Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy											Date: February 2020	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 5: *System Development & Demonstration (SDD)*					R-1 Program Element (Number/Name) PE 0604501N *I Advanced Above Water Sensors*							
COST ($ in Millions)	**Prior Years**	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**	**FY 2022**	**FY 2023**	**FY 2024**	**FY 2025**	**Cost To Complete**	**Total Cost**
Total Program Element	338.146	30.551	30.179	87.809	-	87.809	116.177	103.809	78.128	60.762	Continuing	Continuing
3232: *Multi-Mission Signal Processor*	160.925	2.442	2.005	3.034	-	3.034	3.057	3.115	3.174	3.233	Continuing	Continuing
3236: *Advanced Radar Technology*	141.542	20.467	1.933	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	163.942
3243: *Shipboard Passive Electro-Optical Infrared Development*	0.000	0.000	0.000	65.440	-	65.440	99.702	88.355	62.934	45.269	Continuing	Continuing
3301: *Improved Capabilities SPY-1 Radar*	35.679	7.642	13.116	11.239	-	11.239	12.424	12.339	12.020	12.260	Continuing	Continuing
3408: *AN/SPS-49 Technical Refresh*	0.000	0.000	13.125	8.096	-	8.096	0.994	0.000	0.000	0.000	0.000	22.215

Note

Project 3243 is a new start for Shipboard Passive Electro-Optical Infrared (SPEIR) development that addresses near-term capability requirements and associated gaps identified in the 2019 SPEIR Capability Description Document (CDD). This program answers an urgent counter unmanned aircraft system operational need for the Fleet to provide an initial capability by 2025.

Project 3408 is a new start for AN/SPS-49 Technology Refresh. As the only Air Surveillance Radar on the LSD 41/49 class ships, continued degradation and increasingly low radar availability of the AN/SPS-49 Radar is greatly impacting deployed missions, impacting safety of flight and affecting LSD Air Warfare capability and operations. Funding is to complete development, test and evaluation, validation and integration of a technology refresh of the below deck hardware for the AN/SPS-49A(V)1 Long Range Air Surveillance Radar.

A. Mission Description and Budget Item Justification

Multi-Mission Signal Processor (MMSP): The development of MMSP provides simultaneous Anti-Air Warfare (AAW)/Ballistic Missile Defense (BMD) multi-mission capability for DDG 51 class ships as part of the Aegis Modernization Program. This capability is utilized for DDG 113 and follow new construction and Aegis Ashore. Modifies SPY-1D transmitters
to enable dual beam for reduced frame times and better reaction time, provides stability for all D(V) waveforms, and avoids operational degradation. The SPY-1 radar system detects, tracks, and supports engagements of a broader range of threats. MMSP improves performance in littoral, ducted clutter, electronic attack (EA), and chaff environments and provides greater commonality in computer programs and equipment. This effort also provides for the development of MMSP on Destroyers Commercial Off The Shelf (COTS) refresh and MMSP technology refresh. MMSP/AEGIS Linear Processing System (ALPS) integration provides adjunct processing for data collection.

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604501N *I Advanced Above Water Sensors*

MMSP development includes the commencement of technology refresh to support Aegis Modernization due to Diminishing Manufacturing Sources and Material Shortages (DMSMS) and obsolescence issues. MMSP-Refresh (MMSP-R) began in FY16. MMSP-R includes software updates required on new computer platforms. Engineering efforts will be required to assess alternate technologies and determine optimal MMSP architectural solutions, which will include system security requirements. FY21, funding is for the development of requirements/specification to support integration of ALPS into MMSP-R.

Advanced Radar Technology (ART): Enterprise Air Surveillance Radar (EASR) will modify an existing radar technology to meet the air surveillance requirements for multiple ship classes. EASR will be one sensor in a suite that is designed to meet the performance needs for ship self-defense, situational awareness and air traffic control. EASR will replace the Volume Search Radar (VSR) in the CVN 78 Class Dual Band Radar system and the AN/SPS-48/49 radar systems in numerous ship classes. The AN/SPS-48 Radars are long-range, three-dimensional (3-D) radars used to search, detect and provide space-stabilized, three-coordinate (range, bearing, height) data for air intercept control and designation to a weapon system. The AN/SPS-49A(V)1 radar system is a long range, two dimensional (2-D), L-Band air surveillance radar installed on USN major combatants. The AN/SPY-4 Volume Search Radar (VSR) is an S-Band active phased array radar deployed on CVN 78 providing volume surveillance and air traffic control. EASR funding will develop a modern 3-D air search radar that addresses the latest requirements for Aviation and Amphibious Warfare Ships and closely conforms to existing combat system interfaces, as well as aligns with existing shipboard space, weight, and power limits. The architecture and acquisition strategy for EASR is intended to drive a lower recurring cost by utilizing the same core technology for both fixed-face and rotating array variants. EASR will provide for engineering of component and system level technology improvements for equipment used by in-service air search radars.

Shipboard Passive Electro-Optical Infrared (SPEIR) Block I is a new start that will be an open architecture system that addresses near-term capability requirements and associated gaps identified in the 2019 SPEIR Capability Description Document (CDD). This program answers an urgent counter unmanned aircraft system operational need for the Fleet to provide an initial capability by 2025. The SPEIR acquisition leverages technology developed under the Office of Naval Research's (ONR's) Combined EO/IR Surveillance and Response System (CESARS) Science and Technology (S&T) effort, specifically related to the Shipboard Panoramic EO/IR Cueing and Surveillance System (SPECSS). SPEIR Block I will provide a common EO/IR Electronic Support (ES) capability to surface ships that will passively find, fix, track, and target current / emerging threats in support of the following warfare missions: Navigation, Counter Fast Attack Craft (FAC) / Fast In-shore Attack Craft (FIAC), Counter Unmanned Aircraft Systems (UAS) / Unmanned Aerial Vehicle (UAV), and Anti-Ship Cruise Missile (ASCM) Defense. SPEIR Block I will consist of a passive Wide Field of View (WFOV) capability with a 360 degree field-of-view optical sensor for panoramic detection, tracking, and identification for 24/7 day/night shipboard situational awareness. SPEIR Block I will also include an enhanced, high resolution Narrow Field of View (NFOV) and laser system capability that will provide range-finding and precision 3D target tracking. SPEIR Block I will have limited integration with shipboard combat systems and include a government software development and integration effort for Soft-Kill Coordination System (SKCS) to manage ES engagements. This program includes risk reduction initiatives for Sensor Fusion Algorithms and combat system track publishing to enable limited CSI. SPEIR Block II will be a future program that will build on Block I to address longer-term capability requirements and support Periscope Detection and Discrimination (PDD) as well as Mine Like Object (MLO) avoidance. SPEIR Block II will also provide full combat system integration.

