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 0603673N *I Future Naval Capabilities Advanced 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**
Total Program Element	0.000	216.798	231.061	265.299	-	265.299	-	-	-	-	-	-
3346: *Future Naval Capabilities Adv Tech Dev*	0.000	215.640	220.061	265.299	-	265.299	-	-	-	-	-	-
9999: *Congressional Adds*	0.000	1.158	11.000	0.000	-	0.000	-	-	-	-	-	-

A. Mission Description and Budget Item Justification

The Office of Naval Research (ONR) was established to ensure the technological advantage of U.S. Naval forces. ONR manages the Department of the Navy's science and technology (S&T) research portfolio (Basic, Applied and Advanced Technology Development investments). This work includes the Future Naval Capabilities (FNC) program, which delivers technology solutions to known requirements and accelerates innovative technology insertion into Programs of Record (PORs). In close and structured coordination with POR Stakeholders (Combat Capability Development organizations, Operating Forces, and acquisition organizations), FNC efforts create revolutionary technology for PORs. ONR's S&T competencies create substantially higher levels of technology, trade space, and capability gain than acquisition can create within POR programmatic risk constraints. FNC projects create exponential technology improvement substantially cheaper than POR vendors do. The structured FNC process and its specific transition mechanisms manage technical risk and increase the likelihood that technologies systematically deploy to warfighters.

The efforts described in this Program Element (PE) 0603673N for FNC Advanced Technology Development use earlier research conducted in PE 0602750N for FNC Applied Research., and have follow-on transition funding commitments in the receiving acquisition Program of Record PEs. Using a competitive selection process, ONR and POR Stakeholders assess and select each effort in this PE based on its revolutionary technology payoff to the naval warfighter and prioritized operating force requirements. FNC requests from POR Stakeholders exceed funding available in the FNC Program and drive the competitive selection.

Due to the classified efforts in this PE, some have incomplete descriptions. ONR can provide additional information in classified documents.

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 0603673N *I Future Naval Capabilities Advanced Tech Dev*

B. Program Change Summary ($ in Millions)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Previous President's Budget	222.477	246.054	268.542	-	268.542
Current President's Budget	216.798	231.061	265.299	-	265.299
Total Adjustments	-5.679	-14.993	-3.243	-	-3.243
• Congressional General Reductions	-	-0.078			
• Congressional Directed Reductions	-	-25.915			
• Congressional Rescissions	-	-			
• Congressional Adds	-	11.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.668	0.000			
• SBIR/STTR Transfer	-4.011	0.000			
• Program Adjustments	0.000	0.000	-2.281	-	-2.281
• Rate/Misc Adjustments	0.000	0.000	-0.962	-	-0.962

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2020	FY 2021
Project: 9999: *Congressional Adds*		
Congressional Add: *Advanced Energetics Research*	0.000	6.000
Congressional Add: *Automated critical care system*	1.158	0.000
Congressional Add: *Development of Submersible Air Revitalization*	0.000	5.000
Congressional Add Subtotals for Project: 9999	1.158	11.000
Congressional Add Totals for all Projects	1.158	11.000

Change Summary Explanation

Funding: not applicable

Technical: not applicable

Schedule: 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 0603673N / *Future Naval Capabilities Advanced Tech Dev*	Project (Number/Name) 3346 / *Future Naval Capabilities 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
3346: *Future Naval Capabilities Adv Tech Dev*	0.000	215.640	220.061	265.299	-	265.299	-	-	-	-	-	-
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Future Naval Capabilities (FNC) Program exploits technology advances and responds quickly to Naval needs. As a result, future Budget Activity (BA) 3 investments supporting the FNC Program are made less than one year before commencing execution. Because FNCs start at higher Technology Readiness Levels (TRL), the typical duration of an FNC is 3-years. The FNC Program favors a high level of collaboration. Program Element R-2 Activities align to warfare areas where the FNC technologies will be integrated into acquisition programs of record.

