Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy											Date: February 2018	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*					R-1 Program Element (Number/Name) PE 0603573N *I Advanced Surface Machinery Sys*							
COST ($ in Millions)	**Prior Years**	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	195.686	30.255	29.953	22.109	-	22.109	21.251	20.799	21.213	21.667	Continuing	Continuing
2471: *Integrated Power Systems (IPS)*	195.686	30.255	29.953	22.109	-	22.109	21.251	20.799	21.213	21.667	Continuing	Continuing

A. Mission Description and Budget Item Justification

The FY 2019 funding request was reduced by $0.092 million to reflect the Department of Navy's effort to support the Office of Management and Budget directed reforms for Efficiency and Effectiveness that include a lean, accountable, more efficient government.

This Program Element (PE) includes the development of advanced surface ship hull, mechanical, and electrical (HM&E) components and systems for all future ships and back-fit ships where appropriate as well as development of Cybersecurity Boundary Defense Capabilities for HM&E systems. This PE is managed by PMS 320, the Electric Ships Office, located organizationally within PEO SHIPS, responsible for developing Naval Power and Energy Systems that focus power system integration of Directed Energy (DE) and other high powered mission systems as well as platform integration and improving energy efficiency of those components and systems. The mission of PMS 320 is to develop and provide smaller, simpler, more affordable and more capable electric power systems for all Navy platforms, focus Navy and industry investments, and reduce total ownership cost.

This PE serves as the bridge between Science and Technology (S&T) and ship platform and mission systems acquisition programs by identifying prospective applications for S&T research, advanced development, and performing additional product development and qualification when necessary to meet platform or mission system requirements. This PE also includes HM&E cybersecurity Boundary Defense Capability (BDC) development. The HM&E systems to be protected from cyber-attack by BDC include Machinery Control Systems, Electric Power Systems, Damage Control and Firefighting, Auxiliary Machinery and Fluid Systems, Engines and Power Transmission Systems, Gas Turbine Systems, Video Systems, as well as other HM&E systems. Cybersecurity BDC will allow the ship to better protect, detect, respond, and recover from a cyber attack.

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy					Date: February 2018
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 4: *Advanced Component Development & Prototypes (ACD&P)*			R-1 Program Element (Number/Name) PE 0603573N *I Advanced Surface Machinery Sys*		
B. Program Change Summary ($ in Millions)	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**
Previous President's Budget	36.655	29.953	22.596	-	22.596
Current President's Budget	30.255	29.953	22.109	-	22.109
Total Adjustments	-6.400	0.000	-0.487	-	-0.487
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.604	0.000			
• Program Adjustments	0.000	0.000	-0.092	-	-0.092
• Rate/Misc Adjustments	0.001	0.000	-0.395	-	-0.395
• Congressional Directed Reductions Adjustments	-5.797	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy			Date: February 2018
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603573N / *Advanced Surface Machinery Sys*	Project (Number/Name) 2471 / *Integrated Power Systems (IPS)*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
2471: *Integrated Power Systems (IPS)*	195.686	30.255	29.953	22.109	-	22.109	21.251	20.799	21.213	21.667	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This project supports the development and transition of Naval Power and Energy Systems including power generation, power conversion, power distribution, energy storage, power utilization and automation and control functions for fully integrated electric propulsion (such as T-AKE -1 class or DDG 1000 class), hybrid electric propulsion (such as LHD 8 and LHA(R) class), as well as legacy mechanical propulsion ships (such as DDG51 class). This project supports optimized integration of Directed Energy (DE) and other high powered mission systems, appropriate component and system controls, integration of components and systems into future and current ships, and providing power and energy system solution alternatives to new and existing platforms. Existing ships' power systems require optimized integration via energy storage and advanced controls techniques to withstand the effects of DE and other high powered mission systems and avoid negative impacts to power generating equipment (diesel/gas turbine engines and generators).

Project developments are aligned with the Navy's 30 year shipbuilding plan via the Naval Power and Energy Systems Technology Development Roadmap (TDR), which outlines the way ahead for future developments and provides a basis for coordinated planning and investment by the Navy and private industry.