Improved Capabilities for SPY-1 Radar: These Reliability, Maintainability, and Availability (RM&A) improvements and solid state technology insertions are intended to reduce cascading failures, mitigate obsolescence issues, and improve reliability in support of Anti-Air Warfare (AAW) and Ballistic Missile Defense (BMD) missions while still providing AN/

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604501N *I Advanced Above Water Sensors*

SPY-1 Radar Total Ownership Cost Reductions. Improvements, such as Solid State Insertion to address Diminishing Manufacturing Sources and Material Shortages (DMSMS), will yield reductions in annual fleet maintenance costs and is a top fleet requirement as part of the AEGIS Wholeness initiative. In addition to RM&A improvements, warfighting improvements funded in this line include: Transmitter Noise Cancellation (TNC) development will include hardware/software to counter low radar cross section, low altitude threats. Side Lobe Blanking (SLB) addresses shortfalls in mixed electronic attack environment while in an Integrated Air and Missile Defense (IAMD) mode. The Ship-Based Non-Cooperative Target Recognition (SBNCTR) program Phases 2, 2A and 3 will develop algorithms to provide classification for targets. Transition of Advanced Calibration Experiment (ACE) Phases 1 and 2 from Baseline 7 into Baseline 9. Incorporate Elevated Radar Advanced Calibration Experiment (ERACE) Phases 1/2 and 3 into Baseline 9. Electronic Attack (EA) and Rapid Radar Capability Improvement Program (R2CIP) develop solutions for evolving EA threats. FY21 includes continuation of development of SBNCTR Phase 2A, TNC phase 1 & 2, EA improvements, and ERACE Phase 1/2. ERACE certification is targeted to be part of Baseline 9.2.3 certification, which is scheduled for 2Q FY22.

AN/SPS-49 Technology Refresh is a new start: As the only Air Surveillance Radar on the LSD 41/49 class ships, continued degradation and increasingly low radar availability of the AN/SPS-49 Radar is greatly impacting deployed missions, impacting safety of flight and affecting LSD Air Warfare capability and operations. Funding is to complete development, test and evaluation, validation and integration of a technology refresh of the below deck hardware for the AN/SPS-49A(V)1 Long Range Air Surveillance Radar. This technology refresh will include Reliability, Maintainability, and Availability (RM&A) improvements and solid state technology insertions which will reduce cascading failures and mitigate obsolescence issues. In addition, this effort replaces key components to include: transmitter, receiver, exciter, antenna elevation servo control, radar system control, display and signal data processor (SDP). A digital receiver/exciter (DREX) with high-performance computing technology will be a key component in the new system. The current SPS-49 radar has no software so new software is being developed to mimic the current radar functions to maintain compatibility with internal and external interfaces. This effort will improve SPS-49 electronic protection, have increased surveillance range and increased slow moving small target detection, as well as reduce total ownership cost with lower unit cost and smaller size/weight/power requirements.

B. Program Change Summary ($ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	33.884	34.554	23.693	-	23.693
Current President's Budget	30.551	30.179	87.809	-	87.809
Total Adjustments	-3.333	-4.375	64.116	-	64.116
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-4.375			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-2.535	0.000			
• SBIR/STTR Transfer	-0.798	0.000			
• Program Adjustments	0.000	0.000	64.080	-	64.080
• Rate/Misc Adjustments	0.000	0.000	0.036	-	0.036

Change Summary Explanation

FY 2019 decrease of $3.333M due to below threshold reprogramming in support of higher Departmental priorities and SBIR reductions

Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy	Date: February 2020
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 5: *System Development & Demonstration (SDD)*	**R-1 Program Element (Number/Name)** PE 0604501N *I Advanced Above Water Sensors*

FY 2020 decrease of $4.375M due to AN/SPS-49 (Project 3408) concurrency,
FY 2021 overall increase is due to initiation of Shipboard Passive Electro-Optical Infrared (EO/IR) development effort.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3232 / *Multi-Mission Signal Processor*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3232: *Multi-Mission Signal Processor*	160.925	2.442	2.005	3.034	-	3.034	3.057	3.115	3.174	3.233	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Multi-Mission Signal Processor (MMSP): The development of MMSP provides simultaneous Anti-Air Warfare (AAW)/Ballistic Missile Defense (BMD) multi-mission capability for DDG 51 class ships as part of the Aegis Modernization Program. This capability is utilized for DDG 113 and follow new construction and Aegis Ashore. Modifies SPY-1D transmitters to enable dual beam for reduced frame times and better reaction time, provides stability for all D(V) waveforms, and avoids operational degradation. The SPY-1 radar system detects, tracks, and supports engagements of a broader range of threats. MMSP improves performance in littoral, ducted clutter, electronic attack (EA), and chaff environments and provides greater commonality in computer programs and equipment. This effort also provides for the development of MMSP on Destroyers Commercial Off The Shelf (COTS) refresh and MMSP technology refresh. MMSP/AEGIS Linear Processing System (ALPS) integration provides adjunct processing for data collection.

MMSP development includes the commencement of technology refresh to support Aegis Modernization due to Diminishing Manufacturing Sources and Material Shortages (DMSMS) and obsolescence issues. MMSP-Refresh (MMSP-R) began in FY16. MMSP-R includes software updates required on new computer platforms. Engineering efforts will be required to assess alternate technologies and determine optimal MMSP architectural solutions, which will include system security requirements. FY21, funding is for the development of requirements/specification to support integration of ALPS into MMSP-R.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SYSTEMS ENGINEERING	2.442	2.005	3.034	0.000	3.034
Articles:	-	-	-	-	-
FY 2020 Plans: - Continue MMSP-R development to support AEGIS Modernization due to DMSMS and obsolescence issues. - Continue to maintain alignment with the BMD Program and the associated Ballistic Missile Defense Signal Processor (BSP) adjunct to incorporate BMD capability within MMSP during AEGIS Modernization. - Continue to support ACB16 MMSP improvements. - Complete MMSP-R ECPs. - Perform MMSP/ALPS concept development. - Complete MMSP-R radar Integration and Test (I&T). - Conduct MMSP-R ACB16 Multi-Mission Exercise (MMEX).					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3232 / *Multi-Mission Signal Processor*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Complete MMSP-R ACB16 I&T. ***FY 2021 Base Plans:*** - Continue MMSP-R development to support AEGIS Modernization due to DMSMS and obsolescence issues. - Continue to maintain alignment with the BMD Program and the associated BSP adjunct to incorporate BMD capability within MMSP during AEGIS Modernization. - Initiate MMSP-R ECP/Software Updates. - Perform MMSP/ALPS requirements analysis and specification updates. - Support ACB16 Phase I Certification. - Conduct MMSP-R ACB16 Demo. ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase in FY21 is for development of requirements/specification changes to support integration of ALPS into MMSP-R.					
Accomplishments/Planned Programs Subtotals	2.442	2.005	3.034	0.000	3.034

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/0900: *BLI 0900/ OPN DDG Modernization*	452.908	564.966	547.569	-	547.569	813.820	956.877	1,015.245	1,127.859	2,303.514	11,065.952

