic/non kinetic effects autonomously with heterogeneous platforms, the ability to operate in degraded environments for hours and the ability to coordinate and execute domain kill chains simultaneously. It will deploy artificial intelligent (AI) and machine learning (ML) architecture, neural networked computing and large data handling to enable real time, force level effects assignment, coordination and resource management.					
FY 2021 Plans: Conduct Advanced Technology Development efforts to mature and demonstrate more complex kinetic/non-kinetic kill chains and Human-Machine interactive battle management tools working at machine to machine speeds to support continuous analysis, planning and execution at the operational and tactical levels that will					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3452 / *ELEKTRA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
enable the dynamic synchronization of forces and actions across intelligence, surveillance and reconnaissance, and combat systems. ***FY 2022 Base Plans:*** Continuing efforts will focus on advanced technology development and experimentation. This experimentation will include incorporation of new analytics and decision support functionality, additional non-kinetic and kinetic kill chains, new functionality with airborne platforms, and experimentation with tactical systems on surface and airborne platforms during a large scale exercise. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase in funding from FY 2021 to FY 2022 is due to increased investment in support of platform experiments and technology demonstration in large scale exercise.					
Accomplishments/Planned Programs Subtotals	0.000	10.822	12.889	0.000	12.889

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3452: *ELEKTRA*	0.000	6.006	3.967	-	3.967	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3454 / *MDUSV*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3454: *MDUSV*	0.000	0.000	1.115	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Medium Displacement Unmanned Surface Vehicle (MDUSV) Project will develop and test a 132 ft. unmanned surface vehicle with ocean-spanning range, months of endurance, good seakeeping, and substantial payload. The vessel will have a high level of autonomy for independent operations under sparse supervisory control and have utility for a variety of Navy missions. MDUSVs capable of deployed blue-water operations with operator trust in safe, reliable operation, long-range and endurance autonomous operations. This will create a new paradigm for Navy surface force, a hybrid manned/unmanned force, and enable new tactics in performing naval missions. The Activity identified in Project Unit 3454 specifically addresses Advanced Technology Development in support of the MDUSV INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: MDUSV	0.000	1.115	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The Medium Displacement Unmanned Surface Vehicle (MDUSV) Project will develop and test a 132 ft. unmanned surface vehicle with ocean-spanning range, months of endurance, good seakeeping, and substantial payload. The vessel will have a high level of autonomy for independent operations under sparse supervisory control and have utility for a variety of Navy missions. MDUSVs capable of deployed blue-water operations with operator trust in safe, reliable operation, long-range and endurance autonomous operations. This will create a new paradigm for Navy surface force, a hybrid manned/unmanned force, and enable new tactics in performing naval missions.					
FY 2021 Plans: Continue Adv Tech Dev for integration, demonstration, and transition of autonomous control for medium displacement unmanned surface systems, focusing on common behaviors across multiple missions, additional perception capability and modalities, and testing methodologies for developing trust in the performance of autonomous systems.					
FY 2022 Base Plans: N/A					
FY 2022 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3454 / *MDUSV*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The funding decrease from FY 2021 to FY 2022 is due to completion of the Medium Displacement Unmanned Surface Vehicle (MDUSV) INP effort and transition of the platform to the fleet.					
Accomplishments/Planned Programs Subtotals	0.000	1.115	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3454: *MDUSV*	0.000	4.829	0.000	-	0.000	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3455 / *MINERVA*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3455: *MINERVA*	0.000	0.000	10.889	12.889	-	12.889	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The need to operate in a multiple domain environment against highly capable peers requires improved decision quality and reduced decision timelines. MINERVA will develop AI and Machine-Learning (ML) capabilities to improve mission planning, intelligence gathering, execution and assessment. Minerva will deliver next-generation decision aids by combining operations research with emerging AI capabilities to create learning, self-adaptive automation that supports Composite Warfare Commander's (CWC) and their staffs at the Fleet, Force and Group echelons. It will establish a DevOps environment that includes warfighter staffs in the development and integration of new capabilities. The Activity identified in Project Unit 3455 specifically addresses Advanced Technology Development in support of the MINERVA INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: MINERVA	0.000	10.889	12.889	0.000	12.889
Articles:	-	-	-	-	-
Description: The need to operate in a multiple domain environment against highly capable peers requires improved decision quality and reduced decision timelines. MINERVA will develop AI and Machine-Learning (ML) capabilities to improve mission planning, intelligence gathering, execution and assessment. Minerva will deliver next-generation decision aids by combining operations research with emerging AI capabilities to create learning, self-adaptive automation that supports Composite Warfare Commander's (CWC) and their staffs at the Fleet, Force and Group echelons. It will establish a DevOps environment that includes warfighter staffs in the development and integration of new capabilities.					
FY 2021 Plans: Conduct advanced development research on Artificial Intelligence and Machine Learning (AI/ML) methods to infer an enemy course of action and predict enemy locations. In addition, measure mission planning services, mission execution and adjustment services; and human acceptance of AI/ML decision aid services. Develop methods to test and validate AI/ML enabled decision aiding services.					
FY 2022 Base Plans: Continue research on Artificial Intelligence and Machine Learning (AI/ML) methods to infer an enemy course of action and predict enemy locations. In addition, measure mission planning services, mission execution and adjustment services; and human acceptance of AI/ML decision aid services. Develop methods to test and					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3455 / *MINERVA*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
validate AI/ML enabled decision aiding services. Specific FY22 focused development efforts include: negative search feedback to the Common Operational Picture; dynamic adaptive waterspace management; operational level of war planning that accounts for adversary constraints; maneuver planning capability combined with a weapon-sensor-effect-target assignment algorithms; machine learning algorithms to predict and make inferences about enemy intended actions; multi-domain battle management automation planner; demonstration of current and predicted evaluation of composability of operational systems and force packages; and continue to mature, test, and demonstrate best practices of artificial intelligence and machine learning methods to improve mission planning efficiency. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase in funding from FY 2021 to FY 2022 supports programmed increased investment for MINERVA operational systems and mission planning AI/ML technology demonstrations.					
Accomplishments/Planned Programs Subtotals	0.000	10.889	12.889	0.000	12.889