This project develops and transitions products that electrically integrate and provide power to mission systems, integrates those components and systems into ship platforms, increases energy efficiency, and provides cybersecurity capabilities for current in-service Hull, Mechanical and Electrical (HM&E) systems as well as future systems.

The systems developed by this Project are by their very nature the foundation of the ships kill chain, and are developed with efficiency requirements as part of total life cycle cost minimization. Efforts within Power and Energy Systems are to design, develop, test and integrate shipboard power systems to incorporate advanced sensors, directed energy and other advanced weapons. Design and testing includes modeling and simulation, as well as land based testing, to reduce risk and demonstrate readiness for shipboard use.

Cybersecurity: Develops an approach to implement a cybersecurity Boundary Defense Capability (BDC) for HM&E control systems on surface ships. The HM&E systems to be protected from cyber-attack by BDC include machinery control systems, electric power systems, damage control and firefighting, auxiliary machinery and fluid systems, engines and power transmission systems, gas turbine systems, video systems, as well as other HM&E systems. Design and technical data packages for software and hardware solutions will be developed. Cybersecurity BDC will allow the ship to better protect, detect, respond, and recover from cyber-attack.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Power and Energy Systems	16.999	16.024	13.241	0.000	13.241

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Articles:	-	-	-	-	-
FY 2018 Plans: Complete manufacture and Factory Acceptance Testing (FAT) and deliver the 4.2MW AG9160RF Gas Turbine Generator (GTG) to the Naval Surface Warfare Center (NSWC) - Philadelphia, PA for DDG51 Flight III electrical integration testing. The AG9160RF Gas Turbine Generator (GTG) is an upgrade to the DDG1000 auxiliary gas turbine and will provide increased power to meet DDG51 Flight III requirements for advanced sensors and future weapons with reduction in life cycle costs through increased fuel efficiency over legacy gas turbine generator sets. Conduct First Article Test and Power Hardware in the Loop (PHIL) testing at Florida State University Center for Advanced Power Systems (FSU CAPS) on Air and Missile Defense Radar (AMDR) Power Conversion Modules (PCM) Low Rate Initial Power (LRIP) units. Complete Environmental Qualification Test (EQT) and support delivery and installation of AMDR PCM LRIP units for PCM / AMDR combat system integration testing. Deliver AMDR PCM LRIP units to DDG51 Flight III land based test site. Continue to provide support for AMDR PCM units during PCM / AMDR combat system integration testing and electrical system validation testing at the DDG 51 Flight III test sites. AMDR PCM provides power conversion from ship's 4160 Volts Alternating Current (VAC) distribution systems to 1000 Volts Direct Current (VDC) to support the AMDR on DDG 51 Flight III Class Ships. Continue planning for future gas turbine operational readiness and fuel efficiency upgrades. In order to obtain early insight into the effects of high power and energy mission systems on ships electric power systems, evaluate shipboard power and energy systems, and evaluate power system performance at lower cost than full-scale hardware system testing, simulated electrical system integration testing using power and energy system components will be conducted at the Center for Advanced Power System at Florida State University (FSU CAPS). This lower-cost approach to testing is referred to as Power Hardware In the Loop (PHIL). PHIL includes development of component computer models that simulate and emulate actual operating machinery components and shipboard power and energy systems. PHIL testing replaces component models with hardware once hardware development is complete. PHIL testing costs less than full-scale hardware system testing, shortens development time, and affords the opportunity to identify and mitigate risks in a deliberate fashion from specification development to computer model development to hardware development resulting in a more affordable and robust end product. PHIL testing reduces developmental risk, and demonstrates performance potential prior to live hardware integration testing.