A complete accounting of FNC technologies and a full disposition of each technology development effort is provided annually 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: Capable Manpower (CMP)	10.449	6.373	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: The Capable Manpower R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts focus on all aspects of training, including accelerated learning, training environments, ready relevant training, and Live-Virtual-Constructive (LVC) training.					
FY 2021 Plans: Learning Continuum and Performance Aid (LCaPA): - Continue development of machine-learning algorithms to process and analyze training data from multiple legacy databases in order to modularize content delivery systems for manpower management. Streamlined Marine After-Action Review Tool - Visualization (SMART-Viz) - Initiate technologies that provide timely and improved feedback to warfighters to enhance learning in live and simulated environments, this FNC is in collaboration with a complementary effort funded in PE 0603640M - Marine Corps Advanced Technology Demonstration.					
FY 2022 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
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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 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The decrease from FY 2021 to FY 2022 is due to completion of all Capable Manpower efforts previously identified in this PE.					
Title: Expeditionary Maneuver Warfare (EMW)	13.866	32.315	38.717	0.000	38.717
Articles:	-	-	-	-	-
Description: The Expeditionary Maneuver Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in PE 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. The advanced technologies being developed under this R-2 Activity include innovative naval mine, mine counter measures (MCM), mine delivery methods, and low observable mine neutralization technologies. ***FY 2021 Plans:*** Single-system Multi-mission Airborne Mine Detection (SMAMD): - Complete activity on multi-mission airborne mine detection. Effort will include integrating the prototype airborne mine detection capability on an unmanned platform (currently targeting the MQ-8C Fire Scout); conducting a final demonstration; and collecting final performance data for transition. The desired outcome of this effort is a single-system, airborne mine detection technology to reduce the MCM timeline and facilitate our capability to counter surface and near surface moored/drifting mines from deep water thru the Surf Zone (SZ), and proud mines on the Beach Zone (BZ), day or night. Low Observable No Collateral Damage-Neutralization (LONCD-N) System: - Continue activity on technologies for low observable mine neutralization without collateral damage. Specific effort includes subcomponent prototype construction, in-water experimentation, and initial data collection. These alternative mine neutralization technologies will enhance the capability of the Maritime Expeditionary Standoff Response (MESR) System of Systems and enable more clandestine MCM operations in support of Joint Forcible Entry Operations (JFEO).					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Compact Encapsulated Mine (C-ENCAP): - Initiate development of an alternative clandestine mine with flexible depth capability, improved lethality, payload agnostic and Weapon System Explosives Safety Review Board (WSESRB)-compliant encapsulation, and multimodal sensing with multi-field planning software. Additional details are classified. ***FY 2022 Base Plans:*** Low Observable No Collateral Damage - Neutralization (LONCD-N) System: - Complete development and sea testing of charges, autonomy, 3D LiDAR and subsea wireless communications, and integrate with the Remotely Operated Vehicle (ROV). Conduct shallow water ocean experiments, demonstrations, and data collection with a fully integrated ROV system. Conduct end-to-end deep sea tests and demonstrations of autonomous attachment of mock charges to surrogate sea mines or critical infrastructure by the ROV system utilizing the 3D LiDAR and subsea wireless communications. Demonstrate additional explosive ordnance disposal missions with the ROV system. Compact Encapsulated Mine (C-ENCAP): - Continue activity on technologies for innovative naval mine and mine delivery methods, and integration of these technologies into integrated minefield planning optimization for mixed and multiple minefields. Specific effort includes subcomponent prototype construction, modelling and simulation of explosive characterization. Additional details are classified. Magnetic & Acoustic Generation Next Unmanned Superconducting Sweep (MAGNUSS): - Initiate development of a modular, closed-loop, non-towed, high temperature, superconducting magnet, coupled with a low-/non-towed acoustic source for use as a deployable influence mine-sweeping payload aboard any unmanned craft of opportunity. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase from FY 2021 to FY 2022 is predominantly due to the start in FY22 of the Magnetic & Acoustic Generation Next Unmanned Superconducting Sweep (MAGNUSS) FNC.					
Title: Air Warfare (AW)	36.783	52.624	53.588	0.000	53.588
Articles:	-	-	-	-	-