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3455: *MINERVA*	0.000	5.939	3.966	-	3.966	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3457 / *Long Range Targeting*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3457: *Long Range Targeting*	0.000	0.000	7.957	15.954	-	15.954	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Long Range Targeting emphasizes the specific naval use of AI in an integrated system that addresses a warfighting challenge. This project contains coordinated investments in Applied Research that contribute to the Long Range Targeting (LRT) Innovative Naval Prototype (INP). This Advanced Technology Development, in coordination with a complimentary Applied Research investment in Program Element (PE) 0602792N Innovative Naval Prototypes (INP) Applied Res, will create an overall capability for LRT. Technologies within this activity will enable integrated and distributed forces capable of dynamic synchronized actions. Investments include technologies for sense and sense making and Artificial Intelligence for predictive mission-focused analytics that autonomously gather, analyze, compile, interpret, and visualize a fused tactical and national all source data picture to improve planning and decision making speeds. Investments will also establish a distributed Artificial Intelligence capability that can function in a harsh and adversarial environment, determine an optimal response and react in real-time. The Activity identified in Project Unit 3457 specifically addresses Advanced Technology Development in support of the LRT INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Long Range Targeting	0.000	7.957	15.954	0.000	15.954
Articles:	-	-	-	-	-
Description: Long Range Targeting emphasizes the specific naval use of AI in an integrated system that addresses a warfighting challenge. This project contains coordinated investments in Applied Research that contribute to the Long Range Targeting (LRT) Innovative Naval Prototype (INP). This Advanced Technology Development, in coordination with a complimentary Applied Research investment in Program Element (PE) 0602792N Innovative Naval Prototypes (INP) Applied Res, will create an overall capability for LRT. Technologies within this activity will enable integrated and distributed forces capable of dynamic synchronized actions. Investments include technologies for sense and sense making and Artificial Intelligence for predictive mission-focused analytics that autonomously gather, analyze, compile, interpret, and visualize a fused tactical and national all source data picture to improve planning and decision making speeds. Investments will also establish a distributed Artificial Intelligence capability that can function in a harsh and adversarial environment, determine an optimal response and react in real-time.					
FY 2021 Plans: Complete Adv Tech Dev on framework/architecture studies for Long Range Targeting; Initiate development efforts for sensor and communication technologies and prototypes to fill the gaps identified and needed					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3457 / *Long Range Targeting*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
to achieve the Long Range Targeting capability; Initiate planning for test, integration, demonstration and experiment activities for Long Range Targeting. ***FY 2022 Base Plans:*** Continue to refine the Long Range Targeting framework/architecture. Continue development efforts to incorporate methods and develop technology for beyond-line-of-sight communications and exploit Over-the-Horizon (OTH) sensors, In-Scene aids, and sense making phenomenology to refine BLOS target detection, track and positive identification. Continue planning for test, integration, demonstration and experiment activities for Long Range Targeting. Begin development of technologies to integrate track data with other sources to feed Battle Management Command and Control (BMC2) kill chain algorithms with the objective of supporting live missions. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase in funding from FY 2021 to FY 2022 is due to two efforts: 1) Over the water testing and demonstration of next generation Over-the-Horizon Radar (OTHR) technologies that are being developed in both FY21 and FY22. This will include In-Scene Aids and new cooperative radar techniques for land, air and shipboard beyond line-of-sight (BLOS) surveillance and targeting; 2) A shift from modeling in FY21 to actual development in FY22 of stand-above sensors, communications, and BLOS target data fusion for positive ID and kill chain integration. This effort will lead to live over the water tests demonstrations in future years.					
Accomplishments/Planned Programs Subtotals	0.000	7.957	15.954	0.000	15.954