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Receive, install, check-out, and integrate the Energy Storage Module (ESM) prototype into the test site at FSU CAPS. Conduct PHIL testing of the ESM prototype to demonstrate Energy Magazine (EM). Energy Magazine (EM) serves as the energy resource to enable the introduction of pulsed high power and energy weapons and sensor systems by providing a buffered interface between legacy power systems and new generation weapons and sensors. (Note: The ESM prototype will be tested at FSU CAPS and results will be exchanged with the United Kingdom (UK) Ministry of Defence (MOD) via the Advanced Electrical Power and Propulsion Project (AEP3) Project Arrangement and the OSD Coalition Warfare Program (CWP) Directed Energy Power Systems (DEPS) project.) Conduct PHIL testing of emulated high powered weapons and sensors into ships electrical systems at FSU CAPS. Complete simulated electrical system integration testing of multiple pulsed mission systems integrated into a single branch of a ship's power system in stressing scenarios requiring controlled power flow. Complete simulated electrical system integration testing of multiple pulsed mission systems along with a large sensor load integrated into a new notional Medium Voltage Direct Current (MVDC) Integrated Power & Energy System (IPES) architecture, focused on demonstrating fault detection and isolation utilizing new MVDC circuit breakers developed by ONR and transitioning to PMS 320. IPES adds distributed EM functionality and advanced cyber safe controls to the Integrated Power System of ships such as DDG1000 for enhanced survivability, efficient sharing of power and energy resources between ship propulsion, mission systems and ship service loads. Conduct design review of the ESM prototype for use in Stable Backup Power (SBP) applications, identify necessary modifications required and appropriate test configurations. Evaluate ESM prototype for use in providing shipboard energy storage to reduce individual component Uninterruptible Power Supply (UPS) systems. Continue to refine real time simulation models of various ship classes to reflect learning and state of ongoing development of power and energy system components and pulsed, high power and energy weapons and sensor systems (i.e. Directed Energy Weapons, e.g. laser). Complete planning for FY 19 simulated electrical system integration testing using real time power hardware in the loop at FSU CAPS.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Continue to develop performance specification and required attributes for next generation compact high power Advanced Power Generation Module (APGM). Develop computer component models and commence system level modeling and simulation efforts.					
FY 2019 Base Plans: Increased warfighting capabilities using pulsed high power and energy weapons and sensors (i.e., lasers, advanced radars, etc.) require shipboard energy storage systems to buffer the interface between legacy ship electric distribution systems and the power and energy requirements of new generation weapons and sensors. Prior to FY19, this PE has designed, built, and tested the Energy Storage Module (ESM) prototype. Lessons learned from ESM prototype development are being incorporated into the Energy Magazine (EM), an energy storage system with advanced controls, to serve as the energy resource to enable the introduction of pulsed high power and energy weapons and sensor systems. When fully integrated, EM is expected to also reduce the number of Uninterruptable Power Supply (UPS) on ships which decreases maintenance and costs. The EM energy storage system includes power electronics, controls, power conversion components, and energy storage media. Pulsed high power and energy weapons and sensors require different levels of power and energy storage devices with system specific dynamic interfaces (how quickly power/energy is required). As part of EM development, this PE is pursuing a variety of energy storage media and a common interface to these various storage media for ease of inter-operability in the future. Examples of energy storage media include batteries (i.e., lithium iron phosphate), capacitors, ultra-capacitors, and flywheels. Develop and deliver executable models and an EM Model Description Document (MDD) that capture the behavior of the system, conduct control system analysis, generate detailed interface requirements, and generate test scenarios and sequences. Continue development of an EM software control system emulator to validate the performance and interfaces of the EM controls. Begin acquiring hardware, fabricate assemblies, and commence component level testing and assembly of the EM prototype unit. The hardware includes the storage media, power electronics, interconnecting cabling, and associated equipment. Prepare for the future transition of Advanced Controls developed by ONR's Robust Combat Power Control Future Naval Capability (FNC) to this PE in FY21. Advanced Controls take full advantage of power and energy resources within the ship's machinery control system to deliver mission systems the power and energy they require when required. Advanced controls configure the system to operate at max efficiently when appropriate					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