Remarks

D. Acquisition Strategy

Multi-Mission Signal Processor (MMSP) provides simultaneous AAW/BMD Multi-mission capability for AEGIS Modernization Program and leverages BMD 4.0.1 and SPY-1D(V) designs. This MMSP development efforts support integration of BMD 5.0 signal processing, and will lead to the OPN/SCN procurement for shore sites and shipsets. MMSP technology refresh will be incorporated into Baseline 9 and follow. MMSP/ALPS integration provides adjunct processing for data collection.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3232 / *Multi-Mission Signal Processor*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SYSTEM ENGINEERING	SS/CPFF	Lockheed Martin : Moorestown, NJ	115.186	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	C/CPFF	AEGIS Techrep : Moorestown, NJ	5.491	0.150	Nov 2018	0.105	Jan 2020	0.150	Dec 2020	-		0.150	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	SS/FP	APL/JHU : Laurel, MD	5.031	0.080	Feb 2019	0.050	Dec 2019	0.120	Nov 2020	-		0.120	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	CSCS : Dahlgren, VA	1.642	0.062	Nov 2018	0.062	Nov 2019	0.072	Nov 2020	-		0.072	0.000	1.838	-
SYSTEM ENGINEERING	WR	NRL : Washington, DC	3.164	0.114	Dec 2018	0.126	Nov 2019	0.170	Nov 2020	-		0.170	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	MIPR	MIT/LL : Lexington, MA	1.453	0.000		0.000		0.000		-		0.000	0.000	1.453	-
SYSTEM ENGINEERING	WR	NSWC/DD : Dahlgren, VA	9.140	0.372	Nov 2018	0.689	Nov 2019	0.480	Oct 2020	-		0.480	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	SCSC : Wallops Island, VA	0.019	0.000		0.000		0.000		-		0.000	0.000	0.019	-
SYSTEM ENGINEERING	WR	NSWC/CR : Crane, IN	5.535	1.400	Nov 2018	0.713	Nov 2019	1.696	Oct 2020	-		1.696	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NSWC/PHD : Port Hueneme, CA	4.270	0.165	Nov 2018	0.161	Nov 2019	0.227	Oct 2020	-		0.227	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	Office of Naval Research : Arlington, VA	5.779	0.000		0.000		0.000		-		0.000	0.000	5.779	-
		Subtotal	156.710	2.343		1.906		2.915		-		2.915	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	PEOIWS2 : Washington, DC	0.248	0.010	Jan 2019	0.010	Jan 2020	0.010	Oct 2020	-		0.010	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3232 / *Multi-Mission Signal Processor*

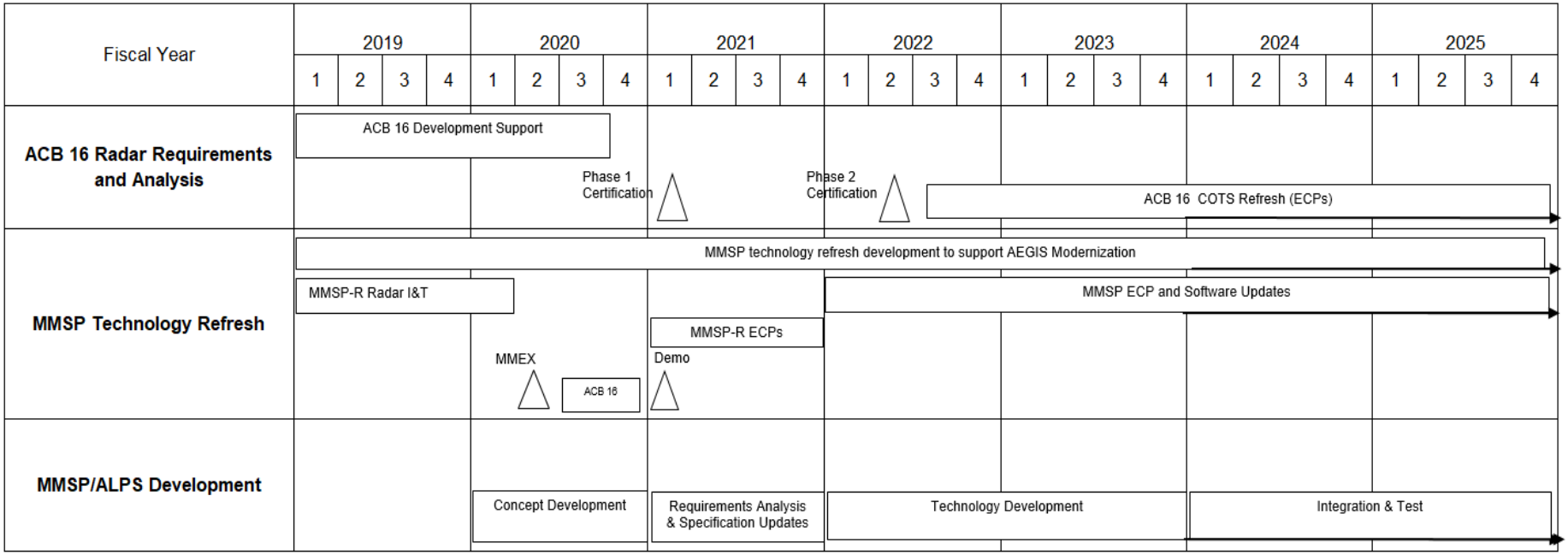
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Support Management Services	C/CPIF	SPA : Washington, DC	0.165	0.089	Dec 2018	0.089	Feb 2020	0.109	Nov 2020	-		0.109	Continuing	Continuing	Continuing
Support Management Services	SS/CPIF	SPA (Bridge) : Washington, DC	1.403	0.000		0.000		0.000		-		0.000	0.000	1.403	-
Support Management Services	C/CPIF	SPA (SEAPORT) : Washington, DC	2.247	0.000		0.000		0.000		-		0.000	0.000	2.247	-
Support Management Services	C/CPFF	CACI : Washington, DC	0.094	0.000		0.000		0.000		-		0.000	0.000	0.094	-
Support Management Services	C/CPFF	TMB : Washington, DC	0.031	0.000		0.000		0.000		-		0.000	0.000	0.031	-
Support Management Services	C/CPFF	Strategic Insight : Washington, DC	0.027	0.000		0.000		0.000		-		0.000	0.000	0.027	-
		Subtotal	4.215	0.099		0.099		0.119		-		0.119	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	160.925	2.442		2.005		3.034		-		3.034	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3232 / *Multi-Mission Signal Processor*



ACB 16 COTS Refresh continues beyond the FYDP.
MMSP Technology Refresh continues beyond the FYDP.
MMSP/ALPS continues beyond the FYDP.
ACB16 Radar Requirements and Analysis schedule has been adjusted to align with the updated ACB16 Combat System schedule.