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0603382N/3443: *Advanced Long Range Targeting(ALRT)*	0.000	0.000	0.000	-	0.000	-	-	-	-	-	-

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3457 / *Long Range Targeting*

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3458 / *Undersea Warfare Efforts*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3458: *Undersea Warfare Efforts*	0.000	0.000	2.489	6.980	-	6.980	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Undersea Warfare Efforts Project will develop new technology for offensive and defensive warfare conducted on the seabed, in the sea (i.e. subsea), and from the sea. Undersea Warfare Efforts as part of Full Spectrum Undersea Warfare (FSUSW) focuses on Theatre Undersea Warfare (TUSW), Joint Targeting and Strike, and Subsea and Seabed Warfare (SSW). There are five thrust areas of the Undersea Warfare Efforts that are key to enabling Chief of Naval Operations Guidance (CNOG), Distributed Maritime Operations (DMO), and the Commandant's Stand in Force with manned and unmanned warfighting capability. These thrust areas were specifically chosen in direct collaboration with STRATCOM, INDO-PACOM, Fleet and Undersea Warfare Commanders and validated with regular Flag engagements. These advanced technology developments will enable future undersea weapon systems (e.g., Maritime Strike Tomahawk and ADCAP variants), COCOM campaign, and operational plans. Undersea Warfare Efforts thrust areas include 1) Undersea effectors, 2) Integrated expeditionary subsea system of systems, 3) Multi-Vehicle Torpedo Tube Development System (MVTTDS) for payload A, 4) Undersea UAV for Over-The-Horizon (OTH) effects and 5) Undersea Launched Devices to enable Commanding Officers and Regional Combatant Commander effects. The thrust areas are technically an operational interconnected. Selected concepts from advanced research will be integrated into viable representative prototypes for field experimentation in a relevant environment. Lessons learned from field experimentation will inform continued applied research spirals to remedy technical shortcomings, expand capability, or define an alternate approach. The Activity identified in the Undersea Warfare Efforts, Project 3458, specifically addresses Advanced Technology Development in support of the Full Spectrum Undersea Warfare INP effort. The Applied Research Budget Activity (BA) 2 funding is in a separate Program Element (PE) 060279N FSUSW INP, Project 3456.