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Description: The Air Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts include human machine interfaces for unmanned platforms and payloads that will assist with delegation of resources from one operator to another, airframe corrosion protection, and a Carrier Air Wing performance assessment tool that uses live, virtual, and constructive data to improve pilot and aircrew performance in near real-time. Different software efforts address unique and specific requirements. ***FY 2021 Plans:*** Cross-Domain Unmanned Systems (C-D UxS): - Continue the development of software and strategy to permit messaging between unmanned platforms and payloads in order to operate across the critical safety boundaries for unmanned systems groups. Fleet Adaptive Multilevel Measurement for Operations & Unit Systems (FAM2OUS): - Continue the development of software toolkit to insert Advanced Tactics models into the Next Generation Threat System (NGTS). Implement objective human performance measurement algorithms in the NGTS Analysis and Reporting Tool. Solid State Structural Repair (S3R): - Continue the development of novel ways to repair aircraft structures. Continue with a focus on beginning development of a Design of Experiments (DoE) to identify the Cold Spray process parameters for producing the optimal combination of adhesion, tensile, fatigue and ductility needed to perform structural repairs on Al-7050. The process parameters include gas type, gas pressure, gas temperature, nozzle raster or traverse speed, raster pattern, nozzle standoff distance, surface preparation and nozzle design. Rapid Adaptive Planning for Time Sensitive Offensive Responsive Strike (RAPTORS): - Initiate the development of a many-on-many mission planning tool for salvos of weapons engaging adversary surface action groups. Additional details are classified. Dynamic INtegrated Operations (DINO): - Continue the development of a Warfare Commanders Portal that provides an interface for the digital sharing of information from diverse ISR and mission planning/execution data sources across the entire kill chain. Artificial					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Intelligence is generating and ranking tactical strike mission courses of action based on this data, which will be provided to the Mission Commander. Additional details are classified. Electromagnetic Maneuver Warfare Resource Allocation Management (EMW RAM): - Continue development and demonstration of prototype algorithms and integrated software technologies for own-platform and multi-platform resource and task management of Electronic Warfare (EW) systems. Continue development to enable autonomous distributed airborne EW operations at naval tactical ranges and timelines. The primary objective is to develop multi-aircraft technologies for collaborative many-on-many manned & unmanned EW operations across all jamming ranges. Prototype software development and documentation includes an EW Battle Management (EWBM) framework, an advanced EW Adaptive System Management for lower-level resource allocation management, and own-platform hybrid teaming between naval aircrews and machines for improving tactical mission effectiveness while reducing human workloads. Advanced Capability Expansion (ACE): - Continue the development of hardware and software that focus on extended range targeting and radar electronic attack protection for the E2-D Advanced Hawkeye APY-9 Radar Sub-System. Additional details are classified. Enhanced Lethality for Maritime Operations (ELMO): - Initiate development of new Multi-Function Sensor (MFAS) modes for the MQ-4C Triton Unmanned Aircraft System (UAS), enhancing Distributed Maritime Operations (DMO) with the Next Generation Network (NGN). This effort is in collaboration with a complementary effort funded in PE 0603640M - Marine Corps Advanced Technology Demonstration, Additional details are classified. Landing Autonomous Navigation Technology for Enhanced Recovery to Navy Ships (LANTERNS): - Initiate development of enhanced, Precise Ship-Relative Navigation (PS-RN) for reliable autonomous ship recovery of Unmanned Aerial Systems (UAS) in all weather, high deck motion environments. Additional details are classified. ***FY 2022 Base Plans:*** Cross-Domain Unmanned Systems (C-D UxS): - Complete C-D UxS effort by employing software in NAVAIR simulator and at Advanced Naval Technology Exercises (ANTX) to demonstrate, assess and mature software for Transfer of Tactical Control (ToTC) of					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Unmanned Vehicles (UxVs), payloads or data. Demonstrate the implementation of ToTC through a Human Machine Interface that works through the PMA-281 Command Control System Program of Record. Extend C-D UxS ToTC concepts to specifically address requirements of MQ-25 unmanned air vehicle. Fleet Adaptive Multilevel Measurement for Operations & Unit Systems (FAM2OUS): - Complete effort by testing FAM2OUS performance measures in relevant simulation environment to quantify impact on mission effectiveness. Test and evaluate the FAM2OUS software toolkit with Advanced Tactics models implemented in the Next Generation Threat System (NGTS) at the Integrated Training Facility (ITF) in support of the Integrated Air Defense Course (IADC). Solid State Structural Repair (S3R): - Complete development by finalizing special tooling design required to enable in-situ repair, conducting the necessary validation and verification to enable flight clearance approval, demonstrating in-situ repair across multiple platforms (V-22 and F/A-18) and parts, including flight critical components, and conducting flight operations. Rapid Adaptive Planning for Time-Sensitive Offensive Responsive Strike (RAPTORS): - Complete development of dynamic tactical mission planning tools. Specific focus on integration into micro service architecture, software delivery and laboratory demonstration. Dynamic INtegrated Operations (DINO): - Complete development of software components that work with the Next Generation Naval Mission Planning System (NGNMPS) to enable a decision engagement environment for continuous over-the-horizon (OTH) weapon employment while ensuring targeting chain-of-custody is maintained. Additional details are classified. Electromagnetic Maneuver Warfare Resource Allocation Management (EMW RAM): - Complete development and demonstrate prototype algorithms and integrated software technologies for own-platform and multi-platform resource and task management of EW systems that enable autonomous distributed airborne EW operations at naval tactical ranges and timelines. Advanced Capability Expansion (ACE):					