Acronyms:
ACB: AEGIS Capability Build
COTS: Commercial Off The Shelf
I&T: Integration & Test
ALPS: AEGIS Linear Processing System
ECP: Engineering Change Proposal
MMEX: Multi-Mission Exercise
MMSP-R: Multi-Mission Signal Processor Refresh

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3232 / *Multi-Mission Signal Processor*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3232				
ACB16 Development Support	1	2019	3	2020
MMSP Technology Refresh to Support AEGIS Modernization	1	2019	4	2025
MMSP-R Radar Integration and Test	1	2019	1	2020
MMSP/ALPS Concept Development	1	2020	4	2020
MMSP-R ACB16 Multi-Mission Exercise (MMEX)	2	2020	2	2020
MMSP-R ACB16 Integration and Test	3	2020	4	2020
ACB16 Phase 1 Certification	1	2021	1	2021
MMSP-R ECPs	1	2021	4	2021
MMSP-R Demo	1	2021	1	2021
MMSP/ALPS Requirements Analysis and Specifications Update	1	2021	4	2021
MMSP ECP and Software Updates	1	2022	4	2025
MMSP/ALPS Technology Development	1	2022	4	2023
ACB16 Phase 2 Certification	2	2022	2	2022
ACB16 COTS Refresh (ECPs)	3	2022	4	2025
MMSP/ALPS Integration and Test	1	2024	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3236 / *Advanced Radar Technology*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3236: *Advanced Radar Technology*	141.542	20.467	1.933	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	163.942
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Advanced Radar Technology (ART): Enterprise Air Surveillance Radar (EASR) will modify an existing radar technology to meet the air surveillance requirements for multiple ship classes. EASR will be one sensor in a suite that is designed to meet the performance needs for ship self-defense, situational awareness and air traffic control. EASR will replace the Volume Search Radar (VSR) in the CVN 78 Class Dual Band Radar system and the AN/SPS-48/49 radar systems in numerous ship classes. The AN/SPS-48 Radars are long-range, three-dimensional (3-D) radars used to search, detect and provide space-stabilized, three-coordinate (range, bearing, height) data for air intercept control and designation to a weapon system. The AN/SPS-49A(V)1 radar system is a long range, two dimensional (2-D), L-Band air surveillance radar installed on USN major combatants. The AN/SPY-4 Volume Search Radar (VSR) is an S-Band active phased array radar deployed on CVN 78 providing volume surveillance and air traffic control. EASR funding will develop a modern 3-D air search radar that addresses the latest requirements for Aviation and Amphibious Warfare Ships and closely conforms to existing combat system interfaces, as well as aligns with existing shipboard space, weight, and power limits. The architecture and acquisition strategy for EASR is intended to drive a lower recurring cost by utilizing the same core technology for both fixed-face and rotating array variants. EASR will provide for engineering of component and system level technology improvements for equipment used by in-service air search radars.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SYSTEMS ENGINEERING - EASR	8.019	0.545	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete DT-3 testing - Conduct System Verification Review (SVR), Functional Configuration Audit (FCA), Production Readiness Review (PRR), and the Transition Critical Design Review (CDR) ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 decrease is due to no RDT&E funding in FY21.					
Title: GOVERNMENT ENGINEERING SERVICES - EASR	10.640	1.201	0.000	0.000	0.000

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete support of DT-3 testing - Conduct Transition CDR/SVR/FCA/PRR - Support EASR cost, schedule, and performance management contract administration, contract oversight, risk identification, and risk mitigation ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 decrease is due to no RDT&E funding in FY21.					
Title: PROGRAM MANAGEMENT SUPPORT - EASR	1.808	0.187	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2020 Plans: - Complete support of EASR Integrated IPTs and WGs. - Complete the analysis and assessment of EASR Engineering & Manufacturing Development (E&MD) contract deliverables - Complete CLIN 0001 closeout ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 decrease is due to no RDT&E funding in FY21.					
Accomplishments/Planned Programs Subtotals	20.467	1.933	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

Advanced Radar Technology (ART)/EASR: The EASR Acquisition is a planned competitive procurement based on a radar specification that incorporates the latest requirements for aviation and amphibious warfare ships, closely conforms to existing combat system interfaces, and includes physical Space Weight and Power (SWAP) Not-to-Exceed (NTE) interface requirements from:

- CVN 79+, LHA, LPD 29+ and FFG(X)
- CVN, LHA, LPD and LHD for back-fit

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering - S2F	C/CPFF	Northrop Grumman - ES : Baltimore, MD	0.608	0.000		0.000		0.000		-		0.000	0.000	0.608	-
Systems Engineering - EASR	C/CPIF	EASR E&MD Contractor - Raytheon : Marlborough, MA	103.824	8.019	Nov 2018	1.933	Nov 2019	0.000		-		0.000	0.000	113.776	-
Systems Engineering - EXI	SS/CPFF	Raytheon : Portsmouth, RI	1.910	0.000		0.000		0.000		-		0.000	0.000	1.910	-
		Subtotal	106.342	8.019		1.933		0.000		-		0.000	0.000	116.294	N/A

Remarks

FY20 funding was prioritized from Warfare Centers/support contractors to Raytheon for Engineering and Manufacturing Development.

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering - EASR	WR	NSWC/DD : Dahlgren, VA	10.180	5.155	Nov 2018	0.000		0.000		-		0.000	0.000	15.335	-
Government Engineering - EASR	WR	NSWC/CR : Crane, IN	2.288	0.512	Dec 2018	0.000		0.000		-		0.000	0.000	2.800	-
Government Engineering - EASR	WR	NSWC/PHD : Port Hueneme, CA	1.778	0.636	Dec 2018	0.000		0.000		-		0.000	0.000	2.414	-
Government Engineering - EASR	WR	NSWC/ PHI : Philadelphia, PA	0.212	0.063	Jan 2019	0.000		0.000		-		0.000	0.000	0.275	-
Government Engineering - EASR	WR	NRL : Washington, DC	1.221	0.292	Jan 2019	0.000		0.000		-		0.000	0.000	1.513	-
Government Engineering - EASR	SS/CPFF	JHU/APL : Baltimore, MD	7.002	2.107	Feb 2019	0.000		0.000		-		0.000	0.000	9.109	-
Government Engineering - EASR	WR	SCSC : Wallops Island, VA	0.232	0.000		0.000		0.000		-		0.000	0.000	0.232	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering - EASR	WR	NSWC/CD : Bethesda, Maryland	0.526	0.000		0.000		0.000		-		0.000	0.000	0.526	-
Engineering Support - EASR	WR	NAVFAC : Washington, DC	4.698	0.000		0.000		0.000		-		0.000	0.000	4.698	-
Engineering Support - EASR	WR	NIWC : San Diego, CA	0.327	0.000		0.000		0.000		-		0.000	0.000	0.327	-
Engineering Support - EASR	C/CPIF	SPA : Washington, DC	2.259	1.160	Dec 2018	0.000		0.000		-		0.000	0.000	3.419	-
Engineering Support - EASR	WR	CIVIL AIR PATROL : Montgomery, AL	0.000	0.056	Jun 2019	0.000		0.000		-		0.000	0.000	0.056	-
Engineering Support - EASR	WR	NSWC/COR : Corona, CA	0.000	0.117	Dec 2018	0.000		0.000		-		0.000	0.000	0.117	-
Engineering Support - EASR	WR	DOI : Boise, ID	0.000	0.509	Jun 2019	0.000		0.000		-		0.000	0.000	0.509	-
Engineering Support - EASR	C/CPIF	SAIC : Andover, MA	0.000	0.033	Jun 2019	0.000		0.000		-		0.000	0.000	0.033	-
		Subtotal	30.723	10.640		0.000		0.000		-		0.000	0.000	41.363	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering - S2F	WR	NRL : Washington, DC	0.582	0.000		0.000		0.000		-		0.000	0.000	0.582	-
		Subtotal	0.582	0.000		0.000		0.000		-		0.000	0.000	0.582	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*