Information security concerns preclude fully detailed descriptions of project efforts, research activities, and technology development plans. Specific information on each project and activity will be provided separately to the Congressional oversight committees.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Undersea Warfare Efforts	0.000	2.489	6.980	0.000	6.980
Articles:	-	-	-	-	-
FY 2021 Plans: Initial Advanced Technology Development associated with Multi-Vehicle Torpedo Tube Deployment System for Virginia Class submarines, including - Initial design and prototyping.					
FY 2022 Base Plans: Continued Advanced Technology Development associated with the Multi-Vehicle Torpedo Tube Deployment System prototype for Virginia Class submarines using including					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3458 / *Undersea Warfare Efforts*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Prototype component tank testing - Assessment of reload viability and features ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The funding increase from FY 2021 to FY 2022 is due to the maturing of the Applied Research phase and the planned ramp-up in Advanced Technology Development which will focus on concept and technology demonstrations.					
Accomplishments/Planned Programs Subtotals	0.000	2.489	6.980	0.000	6.980

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3459 / *Super Swarm (SS)*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3459: *Super Swarm (SS)*	0.000	0.000	3.983	9.971	-	9.971	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Swarming is a concept that allows for multi-domain, heterogeneous swarms of unmanned systems capable of rendering the counter's ability to scale either inadequate or irrelevant and includes offensive and defensive operations, own and adversarial employment, and a physical battlespace ranging from open ocean to ashore. The Super Swarm (SS) INP effort will develop an autonomous control system for multiple USV's consisting of cooperative task allocation, cooperative route planning/behaviors and shared situational awareness. The Swarm autonomy technology is leveraged by other programs including the Medium Displacement Unmanned Surface Vehicle (MDUSV) and the Autonomous USV FNC program. It will consist of the employment of sustainable large-scale robotic swarm warfare across all domains ahead of our adversaries to obviate costly and vulnerable legacy platforms and to gain a competitive advantage. The Activity identified in Project Unit 3459 specifically addresses Advanced Technology Development in support of the Super Swarm INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Super Swarm (SS)	0.000	3.983	9.971	0.000	9.971
Articles:	-	-	-	-	-
Description: Swarming is a concept that allows for multi-domain, heterogeneous swarms of unmanned systems capable of rendering the counter's ability to scale either inadequate or irrelevant and includes offensive and defensive operations, own and adversarial employment, and a physical battlespace ranging from open ocean to ashore. The Super Swarm (SS) INP effort will develop an autonomous control system for multiple USV's consisting of cooperative task allocation, cooperative route planning/behaviors and shared situational awareness. The Swarm autonomy technology is leveraged by other programs including the Medium Displacement Unmanned Surface Vehicle (MDUSV) and the Autonomous USV FNC program. It will consist of the employment of sustainable large-scale robotic swarm warfare across all domains ahead of our adversaries to obviate costly and vulnerable legacy platforms and to gain a competitive advantage.					
FY 2021 Plans: Continue Advanced Technology Development efforts associated with robust, scalable, flexible, and multi-functional swarming unmanned vehicle systems (UxS) generating Super Swarm - Overwhelming Swarm Effects (SS-OSE) employable from surface, sub-surface, airborne, and ground manned and unmanned platforms.					
FY 2022 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3459 / *Super Swarm (SS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Continue efforts focused on interaction of multiple autonomy architectures across multiple domains and platforms to generate coordinated and optimized behaviors for the delivery of effects on target. Due to increase needed on several technology discovery areas associated with the overarching Super Swarm concept, three activities established to support overall program goals and are addressed separately. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase in FY 2022 is due to Project 3459 ramping up to planned funding profile and conducting development and experimentation with multi-domain unmanned systems in order to achieve the swarm goals of the program. Significant increase in effort planned for both small-scale and full-scale platform experimentation to explore and validate methodologies for multi-domain swarm asset control, platform and communications for operation inside of adversary Weapons Engagement Zones, flexible and resilient autonomy architectures, and open architecture and advanced manufacturing techniques to produce low-cost platforms. These events will occur on a rapid (planned bi-monthly) basis to accelerate the learning to inform technical developments as well as Concepts of Employment.					
Accomplishments/Planned Programs Subtotals	0.000	3.983	9.971	0.000	9.971