Exhibit R-2A, RDT&E Project Justification: PB 2022 Navy		Date: May 2021
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Complete the development of hardware and software and demonstrate via ground and flight test capabilities that focus on extended range targeting and radar electronic attack protection for the E2-D Advanced Hawkeye APY-9 Radar Sub-System. Additional details are classified. Enhanced Lethality for Maritime Operations (ELMO): - Continue development of ELMO performing Counter Electronic Attack (CEA)-1/2 build 1 surrogate flight test and analysis. Procure Hardware Processing Bench and Software Development for Advanced CEA Mode Development. Initiate development of CEA-2 Bld-2. Additional details are classified. Landing Autonomous Navigation Technology for Enhanced Recovery to Navy Ships (LANTERNS): - Continue development of enhanced, Precise Ship-Relative Navigation (PS-RN) for reliable autonomous ship recovery of Unmanned Aerial Systems (UAS) in all weather, high deck motion environments. Specific focus on preliminary designs, down select to single vendor and prototype laboratory demonstrations. Additional details are classified. Incapacitation Prediction in Readiness Domains: an Integrated Computational Tool (I-PREDICT): - Initiate development of a computational model of the living warfighter that enables prediction of injury risk for both acute traumatic and chronic repetitive operational exposures. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The moderately increased investment in AW from FY 2021 to FY 2022 is due primarily to the initiation in FY22 of I-PREDICT and the ramp-up in FY22 of ELMO.					
Title: Information Warfare (IW)	60.705	41.591	59.966	0.000	59.966
Articles:	-	-	-	-	-
Description: The Information Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts provide Information Warfare capabilities across several disparate uses and environments.					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
FY 2021 Plans: SCAMM: - Complete development of SCAMM for the Ship's Signal Exploitation Equipment (SSEE) program. Additional details are classified. Propagation Channel Assessment and Prediction (PCAP): - Complete the development and testing of software and algorithms for ship Radio Frequency (RF) systems that incorporate observed and predicted atmospheric conditions to provide ranges against signals of interest. It will also involve integration of PCAP into SLQ-32(V)6 Program of Record for final demonstration and testing. Acoustic Automation Processing for Undersea Surveillance Barriers: - Complete development of Acoustic Automated Processing (AAP) for Fixed Surveillance Systems. Specific effort will include delivering software and algorithms that automate the processes of cross-sensor correlation and signature recognition. Conduct testing to ensure these algorithms achieve suitable probability of detection vs. very quiet targets at the required range and reduce the False Alarm Rate. Complete refinement of prototype algorithms and then test and integrate them into the Fixed Surveillance System (FSS). This is in preparation for demonstration at the PMS 485 Test Bed Facility. The desired outcome is to provide early warning of threat submarines intruding into the ocean commons to the warfighter via the Fixed Surveillance System (FSS). This will aid in protecting the sea lines of communication between the United States and its allies and partners. This is directly supporting the CNO's "Design for Maintaining Maritime Superiority, version 2, Line of Effort Blue: Strengthen Navy Power at and from the Sea." ACES: - Complete development of advanced adversary platform identification from non-traditional methods. Demonstrate this capability in an autonomous vehicle. Complete current and emerging protocol analyses. Additional details are classified. Extended Range-Directional Frequency Analysis and Recording (ER-DIFAR) Sonobuoy: - Continue building and demonstrating an A-size (i.e., fits existing standard sonobuoy deployment chute) passive sonobuoy system capable of delivering the required array gain for target detection, localization, and measurement at the required range. Continue development of the Build 2 software using the prototype array and Build 1 software prototypes with lake test data. Conduct an at-sea checkout and integration into the into Build 1					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
processor hardware in the laboratory configuration. The desired outcome for ER-DIFAR is to provide acoustic intelligence to the Type Commander to aid in decisions for achieving readiness in warfighting enterprises in accordance with CNO's "Design for Maintaining Maritime Superiority version 2.0, Line of Effort Blue: Strengthen Navy Power at and from the Sea" Advanced Naval Super Wideband Energy Reciever (ANSWER): - Continue development of a next generation recorder capable of processing a minimum of 20GHZ of simultaneous dynamic bandwidth. Demonstrate the recorder in the field to collect metrics and performance for rapid technology insertion into Naval systems. Additional details are classified. High Frequency Ionospheric and Ocean Scatter for Tactical Maneuver (HIFIOS-TM): - Complete development of this FNC for the Ships Signal Exploitation Equipment (SSEE) Family of Systems (FoS) Medusa-Next program. Additional details are classified. Water-space Planning and Execution for Theater Undersea Warfare (WasP-ET): - Initiate development of a dynamic and adaptive Prevention of Mutual Interference / Water Space