and switch to max performance when necessary though three-way communication and control between the machinery control system, mission planning and pulsed high power and energy weapon systems and sensors. This PE has developed a low-cost approach to testing, referred to as PHIL, which employs computer models that simulate and emulate actual operating machinery components and shipboard power and energy systems. PHIL testing replaces component models with hardware once hardware development is complete. PHIL testing costs less than full-scale hardware system testing, shortens development time, and affords the opportunity to identify and mitigate risks in a deliberate fashion from specification development to computer model development to hardware development resulting in a more affordable and robust end product. PHIL testing provides early insight into the effects of high power and energy mission systems (i.e., laser, advanced radars, etc.) on a ship's electric power system, evaluates shipboard power and energy systems, and evaluates power system performance. The PHIL test site is located at Florida State University's Center for Advanced Power System (FSU CAPS). PHIL testing at FSU CAPS has been ongoing since FY17. Eight different PHIL demonstrations were planned with 5 to be completed through FY18 and 3 planned in FY19. PHIL demonstrations to date have replaced component models with the United Kingdom's Flywheel Energy Storage System (FESS), the ESM prototype unit developed by this PE, and Advanced Circuit Protection Devices developed by ONR. The purpose of the FY19 demonstrations is to focus on DDG 51 FLT III and Future Surface Combatants with multiple high pulsed power loads; and to de-risk EM, advanced electrical architectures, power conversion equipment, and controls for implementation into an Integrated Power and Energy System (IPES). Conduct feasibility studies, cost based assessments, and begin developing technical and performance specifications for an Integrated Power & Energy System (IPES) in support of future surface combatant and mission system power and energy requirements. Identify shared energy storage and advanced controls requirements enabling an affordable, scalable and flexible power system to meet current and future needs. Refine IPES notional architectures and risk assessments through studies and industry engagement. Draft performance specifications for IPES system, equipment and components. Develop computer component models and commence system level modeling and simulation efforts. Plan for land based testing activities. Continue planning for future gas turbine operational readiness and fuel efficiency upgrades. Continue to define performance requirements, explore trade space in next generation compact high power Advanced Power Generation Modules (APGM), develop characterization data used to conduct ship design studies and to establish a benchmark for performance comparison, develop a stand-alone technical description					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
document which describes performance characteristics, evaluate the effect of large pulse loads from future electric weapons on the cycle life of gas turbine engines, and engine capability to respond to such pulse loads without an unacceptable reduction in time between overhaul. Conduct feasibility studies, Cost Based Assessments, and begin developing performance and technical specifications for next generation compact high power Advanced Power Conversion Module (APCM) incorporating high band gap materials such as silicon carbide. Develop computer component models and commence system level modeling and simulation efforts. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Decrease from FY 2018 to FY 2019 is due to transitioning to production mission critical hardware for DDG 51 Flight III (AG9160RF Gas Turbine Generator (GTG) and AMDR PCMs).					
Title: Naval Power Technology Development / Platform Integration & Transition	1.104	1.104	1.104	0.000	1.104
Articles:	-	-	-	-	-
FY 2018 Plans: Continue to execute the Advanced Electric Power and Propulsion Systems Development Project ((short title is AEP3), Project Arrangement (PA) ref DoD-MOD-N-12-0001 which is an agreement between the US and UK Governments to cooperate on a scope of work associated with characterizing, developing, modeling, and de-risking electrical power and propulsion system architectures and equipment for future surface and submarine platforms to meet the needs of both Navies. Complete execution of PA complimentary effort (Directed Energy Power Systems (DEPS)) under the Coalition Warfare Program (CWP). Continue to develop power and propulsion system configurations in support of future surface ship acquisition programs. Develop alternative power and propulsion solutions for future surface combatants and amphibious ships. Continue to improve baseline power system performance by performing analysis, modeling and simulation, life cycle cost analysis, producibility studies, module development, and ship integration studies and planning. Continue to analyze alternatives for supplying power to advanced radars, combat systems, and electric weapons power demands and potential interfaces to develop optimum alternative solutions. Continue assessments of Naval Power and Energy System alternate architectures to best meet emerging ship requirements.					