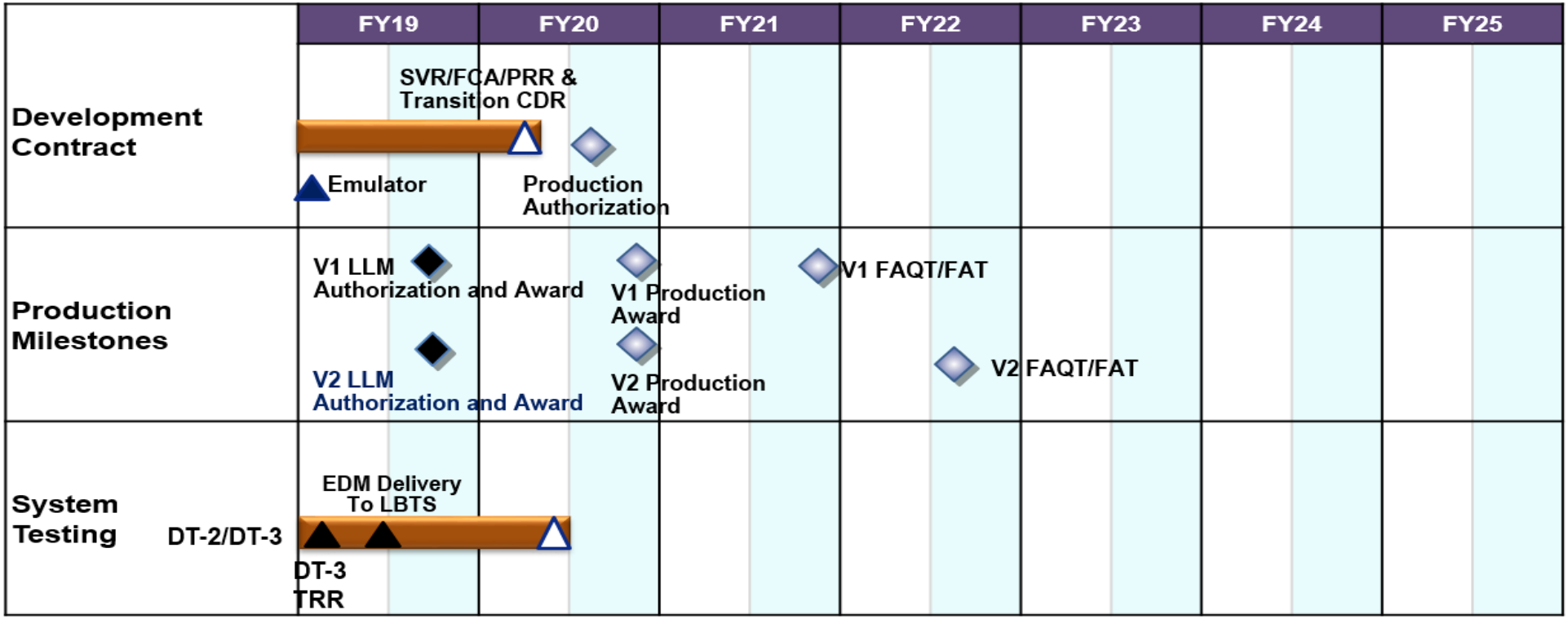
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Support Management Services	C/CPIF	SPA : Washington, DC	1.619	0.947	Dec 2018	0.000		0.000		-		0.000	0.000	2.566	-
Travel	Allot	TRAVEL : Washington, DC	0.102	0.050	Jan 2019	0.000		0.000		-		0.000	0.000	0.152	-
Support Management Services	C/CPIF	CACI : Washington, DC	0.413	0.075	Dec 2018	0.000		0.000		-		0.000	0.000	0.488	-
Support Management Services	SS/CPIF	SPA (Bridge) : Washington, DC	0.625	0.000		0.000		0.000		-		0.000	0.000	0.625	-
Support Management Services	C/CPIF	TMB : Washington, DC	0.462	0.177	Feb 2019	0.000		0.000		-		0.000	0.000	0.639	-
Support Management Services	C/CPIF	STRATEGIC INSIGHT : Washington, DC	0.117	0.035	Jan 2019	0.000		0.000		-		0.000	0.000	0.152	-
Support Management Services	WR	NSWC/DD : Dahlgren, VA	0.557	0.524	Dec 2018	0.000		0.000		-		0.000	0.000	1.081	-
		Subtotal	3.895	1.808		0.000		0.000		-		0.000	0.000	5.703	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	141.542	20.467		1.933		0.000		-		0.000	0.000	163.942	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*



CDR	Critical Design Review
DT	Developmental Testing
EDM	Engineering Development Model
FAQT/FAT	First Article Qualification Test / Factory Acceptance Testing
LBTS	Land Based Test Site
LLM	Long Lead Material
SVR/FCA/PRR	System Verification Review / Functional Configuration Audit / Production Readiness Review
TRR	Test Readiness Review

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3236				
EASR DT 2	1	2019	2	2020
EASR TRR and DT3	1	2019	2	2020
Delivery of EASR Emulator	1	2019	1	2019
EASR EDM Delivery to LBTS	2	2019	2	2019
EASR V1 Long Lead Material Authorization and Award	3	2019	3	2019
EASR V2 Long Lead Material Authorization and Award	3	2019	3	2019
EASR System Verification Review (SVR)/Functional Configuration Audit (FCA)/ Production Readiness Review (PRR) EASR Transition CDR	1	2020	1	2020
EASR Production Authorization	3	2020	3	2020
EASR V1 Production Award	4	2020	4	2020
EASR V2 Production Award	4	2020	4	2020
EASR V1 FAQT/FAT	4	2021	4	2021
EASR V2 FAQT/FAT	3	2022	3	2022

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3243 / *Shipboard Passive Electro-Optical Infrared Development*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3243: *Shipboard Passive Electro-Optical Infrared Development*	0.000	0.000	0.000	65.440	-	65.440	99.702	88.355	62.934	45.269	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Shipboard Passive Electro-Optical Infrared (SPEIR) Block I will be an open architecture system that addresses near-term capability requirements and associated gaps identified in the 2019 SPEIR Capability Description Document (CDD). This program answers an urgent counter unmanned aircraft system operational need for the Fleet to provide an initial capability by 2025. The SPEIR acquisition leverages technology developed under the Office of Naval Research's (ONR's) Combined EO/IR Surveillance and Response System (CESARS) Science and Technology (S&T) effort, specifically related to the Shipboard Panoramic EO/IR Cueing and Surveillance System (SPECSS).