Management (PMI/ WSM) application that works in a multi-level security environment, enabling integration of allied and coalition forces with a process that involves sound operations research, machine learning, and intelligent agent capabilities. Long Endurance Airborne Platform (LEAP) Decoy: - Initiate development of a rapidly deployable, long endurance, unmanned, airborne advanced decoy with an advanced electronic warfare capability that can counter varied threats while maintaining continuous ship communications. DECAF: - Initiate development of a new information warfare capability termed DECAF. Additional details are classified. ***FY 2022 Base Plans:*** The increase in Information Warfare funding from FY 2021 to FY 2022 is primarily due to the initiation of three high priority FNCs in FY 2022: MACE, DF-MOTF, and SI^2. The initiation of Multi-Beam Array for Cooperative					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Engagement (MACE) will provide the first fully digital communications system in the fleet, and the design of this communications system will be adaptable for other shipboard and expeditionary systems. The initiation of a fully informed Data Framework for the Maritime Operations Centers of the Future (DF-MOTF) is a significant Fleet priority for warfighting that can only be discussed in a classified forum. The initiation of the SLQ 32 Signal Identification Improvements (SI^2) FNC will increase the survivability of surface platforms by making urgently needed improvements to the Navy's Electronic Warfare program of record. Extended Range - Directional Frequency Analysis and Recording (ER-DIFAR) Sonobuoy: - Complete development and testing of an A-size passive sonobuoy system capable of delivering the required array gain for target detection, localization, and measurement at the required range. Advanced Naval Super Wideband Energy Receiver (ANSWER): - Complete development of advanced algorithms and signal processing capabilities for integration with next-generation, super-wide bandwidth recording systems. Demonstrate the capability in the field for rapid technology insertion into naval systems. Additional details are classified. Water-space Planning and Execution for Theater Undersea Warfare (WasP-ET): - Continue development of a dynamic and adaptive Prevention of Mutual Interference/Water Space Management (PMI/ WSM) application that delivers a new weapons engagement planning capability for Anti-Submarine Warfare (ASW) scenarios. Continue the development of machine learning and optimization algorithms that automatically de-conflicts blue on blue weapon engagements while dynamically assigning blue on red engagements based on exploited intelligence information and tactical contact reporting to generate probabilistic estimates of target location, intended mission, and projected location. Long Endurance Airborne Platform (LEAP) Decoy: - Continue development of LEAP Technologies. Due to FY21 funding cuts, FY22 Plans have been compressed with the CounterMeasure (CM) preliminary design review scheduled in the 1st Quarter, followed by detailed design, which will include the launcher. Planned risk reduction tests will include a chamber test measuring antenna isolation performance. CM component and integration tests will be conducted and test plans will be developed for tethered and untethered flight tests of two prototypes. DECAF:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Continue DECAF by finishing the underlying analysis and continuing development of a new information warfare capability for a field demonstration. Additional details are classified. Data Framework for Maritime Operations Center of the Future (DF-MOTF): - Additional details are classified. Multi-Beam Array for Cooperative Engagement (MACE): - Initiate development of a new fully digital, multichannel, multi-beam, communications capability for the Navy's Cooperative Engagement Capability (CEC) to enable significantly more targets to be tracked and engaged. SLQ 32 Signal Identification Improvements (SI^2): - Initiate development of new technology that extends existing machine learning based electronic warfare classification systems and expands their capabilities to detect and more accurately characterize modern emitters not accurately captured with existing systems. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase from FY 2021 to FY 2022 is primarily due to the initiation of three high priority FNCs in FY 2022: DF-MOTF, Multi-Beam Array for Cooperative Engagement (MACE), and SLQ 32 Signal Identification Improvements (SI^2).					
Title: Surface Warfare (SW)	43.399	40.534	52.990	0.000	52.990
Articles:	-	-	-	-	-
Description: The Surface Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts include technologies that will provide mission visualization, network analysis, and training for operators in denied and degraded environments. ***FY 2021 Plans:*** SCRAM:					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Complete development of SCRAM for Hull, Mechanical and Electrical (HM&E) systems, combat and navigation systems, and the NATO Sea Sparrow Missile System (NSSMS) program. Additional details are classified. Fleet Training Technologies (FleeT2): - Complete a cross-platform, mission-centric, simulation for training and assessment of staff and operators in denied and degraded environments. Develop tools to permit more real-time debriefing of operators and command staff. Standard Missile Qualified Universal Initiation Baseline (SQUIB): - Complete