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Complete biennial update of the Naval Power and Energy Systems (NPES) Technology Development Roadmap (TDR). Support maturation and transition of ONR Future Naval Capabilities (FNC) products to meet NPES TDR identified gaps. Continue to support maturation and transition of ONR Future Naval Capabilities (FNC) products to meet NPES TDR identified gaps. Continue Combat Power and Energy System Overarching Integrated Product Team (OIPT). Continue to generate strategy, technology development plan and resource requirements for future surface combatant integrated power and energy system. ***FY 2019 Base Plans:*** Continue to execute the Advanced Electric Power and Propulsion Systems Development Project (short title is AEP3), Project Arrangement (PA) ref DoD-MOD-N-12-0001 which is an agreement between the US and UK Governments to cooperate on a scope of work associated with characterizing, developing, modeling, and de-risking electrical power and propulsion system architectures and equipment for future surface and submarine platforms to meet the needs of both Navies. Continue to develop power and propulsion system configurations in support of future surface ship acquisition programs. Develop alternative power and propulsion solutions for future surface combatants and amphibious ships. Continue to improve baseline power system performance by performing analysis, modeling and simulation, life cycle cost analysis, producibility studies, module development, and ship integration studies and planning. Continue to analyze alternatives for supplying power to advanced radars, combat systems, and electric weapons power demands and potential interfaces to develop optimum alternative solutions. Continue assessments of Naval Power and Energy System alternate architectures to best meet emerging ship requirements. Commence biennial update of the Naval Power and Energy Systems (NPES) Technology Development Roadmap (TDR).					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Continue to support maturation and transition of ONR Future Naval Capabilities (FNC) products to meet NPES TDR identified gaps. Support transition from ONR of Silicon Carbon (and other high bandgap semiconductor materials) based power electronic modules. High band gap semiconductor materials operate at high speeds and temperatures as compared with silicon based materials affording more compact, thermally tolerant power conversion equipment making them highly desirable for naval applications. Continue Combat Power and Energy System Overarching Integrated Product Team (OIPT). Continue to generate strategy, technology development plan and resource requirements for future surface combatant integrated power and energy system. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** There is no increase or decrease to the funding level between FY18 and FY19. Continue to execute requirements as outlined in the FY 2018 and FY 2019 plans.					
Title: Cybersecurity Boundary Defense Capability	12.152	12.825	7.764	0.000	7.764
Articles:	-	-	-	-	-
FY 2018 Plans: FY 2018 plans will include the testing of the Cybersecurity Boundary Defense Capability (BDC) in Navy land based site laboratories and on combatants and amphibious ships as non-permanent changes. The intent of the testing is to demonstrate the overall approach to implement a cybersecurity boundary defense capability for Hull, Mechanical and Electrical (HM&E) control systems on surface ships as being an effective approach. HM&E systems to be protected will include Machinery Control Systems, Electric Power Systems, Damage Control and Firefighting, Auxiliary Machinery and Fluid systems, Engines and Power Transmission Systems, Gas Turbine Systems, Video Systems as well as other HM&E systems. Design and technical data packages for software and hardware solutions will be developed. The intent of the total boundary defense capability will be to allow the ship to better protect, detect, respond, and recover from potential cyber attacks on the HM&E enclave on surface ships ***FY 2019 Base Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
The FY19 plans will include the continued detailed development testing and system integration of the common Cybersecurity Boundary Defense Capability (BDC) for H,M&E systems to be applied across multiple ship classes. This capability will include both a BDC capability and cyber situational awareness tools for the H,M&E systems. HM&E systems to be protected will include Machinery Control Systems, Electric Power Systems, Damage Control and Firefighting, Auxiliary Machinery and Fluid systems, Engines and Power Transmission Systems, Gas Turbine Systems, Video Systems as well as other HM&E systems. Design and technical data packages for software and hardware solutions will be developed. The intent of the total boundary defense capability will be to allow the ship to better protect, detect, respond, and recover from potential cyber attacks on the HM&E enclave on surface ships. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Decrease from FY 2018 to FY 2019 is due to transitioning to production. Cybersecurity Boundary Defense Capability (BDC) was funded in FY 2016 in PE: 0604567N / PU 1803 to establish the infrastructure and detailed plans to fully execute Cybersecurity starting 1 Oct 16. FY 2017-2021 cybersecurity efforts are budgeted in PE 0603573N / PU 2471.					
Accomplishments/Planned Programs Subtotals	30.255	29.953	22.109	0.000	22.109