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3461 / *MASS*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3461: *MASS*	0.000	0.000	0.000	3.491	-	3.491	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level. This is not a new start.

A. Mission Description and Budget Item Justification

The rising use of air, surface, and sub-surface unmanned and autonomous systems requires a paradigm shift in the development, production, and life-cycle management of these systems in order to gain a competitive advantage against adversarial capabilities as well as allow for fielding of significant numbers (1000's to 10,000's) in an increasingly budget-constrained acquisition environment. The growth in rapid prototyping and additive manufacturing technologies presents an opportunity to capitalize on these advances though technical development and demonstration efforts focused on scale-up both in terms of rapid production of relevant quantities as well as greatly increasing the physical size of platforms produced far beyond what is currently achievable. Manufacturing of Autonomous Systems at Scale (MASS) efforts will utilize wide range of advanced manufacturing methods combined with adaptive digital design processes with "Design for Low-Cost Platform Attriteability" as a major attribute to avoid the platform cost growths normally associated with exquisite systems development. This also represents the ability to rapidly modify platform attributes based on evolving operational needs and quickly insert into build process without costly retooling. Secondary goals focus on increasing commonality of critical components across platforms and design of these in modular fashion in order to manage supply chain vulnerability. Lastly, the project will look at ability to place manufacturing capability as far forward/afloat as possible to reduce the logistics tail and speed delivery of capability at-scale into the fleet. The activity identified in Project Unit 3461 MASS specifically addresses Advanced Technology Development in support of the MASS effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Manufacture of Autonomous Systems at Scale (MASS)	0.000	0.000	3.491	0.000	3.491
Articles:	-	-	-	-	-
FY 2021 Plans: N/A					
FY 2022 Base Plans: Continue Manufacturing of Autonomous Systems at Scale (MASS) experimentation and demonstration efforts to build and employ the use of advanced manufacturing methods combined with Designed for Attriteability platforms as the enablers for Project Unit 3459 - Super Swarm - Overwhelming Swarm Effects.					
FY 2022 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3461 / *MASS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level. Efforts focused on large-scale air and surface platforms (both quantities and size) utilizing techniques that could ultimately be forward deployable will initiate. Efforts to demonstrate exercising rapid scale up of supply chain needs will be initiated specifically focusing on air and surface platforms that are appropriate for achieving Concepts of Employment developed under the Project Unit 3459: Super Swarm - Overwhelming Swarm Effects as well as the Deployment and Employment of Autonomous Long Range Systems activity.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	3.491	0.000	3.491

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3461: *MASS*	0.000	0.000	4.487	-	4.487	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3462 / *DEALRS*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3462: *DEALRS*	0.000	0.000	0.000	4.986	-	4.986	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level. This is not a new start.