maturation of an Electronic Ignition Safety Device (EISD)/Safety Module Assembly and integrate it into prototypical Rocket Motors in STANDARD Missile 6 (SM-6) Block IB Demonstration Propulsion Units (DPUs). The resulting Technical Data Package (TDP) will serve as a basis to issue an Request for Proposals (RFP) for transition of the EISD/Safety Module Assembly to a contractor for industry upgrade, ensuring producibility and Design Verification Testing (DVT). Receive-Only Cooperative Radar (ROCR): - Continue to develop a receive-only capability for the SPY-6 product line that improves situational awareness during Emissions Control (EMCON) and improves radar timelines with advanced waveforms for communications and radar operations. Hypersonic-threat Dynamic Reassessment and Adaptation (HyDRA): - Continue to develop modifications to the AEGIS Weapon System. Additional details are classified. Robust Combat Power Control (RCPC): - Initiate development of a power control system enabling tactical energy management within a ship's Integrated Power and Energy System (IPES), employing shared zonal energy storage to ensure power and energy accessibility to all mission critical equipment. Electronic MIMO Protection for Ensured Radar Effect (EMPIRE):					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Initiate development of efficient computational techniques for signal processing on SPY-6 for a heterogeneous processing framework, improving resilience and situational awareness in contested electromagnetic environments and increasing the capacity for distributed maritime operations and the survivability of platforms.					
FY 2022 Base Plans: The increase in Surface Warfare from FY 2021 to FY 2022 is primarily due to the initiation of three high priority FNCs in FY22: ASPIRE, Amon Hen and CHAOS. Agnostic Signal Processing for Increased Radar Efficiency (ASPIRE) will improve operations in highly contested and environmentally complex waters by increasing the Navy's capability for distributed maritime operations and long-range targeting. Amon Hen will provide the Fleet with improved situational awareness, increasing the survivability of the High Value Unit while it operates in EMCON. Conventional Ammunition High Density Reactive Material Augmented Ordnance Systems (CHAOS) will increase the lethality of conventional weapon projectiles. Several efforts involving the SPY-6 each involve unique, specific, and needed aspects of the entire system.					
Fleet Training Technologies (FleeT2): - Complete development of FleeT2 by extending simulations and training technologies to include models for theater specific operations in denied/degraded environments (D2E) for Strike Group Warfare Commanders. This includes developing D2E training interventions and adapted models for Strike Group Commanders and additional D2E models that address anticipated adversarial tactics and techniques for strike group training and certification.					
Receive-Only Cooperative Radar (ROCR): - Complete development of a receive-only capability for the SPY-6 product line that improves situational awareness during Emissions Control (EMCON) and improves radar timelines with advanced waveforms for communications and radar operations					
Hypersonic-threat Dynamic Reassessment and Adaptation (HyDRA): - Complete development of modifications to the AEGIS Weapon System. Additional details are classified.					
Robust Combat Power Control (RCPC): - Continue to develop and implement the control layers of the shipboard Tactical Energy Management as described in the 2019 Electric Ships Technology Development Roadmap, with the FY22 focus being on the					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
controls implementation on a notional ship reference system instantiated using a Power Hardware In-the-Loop (PHIL). This effort will enable shipboard power for future electric weapons. Electronic MIMO Protection for Ensured Radar Effect (EMPIRE): - Continue development of efficient computational techniques for signal processing on SPY-6 for a heterogeneous processing framework, improving resilience and situational awareness in contested electromagnetic environments and increasing the capacity for distributed maritime operations and the survivability of platforms. Agnostic Signal Processing for Increased Radar Efficiency (ASPIRE): - Initiate development of new technology that increases the performance and reduces the size, weight, power and cost of the SPY-6 digital receiver and exciter, beam-former and backend signal processor to counter the proliferation of advanced threats and support distributed radar network operations within contested waters. Amon Hen: - Initiate development of a low cost portable multi-sensor multi-function C5ISR-T capability that is supports a maneuverable illuminator for unmanned surface vehicles that is compatible with SPY-6 and other radars receiving apertures. Conventional Ammunition High Density Reactive Material Augmented Ordnance Systems (CHAOS): - Initiate development of the capability to integrate High Density Reactive Material (HDRM) into conventional ammunition. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase from FY 2021 to FY 2022 is primarily due to the initiation of three high priority FNCs in FY22: Agnostic Signal Processing for Increased Radar Efficiency (ASPIRE), Amon Hen, and Conventional Ammunition High Density Reactive Material Augmented Ordnance Systems (CHAOS).					
Title: Undersea Warfare (UW)	50.438	46.624	60.038	0.000	60.038
Articles:	-	-	-	-	-