SPEIR Block I will provide a common EO/IR Electronic Support (ES) capability to surface ships that will passively find, fix, track, and target current / emerging threats in support of the following warfare missions: Navigation, Counter Fast Attack Craft (FAC) / Fast In-shore Attack Craft (FIAC), Counter Unmanned Aircraft Systems (UAS) / Unmanned Aerial Vehicle (UAV), and Anti-Ship Cruise Missile (ASCM) Defense.

SPEIR Block I will consist of a passive Wide Field of View (WFOV) capability with a 360 degree field-of-view optical sensor for panoramic detection, tracking, and identification for 24/7 day/night shipboard situational awareness. SPEIR Block I will also include an enhanced, high resolution Narrow Field of View (NFOV) and laser system capability that will provide range-finding and precision 3D target tracking. SPEIR Block I will have limited integration with shipboard combat systems and include a government software development and integration effort for Soft-Kill Coordination System (SKCS) to manage ES engagements. This program includes risk reduction initiatives for Sensor Fusion Algorithms and combat system track publishing to enable limited CSI. SPEIR Block II will be a future program that will build on Block I to address longer-term capability requirements and support Periscope Detection and Discrimination (PDD) as well as Mine Like Object (MLO) avoidance. SPEIR Block II will also provide full combat system integration.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: SPEIR Block 1 Systems Engineering	0.000	0.000	23.940	0.000	23.940
Articles:	-	-	-	-	-
FY 2020 Plans: N/A					
FY 2021 Base Plans: - Complete source selection evaluation efforts					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3243 / *Shipboard Passive Electro-Optical Infrared Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Complete Milestone (MS) B preparation and acquisition documentation - Award Engineering & Manufacturing Development (E&MD) contract - Review and assess contract deliverables - Commence preparation and support for Integrated Baseline Review (IBR) - Support preparation for Preliminary Design Review (PDR) - Commence training curriculum - Commence test planning - Commence test program Modeling and Simulation - Commence Soft-Kill Coordination System (SKCS) software development & Integration effort - Commence integrated topside design activities with multiple ship classes - Support integration activities to ensure compatibility with AEGIS and SSDS Combat Systems - Commence sensor fusion risk mitigation effort - Commence track publishing risk mitigation effort ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 is the first year of funding for this effort.					
Title: SPEIR Block 1 Development	0.000	0.000	41.500	0.000	41.500
Articles:	-	-	-	-	-
FY 2020 Plans: N/A ***FY 2021 Base Plans:*** - Commence Engineering & Manufacturing Development (E&MD) design activities - Prepare for and conduct Integrated Baseline Review (IBR) - Prepare for and conduct Preliminary Design Review (PDR) - Commence integrated topside design activities with multiple ship classes - Commence integration activities to ensure compatibility with AEGIS and SSDS Combat Systems - Commence purchase of Long Lead Material items for up to three (3) Engineering Development Model (EDM) builds ***FY 2021 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3243 / *Shipboard Passive Electro-Optical Infrared Development*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 is the first year of funding for this effort.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	65.440	0.000	65.440

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• OPN/2980: *SPEIR Block I*	0.000	0.000	0.000	-	0.000	0.000	24.195	24.471	27.259	Continuing	Continuing

Remarks

D. Acquisition Strategy

SPEIR will develop initial capability and required upgrades based on integrating technology advances and adding functional capabilities in an evolutionary fashion. Each Block acquisition program will be developed and contracted in an individual yet coordinated and overlapping fashion. Specifically, SPEIR involves the work performed under the CESARS program sponsored by ONR and transitioning the passive EO/IR component (SPECSS) which focuses on designing/architecting an advanced, integrated, EO/IR WFOV surveillance capability system for Naval Surface Platforms.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3243 / *Shipboard Passive Electro-Optical Infrared Development*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SPEIR Block 1 Development	C/CPIF	TBD : TBD	0.000	0.000		0.000		41.500	May 2021	-		41.500	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		41.500		-		41.500	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SPEIR Block 1 Integrated Logistics Support	WR	NSWC Crane : Crane, IN	0.000	0.000		0.000		0.537	Oct 2020	-		0.537	Continuing	Continuing	Continuing
SPEIR Block 1 Systems Engineering Support	WR	NSWC Crane : Crane, IN	0.000	0.000		0.000		2.500	Oct 2020	-		2.500	Continuing	Continuing	Continuing
SPEIR Block 1 Systems Engineering Support	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.000		4.400	Oct 2020	-		4.400	Continuing	Continuing	Continuing
SPEIR Block 1 Systems Engineering Support	WR	NRL : Washington, DC	0.000	0.000		0.000		2.650	Oct 2020	-		2.650	Continuing	Continuing	Continuing
SPEIR Block 1 Systems Engineering Support	SS/CPFF	APL : Laurel, MD	0.000	0.000		0.000		1.350	Nov 2020	-		1.350	Continuing	Continuing	Continuing
SPEIR Block 1 Systems Engineering Support	MIPR	MIT-LL : Cambridge, MA	0.000	0.000		0.000		0.718	Nov 2020	-		0.718	Continuing	Continuing	Continuing
SPEIR Block 1 Platform Integration Studies	C/BA	BIW : Bath, ME	0.000	0.000		0.000		0.400	Nov 2020	-		0.400	Continuing	Continuing	Continuing
SPEIR Block 1 Platform Integration Studies	C/BA	Norfolk Naval Shipyard (NNSY) : Norfolk, VA	0.000	0.000		0.000		0.200	Nov 2020	-		0.200	Continuing	Continuing	Continuing
SPEIR Block 1 Platform Integration Studies	C/BA	SUPSHIP Gulf Coast : Pascagoula, MS	0.000	0.000		0.000		0.250	Nov 2020	-		0.250	Continuing	Continuing	Continuing
SPEIR Sensor Fusion	MIPR	GTRI : Atlanta, GA	0.000	0.000		0.000		0.750	Dec 2020	-		0.750	Continuing	Continuing	Continuing
SPEIR Sensor Fusion	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.000		0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
SPEIR Sensor Fusion	SS/CPFF	APL : Laurel, MD	0.000	0.000		0.000		1.000	Nov 2020	-		1.000	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3243 / *Shipboard Passive Electro-Optical Infrared Development*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SPEIR Sensor Fusion	WR	NSWC Crane : Crane, IN	0.000	0.000		0.000		1.500	Oct 2020	-		1.500	Continuing	Continuing	Continuing
SPEIR Track Publishing	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.000		1.500	Oct 2020	-		1.500	Continuing	Continuing	Continuing
SPEIR Track Publishing	SS/CPFF	APL : Laurel, MD	0.000	0.000		0.000		1.000	Nov 2020	-		1.000	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		19.255		-		19.255	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SPEIR Block 1 Test Planning/T&E Events	WR	NSWC Crane : Crane, IN	0.000	0.000		0.000		0.200	Oct 2020	-		0.200	Continuing	Continuing	Continuing
SPEIR Block 1 Test Planning/T&E Events	WR	NSWC Dahlgren : Dahlgren, VA	0.000	0.000		0.000		0.200	Oct 2020	-		0.200	Continuing	Continuing	Continuing
SPEIR Block 1 Test Planning/T&E Events	WR	NRL : Washington, DC	0.000	0.000		0.000		1.500	Oct 2020	-		1.500	Continuing	Continuing	Continuing
SPEIR Block 1 Test Planning/T&E Events	SS/CPFF	APL : Laurel, MD	0.000	0.000		0.000		1.000	Nov 2020	-		1.000	Continuing	Continuing	Continuing
SPEIR Block 1 Test Planning/T&E Events	WR	COMOPTEVFOR : Norfolk, VA	0.000	0.000		0.000		0.200	Oct 2020	-		0.200	Continuing	Continuing	Continuing
SPEIR Block 1 Test Planning/T&E Events	WR	SCSC Wallops : Wallops Island, VA	0.000	0.000		0.000		0.285	Oct 2020	-		0.285	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		3.385		-		3.385	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3243 / *Shipboard Passive Electro-Optical Infrared Development*