A. Mission Description and Budget Item Justification

Adversary Anti-Access and Area Denial (A2/AD) capabilities continue to improve but remain focused on targeting specific US and joint force capabilities. The Deployment and Employment of Autonomous Long Range Systems (DEALRS) project will develop technologies that sidestep, operate below the threshold, or deplete adversary A2/AD capabilities. DEALRS will specifically develop technologies to enable low-cost unmanned systems that can maneuver across theater-level ranges to penetrate, operate within, and launch strikes from within adversary A2/AD system coverage. This project will develop technologies to increase the range and endurance of autonomous systems while maintaining tactically relevant speeds, loiter times, and signatures with low cost. It will also address technologies that enable the marsupial launch of terminal engagement autonomous unmanned systems across all domains from larger and/or longer-range host systems that bring them to the launch area and the associated technologies needed to ensure roboticized and autonomous startup and launch of the marsupial systems without human intervention. The Activity identified in Project Unit 3462 DEALRS specifically addresses Advanced Technology Development in support of the INP effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Deployment & Employment of Autonomous Long Range Systems (DEALRS)	0.000	0.000	4.986	0.000	4.986
Articles:	-	-	-	-	-
FY 2021 Plans: N/A					
FY 2022 Base Plans: Continue efforts to demonstrate concepts for the Deployment and Employment of Autonomous Long Range Systems (DEALRS) across all domains. Efforts will focus on scaling up promising concepts to demonstrate trans-Oceanic deployment and employment of large numbers of unmanned systems to deliver desired effects in the areas of operation.					
FY 2022 OCO Plans: N/A					
FY 2021 to FY 2022 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3462 / *DEALRS*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level. Efforts focused on concepts than can leverage mature platform concepts for demonstration and adaptation as carriers for autonomous systems will continue. This includes use of "crafts of opportunity" for conversion to autonomous platforms. This approach will allow for a strong focus on demonstration of automated deployment and employment characteristics associated with delivering Overwhelming Swarm Effects into a contested operating environment addressed in Project Unit 3459 Super Swarm.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	4.986	0.000	4.986

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3462: *DEALRS*	0.000	0.000	5.983	-	5.983	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3463 / *MATes*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3463: *MATes*	0.000	0.000	0.000	3.989	-	3.989	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA3 level. This is not a new start.

A. Mission Description and Budget Item Justification

Traditionally, the utilization of autonomous systems is either operationally segregated from manned operations or requires a significant amount of human oversight when operating in conjunction with manned assets, which mitigates some of the advantage from using them. The goal of the Manned and Autonomous Teams (MATes) project is to develop autonomic robotic technology and collaborative autonomous behaviors that seamlessly operate across all domains in conjunction with manned units, allowing for real-time adaptation and optimization in a manner that streamlines the element of human interaction needed to share mission goals. This technology will monitor human or manned system teammate state, behavior, mission, and adversary threat status to anticipate and act in a tactically appropriate manner that is predictable, communicable, and trusted by the human/manned teammates and which enables autonomous system optimization in coordination with the human/manned teammate and mission objectives. Intuitive human/autonomous system interfaces will be developed to allow focus on higher-order decision-making tasks by the operators allowing for large numbers of autonomous systems (100's or 1000's) to be managed in support of manned operations. The activity identified in Project Unit 3463 MAtes specifically addresses Advanced Technology Development in support of the MATes effort.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: Manned and Autonomous Teams (MATes)	0.000	0.000	3.989	0.000	3.989
Articles:	-	-	-	-	-
FY 2021 Plans: N/A					
FY 2022 Base Plans: Continue efforts to explore autonomy, perception, and command and control (C2) concepts for Manned and Autonomous Teams (MATES) conducting complex multi-domain operations in proximity to each other along a spectrum of missions. Missions range from fully autonomous to highly supervised requiring an agile optimization as real-world factors change.					
FY 2022 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3463 / *MATes*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** This activity is being broken out from Project Unit 3459 Super Swarm to provide increased visibility and focus on this technical challenge area at the BA2 level. Efforts focused on multiple autonomy architectures and their optimization to a changing mission based on perception data and human operator connectivity will continue. The validation of this approach will be done through repeated small-scale experimentation established under Project Unit 3459: Super Swarm - Overwhelming Swarm Effects to gain understanding and trust of autonomy modes under increasingly difficult, changing, or uncertain operating conditions.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	3.989	0.000	3.989