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
Description: The Undersea Warfare R-2 Activity focuses on the advanced technology development of new capabilities that leverage the underlying applied research investments in Program Element (PE) 0602750N, Future Naval Capabilities (FNC) Applied Research. These advanced technology investments align to acquisition programs of record. Efforts include improvements to a broad range of undersea warfare capabilities, including undersea weapons, submarine acoustic sensing and signal processing systems, communications, electro-optics systems, signature management, training, and decision aids. ***FY 2021 Plans:*** Stern Area System: - Continue development to conduct the first at-sea trial test series to evaluate system performance and begin testing and analysis. Trial data will be analyzed to inform system updates and preparations. System dock-side testing and shipbuilder trials will be completed in FY 2021 to confirm system installation and function to complete ship Post Shakedown Availability (PSA) period. Additional details are classified. System for Non-Acoustic Control of Signatures (SNACS): - Complete vendor fabrication and delivery of six prototype radar camouflage units (RCU) to the Navy for mechanical, environmental and signature performance testing. Electronic Warfare Micro-Adaptive Trainer (EW-MAT): - Complete the advanced technology development of a submarine Electronic Warfare training capability that combines a digital RF simulation generator and a micro-adaptive training engine that emulates one-on-one human tutoring experience by adjusting instruction to target individual trainee needs. Diver Augmented Vision Display with Enhanced Communications (DAVD): - Continue development of augmented and mixed reality interfaces for divers as well as software that provides top-down, real-time view of diver's environment for navigation and location of targets. Continue development of telemetry system that a diver uses to enable communication and control of Remotely Operated Underwater Vehicle. Avalanche: - Continue activity on Unmanned Underwater Vehicle persistence and infrastructure. The specific effort will involve the development and maturation of technologies for autonomous, non-wet, mateable-transfer of energy					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
and data in support of long endurance missions for unmanned undersea vehicles and seabed warfare. It will also include the development of long endurance autonomy and hardware solutions for fixed and deployable energy sources and heterogeneous communication networks. Submarine Propagation Channel Assessment and Prediction (subPCAP): - Continue algorithm maturation and building prototype software to incorporate observed and predicted atmospheric conditions, especially in the immediate air-ocean boundary layer, into a submarine's passive radio frequency (RF) sensor assessment. Compact Rapid Attack Weapon (CRAW) Upgrade: - Continue the development of advanced ASW capability software and conduct in-water testing. Continue software and hardware modifications to enable integration with the host platform. Continue the ASW capability software baseline development and performance validation. Advanced Broadband Navigation Sonar System (ABNSS): - Continue development and transition of new sonar waveforms for the submarine force for employment in the navigation sonar system to improve performance and reduce operational constraints. VIRGINIA Improved Propulsion Bearing (VIPB): - Initiate development of an improved propulsor bearing for demonstration on a VIRGINIA Class submarine in order to reduce the risk of introducing the bearing on the new COLUMBIA Class submarine. Additional details are classified. Submarine Tethered Expendable Buoy: - Initiate development of a free-floating, tethered buoy for Intelligence, Surveillance and Reconnaissance (ISR) data collection and satellite communications in order to improve submarine stealth. ***FY 2022 Base Plans:*** The increase in Undersea Warfare from FY 2021 to FY 2022 is primarily due to the ramp up of technology development efforts for the VIPB FNC and the initiation in FY 2022 of two high priority FNCs: M2P2 and M&M. The VIRGINIA Improved Propulsion Bearing (VIPB) is a highly important FNC for the submarine program that reduces Risk reduction for the COLUMBIA class submarine. Commencing the manufacturing of a full-scale					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
prototype bearing and starting the fabrication of the scale shaft-line test bed in FY22 are the reasons this FNC's cost went up substantially. The Multi-Material Propeller Prototype (M2P2) will reduce the weight of submarine propellers enabling greater payload fraction/speed and will reduce the cost of Fleet operations as it will be removable and repairable without needing to dry-dock. The MK-48 Acoustic Modifications (M&M) FNC will substantially improve this heavyweight torpedo's probability of kill. Stern Area System (SAS): - Continue analysis of FY21's first SAS at-sea trial. Analysis will include the evaluation of SAS system hardware and software performance, and preparations for a full functional SAS demonstration at sea in FY23. Additional details are classified. Diver Augmented Vision Display with Enhanced Communications (DAVD): - Complete development of DAVD by coordinating demonstration and acceptance testing with NAVSEA OOC and Fleet Units as the system migrates to DAVD Gen 3. Working with Fleet and Technical Representatives; develop preventive maintenance plans for the entire DAVD System (topside box, tether and Helmet system to include integrated sonar systems) and integrate procedures into the Navy Preventive Maintenance System (PMS). Avalanche: - Complete this activity on undersea persistence and infrastructure. The prototyping of long endurance autonomy and hardware solutions for fixed and deployable energy sources and heterogeneous communication networks will be complete and a system of systems design package complete. Submarine Propagation Channel Assessment & Prediction (subPCAP): - Complete software integration of the environmental assessment and prediction module within the BLQ-10 and APB programs. Compact Rapid Attack Weapon (CRAW) Upgrade: - Continue this FNC with an in-water demonstration of the Anti-Submarine Warfare (ASW) capability with a submarine launched CRAW. Advanced Broadband Navigation Sonar System (ABNSS):					