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

This program develops and transitions higher performance and more affordable electric power and propulsion systems to both new construction and back fit ship applications using an evolutionary acquisition approach. For new contract awards, full and open competition is utilized to the maximum extent possible to provide maximum benefit to the Navy at the lowest possible cost to the taxpayer. When able to meet Navy requirements, commercial technology is leveraged to further minimize cost to the Navy. Cybersecurity efforts will maximize use of government field activity labs and already contracted HM&E equipment vendors.

E. Performance Metrics

This project will execute 100% of the signed Technology Transition Agreements with ONR; complete 100% of the advanced developments currently planned for the Energy Storage Module and Power Generation Module; achieve up to 10% Specific Fuel Consumption (SFC) improvement for Advanced Power Generation Module; mature technology to Technology Readiness Level (TRL) 6 by milestone decisions for ship acquisition program; and, complete HM&E cybersecurity studies and

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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production of a boundary defense capability architecture and implementation approach for HM&E systems on surface ships in alignment with the Task Force Cyber Awareness (TFCA) goals.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy		Date: February 2018
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Product Development	SS/FFP	Rolls Royce : Walpole, MA	33.006	3.391	Oct 2016	1.506	Oct 2017	0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	SS/BOA	General Electric Company : Cincinatti, OH	3.560	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Product Development	C/FFP	DRS : DRS, Milwaukee WI	40.677	5.256	Dec 2016	5.345	Dec 2017	5.118	Oct 2018	-		5.118	Continuing	Continuing	Continuing
Product Development	C/CPFF	Various : Various	38.224	3.529	Oct 2016	4.747	Oct 2017	4.722	Oct 2018	-		4.722	Continuing	Continuing	Continuing
Product Development	WR	NSWCPD : Phila, PA	52.127	4.340	Oct 2016	4.530	Oct 2017	3.505	Oct 2018	-		3.505	Continuing	Continuing	Continuing
Cybersecurity BDC	WR	NSWCPD : Phila, PA	0.000	4.223	Oct 2016	5.400	Nov 2017	3.353	Nov 2018	-		3.353	Continuing	Continuing	Continuing
Cybersecurity BDC	C/CPIF	Boeing : Huntington Beach, CA	0.000	0.700	Jun 2017	0.700	Jan 2018	0.500	Feb 2019	-		0.500	Continuing	Continuing	Continuing
Cybersecurity BDC	C/FP	Various HM&E Equipment Vendors : Various	0.000	1.998	Mar 2017	3.000	Jan 2018	0.500	Jan 2019	-		0.500	Continuing	Continuing	Continuing
Cybersecurity BDC	C/CPIF	Various : Various	0.000	3.000	Apr 2017	0.250	Jan 2018	0.700	Jan 2019	-		0.700	Continuing	Continuing	Continuing
Product Development	WR	Various Govt : Various	0.000	0.633	Jan 2017	0.000		0.000		-		0.000	0.000	0.633	-
Cybersecurity BDC	C/CPFF	JHU APL : Laurel, MD	0.000	2.231	Mar 2017	3.475	Jan 2018	2.711	Dec 2018	-		2.711	0.000	8.417	-
		Subtotal	167.594	29.301		28.953		21.109		-		21.109	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Test and Evaluation	WR	NSWCCD-SSES : Phila, PA	24.954	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
		Subtotal	24.954	0.000		0.000		0.000		-		0.000	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Management	C/CPFF	Herren Associates : Alexandria, VA	3.138	0.954	Feb 2017	1.000	Dec 2017	1.000	Oct 2018	-		1.000	Continuing	Continuing	Continuing
		Subtotal	3.138	0.954		1.000		1.000		-		1.000	Continuing	Continuing	N/A

	Prior Years	FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	195.686	30.255		29.953		22.109		-		22.109	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