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
• RDTEN/0602792N/3463: *MATes*	0.000	0.000	4.986	-	4.986	-	-	-	-	-	-

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 3464 / *REDCAT*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
3464: *REDCAT*	0.000	0.000	0.000	3.989	-	3.989	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

REDCAT is a stand-alone effort evolved from prior years related research under HIJENKS Project 3416 in this Program Element (PE). The $4M increase is due to funds transferred from Project 3416 HIJENKS to Project 3464 REDCAT in FY 2022 to fund REDCAT. this is not a new start.

A. Mission Description and Budget Item Justification

Remote Electromagnetic Disruption of Critical Advanced Threats (REDCAT) will demonstrate High Power Microwave (HPM) integration onto Naval platforms for air defense missions. The objective of the REDCAT rapid prototyping effort is to demonstrate that the REDCAT system is able to detect, track, engage, defeat and assess advanced threats to the ship in a maritime environment. This HPM payload capability will supplement and conserve the ships kinetic defensive weapons. In addition to advancing the HPM source and antenna technologies, this program will also enhance sensor systems well as common weapon console with ongoing laser programs. REDCAT will also develop novel Radio Frequency (RF) waveforms to improve HPM effectiveness. When combined with other non-kinetic capabilities and integrated with the ship's command and control (C2), REDCAT will provide a low cost-per-shot, deep magazine capability for significantly expanding the self-defense capabilities of US Navy platforms. Rapid engagement of targets for large threat raid defeat is a major feature of the system. The system will demonstrate full kill chain integration from find to assess. The payoffs for the REDCAT program include integrated non-kinetic air defense systems to improve the layered defense, optimized use of defensive kinetic weapons and improved sensor and control systems.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Title: REDCAT	0.000	0.000	3.989	0.000	3.989
Articles:	-	-	-	-	-
FY 2021 Plans: N/A					
FY 2022 Base Plans: Complete HPM payload build, system level performance analysis and mission level modeling. Complete full HPM, sensor and control console system integration. Complete full system land based testing as a risk reduction to at sea testing. Perform capability demonstration in operationally relevant maritime environment against representative threat surrogates. Demonstrate full kill chain integration from find to assess.					
FY 2022 OCO Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
Appropriation/Budget Activity 1319 / 3	**R-1 Program Element (Number/Name)** PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	**Project (Number/Name)** 3464 / *REDCAT*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** REDCAT is a stand-alone effort evolved from prior years related research under HIJENKS Project 3416 in this Program Element (PE). The $4M increase is due to funds transferred from Project 3416 HIJENKS in FY 2022 to fund Proj: 3464 REDCAT.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	3.989	0.000	3.989

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy			Date: May 2021
Appropriation/Budget Activity 1319 / 3	R-1 Program Element (Number/Name) PE 0603801N / *Innovative Naval Prototypes (INP) Adv Tec Dev*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total	FY 2023	FY 2024	FY 2025	FY 2026	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	7.723	20.000	0.000	-	0.000	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2020	FY 2021
Congressional Add: Electromagnetic Railgun ***FY 2020 Accomplishments:*** N/A ***FY 2021 Plans:*** FY21 Congressional Add funds will be used to complete Railgun INP final demonstrations and continue demonstrating Railgun and Hypervelocity Projectile (HVP) capabilities. Funding will also advance HVP development with tests to demonstrate HVP survivability and maneuverability, alternative fire control techniques, and Naval Surface Fire Support. Railgun technology and knowledge attained will be documented and preserved. Railgun hardware will be realigned to maximize its sustainability to facilitate potential future use.	0.000	20.000
Congressional Add: Advanced thermal and power technology for improved DEW SWAP ***FY 2020 Accomplishments:*** N/A ***FY 2021 Plans:*** N/A	7.723	0.000
Congressional Adds Subtotals	7.723	20.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A