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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2020	FY 2021	FY 2022 Base	FY 2022 OCO	FY 2022 Total
- Complete development and transition of new sonar waveforms for the submarine force for employment in the navigation sonar system to improve performance and reduce operational constraints. VIRGINIA Improved Propulsion Bearing (VIPB): - Continue this FNC with the FY22 focus to include the start of manufacturing of the full-scale VIRGINIA prototype bearing and the start of fabrication of components of the scale shaft-line test bed. Additional details are classified. Submarine Tethered Expendable Buoy: - Continue development of buoy prototype by testing sensor payload, fiber deployment, and launcher. Multi-Material Propeller Prototype (M2P2) - Initiate development of techniques for incorporating multi-materials into propeller design to reduce propeller weight, while providing the required thrust. Benefits include greater ship design flexibility and reduced cost to the Fleet for operations and repair. Additional details are classified. MK-48 Acoustic Modifications (M&M) - Initiate development of acoustic modifications to the MK-48 torpedo that will improve the weapon's probability of kill. ***FY 2022 OCO Plans:*** N/A ***FY 2021 to FY 2022 Increase/Decrease Statement:*** The increase from FY 2021 to FY 2022 is primarily due to the initiation in FY 2022 of two high priority FNCs: M2P2 and MK-48 Acoustic Modifications, and the ramp-up in FY 2022 of development efforts for the VIRGINIA Improved Propulsion Bearing (VIPB) FNC.					
Accomplishments/Planned Programs Subtotals	215.640	220.061	265.299	0.000	265.299

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

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D. Acquisition Strategy

N/A

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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	1.158	11.000	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: Advanced Energetics Research ***FY 2020 Accomplishments:*** N/A ***FY 2021 Plans:*** FY21 funds will be used toward the advanced demonstration of energetic materials in weapon system applications to include: high performance solid rocket propulsion, advanced liquid fuels for air breathing weapon system propulsion, novel advanced warhead demonstrations focused on advanced ship defeat capabilities, and the demonstration of modeling and simulation capabilities to predict weapon system lethality and effectiveness specifically accounting for non-traditional lethal effects and the quantification of their damage potential on adversary weapon systems.	0.000	6.000
Congressional Add: Automated critical care system ***FY 2020 Accomplishments:*** N/A ***FY 2021 Plans:*** N/A	1.158	0.000
Congressional Add: Development of Submersible Air Revitalization ***FY 2020 Accomplishments:*** N/A ***FY 2021 Plans:*** Conduct advanced technology development of submersible air revitalization.	0.000	5.000
Congressional Adds Subtotals	1.158	11.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A