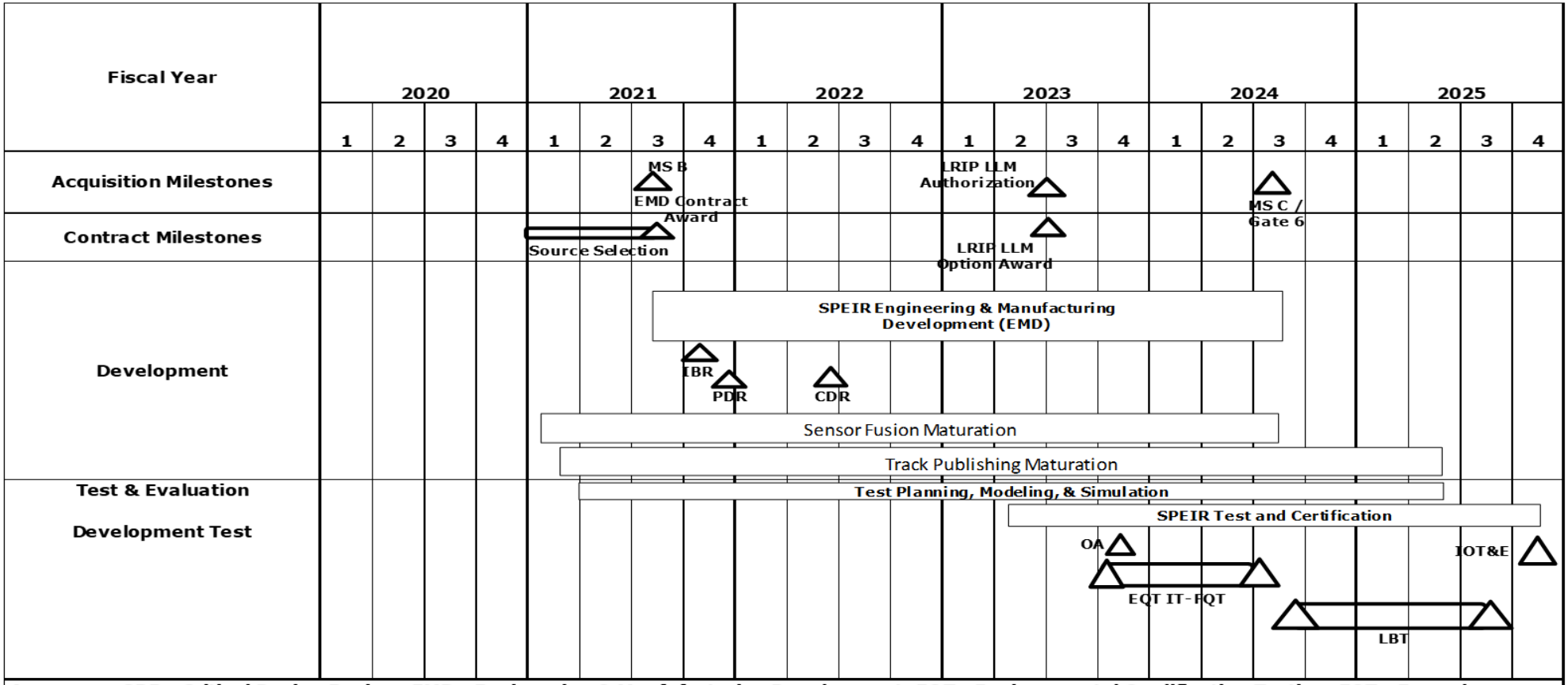
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SPEIR Block 1 Program Management	C/CPFF	SPA ESS (SEAPORT) : Washington, DC	0.000	0.000		0.000		0.400	Oct 2020	-		0.400	Continuing	Continuing	Continuing
SPEIR Block 1 Program Management	C/CPFF	TBD BFM (SEAPORT) : Washington, DC	0.000	0.000		0.000		0.600	Oct 2020	-		0.600	Continuing	Continuing	Continuing
SPEIR Block 1 Program Management	C/CPFF	TBD ACQ/ILS (SEAPORT) : Washington, DC	0.000	0.000		0.000		0.250	Oct 2020	-		0.250	Continuing	Continuing	Continuing
SPEIR Block 1 Program Management	Sub Allot	NAVSEA Travel : Washington, DC	0.000	0.000		0.000		0.050	Oct 2020	-		0.050	Continuing	Continuing	Continuing
		Subtotal	0.000	0.000		0.000		1.300		-		1.300	Continuing	Continuing	N/A

	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		65.440		-		65.440	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3243 / *Shipboard Passive Electro-Optical Infrared Development*



Acronyms: CDR - Critical Design Review; EMD - Engineering & Manufacturing Development; EQT - Environmental Qualification Testing; FQT - Formal Qualification Testing; IT - Integrated Testing; IOT&E - Initial Operational Test & Evaluation; LBT - Land Based Testing; LLM - Long Lead Material; LRIP - Low Rate Initial Procurement; MS - Milestone; OA - Operational Assessment; PDR - Preliminary Design Review; SFR - System Functional Review; SRR - System Requirements Review;