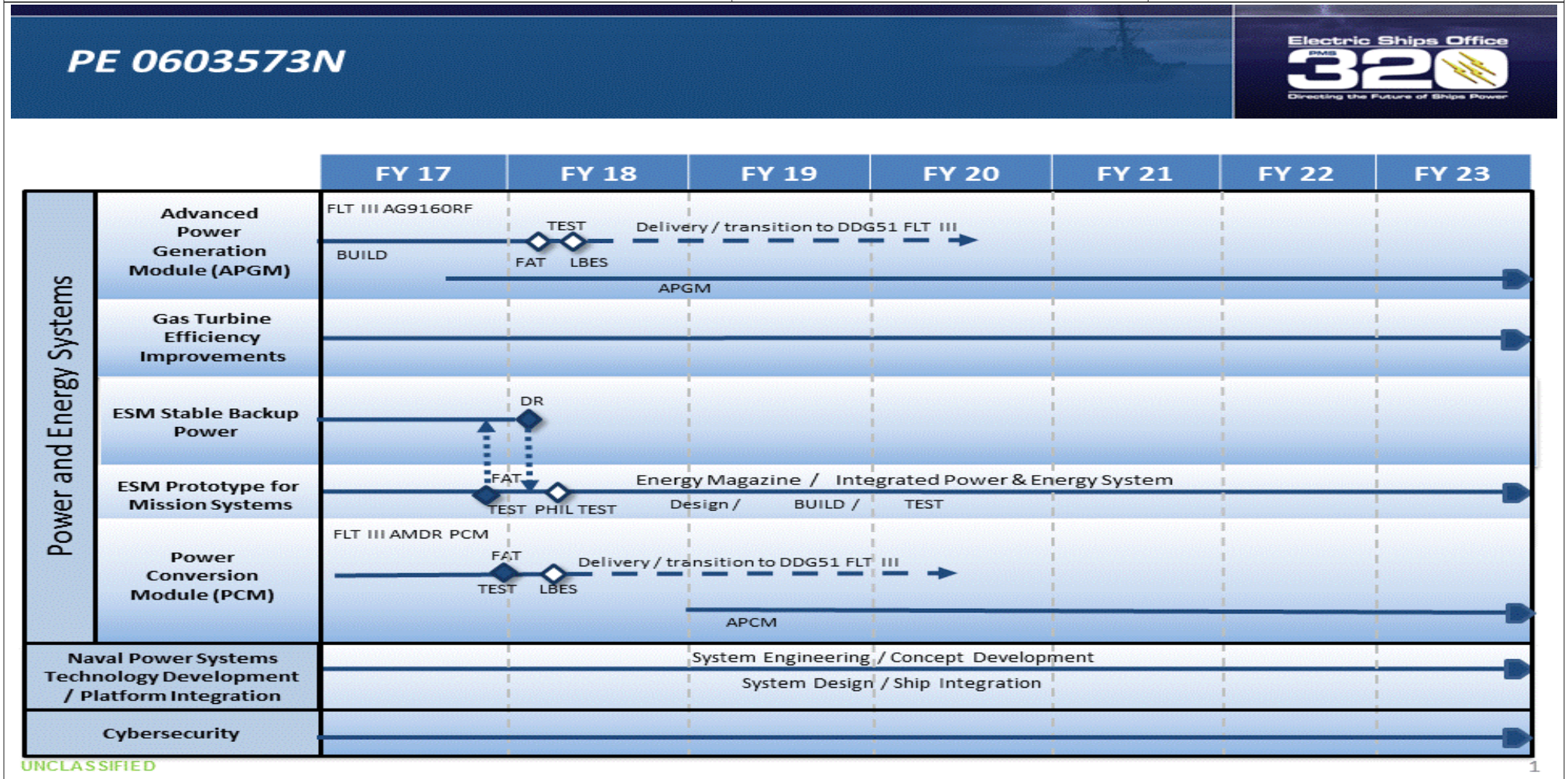

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 4	**R-1 Program Element (Number/Name)** PE 0603573N / *Advanced Surface Machinery Sys*	**Project (Number/Name)** 2471 / *Integrated Power Systems (IPS)*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 2471				
Power and Energy Systems	1	2017	4	2023
Naval Power Technology Development / Platforms Integration & transition	1	2017	4	2023
Cybersecurity BDC	1	2017	4	2023