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3243 / *Shipboard Passive Electro-Optical Infrared Development*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3243				
Sensor Fusion Maturation	1	2021	3	2024
Track Publishing Maturation	1	2021	2	2025
Test Planning, Modeling & Simulation	2	2021	2	2025
E&MD Contract Award	3	2021	3	2021
Milestone B	3	2021	3	2021
Engineering & Manufacturing Development (E&MD)	3	2021	3	2024
Conduct Integrated Baseline Review (IBR)	4	2021	4	2021
Preliminary Design Review (PDR)	4	2021	4	2021
Critical Design Review (CDR)	2	2022	2	2022
SPEIR Test and Certification	2	2023	4	2025
LRIP LLM Authorization	2	2023	2	2023
LRIP LLM Option Award	2	2023	2	2023
EQT IT - Formal Qualification Test (FQT)	4	2023	3	2024
Operational Assessment (OA)	4	2023	4	2023
Milestone C	3	2024	3	2024
Land Based Test (LBT)	3	2024	3	2025
Initial Operational Test & Evaluation (IOT&E)	4	2025	4	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3301 / *Improved Capabilities SPY-1 Radar*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3301: *Improved Capabilities SPY-1 Radar*	35.679	7.642	13.116	11.239	-	11.239	12.424	12.339	12.020	12.260	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Improved Capabilities for SPY-1 Radar: These Reliability, Maintainability, and Availability (RM&A) improvements and solid state technology insertions are intended to reduce
cascading failures, mitigate obsolescence issues, and improve reliability in support of Anti-Air Warfare (AAW) and Ballistic Missile Defense (BMD) missions while still providing AN/ SPY-1 Radar Total Ownership Cost Reductions. Improvements, such as Solid State Insertion to address Diminishing Manufacturing Sources and Material Shortages (DMSMS), will yield reductions in annual fleet maintenance costs and is a top fleet requirement as part of the AEGIS Wholeness initiative. In addition to RM&A improvements, warfighting improvements funded in this line include: Transmitter Noise Cancellation (TNC) development will include hardware/software to counter low radar cross section, low altitude threats. Side Lobe Blanking (SLB) addresses shortfalls in mixed electronic attack environment while in an Integrated Air and Missile Defense (IAMD) mode. The Ship-Based Non-Cooperative Target Recognition (SBNCTR) program Phases 2, 2A and 3 will develop algorithms to provide classification for targets. Transition of Advanced Calibration Experiment (ACE) Phases 1 and 2 from Baseline 7 into Baseline 9. Incorporate ERACE Phases 1/2 and 3 into Baseline 9. Electronic Attack (EA) and Rapid Radar Capability Improvement Program (R2CIP) develop solutions for evolving EA threats.

FY21 includes continuation of development of SBNCTR Phase 2A, TNC phase 1 & 2, EA improvements, and Elevated Radar Advanced Calibration Experiment (ERACE) Phase 1/2. ERACE certification is targeted to be part of Baseline 9.2.3 certification, which is scheduled for 2Q FY22.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Improved Capabilities SPY-1 Radar	7.642	13.116	11.239	0.000	11.239
Articles:	-	-	-	-	-
FY 2020 Plans:					
- Complete ACE Phase 1 development Baseline 9					
- Restart SBNCTR Phase 2A development; includes integration of other sensors and threats					
- Conduct SBNCTR Phase 2A IPR#3					
- Conduct TNC Phase 1 regression testing					
- Conduct TNC Phase 2 requirements definition					
- Continue EA improvements technology development, integration and test					
- Continue ERACE Phase 1/2 development					
- Conduct ERACE Phase 1/2 FLEX Event to test multiple sensors in an at-sea operational environment					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3301 / *Improved Capabilities SPY-1 Radar*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Continue Solid State/Digital Receive Upgrade Analysis - Complete Digital Receive Equipment Trade Study					
FY 2021 Base Plans: - Conduct TNC Phase 1 integration and test - Conduct TNC Phase 2 IPR #1 - Continue EA improvements technology development, integration and test - Continue ERACE Phase 1/2 development - Continue Solid State/Digital Receive Upgrade Analysis - Commence digital Low Noise Amplifier (dLNA) requirements and specification analysis - Conduct ACE Phase 1 Certification Baseline 9					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Decrease in FY21 is due to reprioritization of development efforts.					
Accomplishments/Planned Programs Subtotals	7.642	13.116	11.239	0.000	11.239

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
• O&MN/1C1C/0702228N: *O&M,N AEGIS Wholeness SPY Transmitter Reliability*	4.027	4.261	4.227	-	4.227	4.352	4.422	4.550	4.645	Continuing	Continuing
• OPN/2980: *OPN SPY-1 RM&A IMPROVEMENTS*	24.816	26.492	28.152	-	28.152	16.646	16.590	56.532	57.642	Continuing	Continuing

Remarks

D. Acquisition Strategy

Improved Capabilities SPY-1 Reliability, Maintainability, and Availability (RM&A) will design and develop an Ordnance Alterations (ORDALT) Package for fixes and modifications to known transmitter, signal processor, microwave tube (MWT), and logistic shortcomings. Investment in development of SPY-1 RM&A improvements to address failure mechanisms and improve reliability is planned to continue beyond the FYDP. Radar capability upgrades (SBNCTR, TNC, ACE and ERACE) and reliability improvements will be incorporated into Baseline 9 and follow.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3301 / *Improved Capabilities SPY-1 Radar*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
SYSTEM ENGINEERING	MIPR	Office of Naval Research : Arlington, VA	1.000	0.000		0.000		0.000		-		0.000	0.000	1.000	-
SYSTEM ENGINEERING	C/CPFF	Raytheon : Sudbury, MA	1.941	0.000		0.000		0.000		-		0.000	0.000	1.941	-
SYSTEM ENGINEERING	WR	NSWC/Crane, IN : Crane, IN	13.926	1.142	Dec 2018	2.485	Oct 2019	8.224	Nov 2020	-		8.224	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	SS/CPFF	Lockheed Martin : Moorestown, NJ	10.929	3.931	Jan 2019	6.646	Dec 2019	0.000		-		0.000	0.000	21.506	-
SYSTEM ENGINEERING	SS/CPFF	AEGIS Techrep : Moorestown, NJ	0.776	0.222	Nov 2018	0.222	Jan 2020	0.180	Dec 2020	-		0.180	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	SS/FP	APL/JHU : Laurel, MD	0.835	0.365	Jan 2019	0.465	Dec 2019	0.400	Nov 2020	-		0.400	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	CSCS : Dahlgren, VA	0.342	0.062	Dec 2018	0.190	Oct 2019	0.062	Nov 2020	-		0.062	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NRL : Washington, DC	0.655	0.283	Jan 2019	0.396	Nov 2019	0.396	Nov 2020	-		0.396	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	MIPR	MIT/LL : Lexington, MA	0.900	0.204	Jan 2019	0.315	Feb 2020	0.450	Feb 2021	-		0.450	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NSWC DD : Dahlgren, VA	2.976	0.995	Nov 2018	1.677	Oct 2019	1.091	Nov 2020	-		1.091	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NSWC/PHD : Port Hueneme, CA	0.317	0.136	Nov 2018	0.360	Oct 2019	0.166	Nov 2020	-		0.166	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	MIPR	DTIC : Fort Belvior, VA	0.234	0.050	Feb 2019	0.000		0.000		-		0.000	0.000	0.284	-
SYSTEM ENGINEERING	WR	SCSC Wallops : Wallops Island, VA	0.000	0.032	Feb 2019	0.000		0.000		-		0.000	0.000	0.032	-
SYSTEM ENGINEERING	C/FFP	Raytheon : Waltham, MA	0.000	0.000		0.090	Feb 2020	0.000		-		0.000	0.000	0.090	-
		Subtotal	34.831	7.422		12.846		10.969		-		10.969	Continuing	Continuing	N/A

Remarks

FY20 funding requirements were refined and allocations increased primarily due to support of digital Low Noise Amplifier (dLNA) effort.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3301 / *Improved Capabilities SPY-1 Radar*

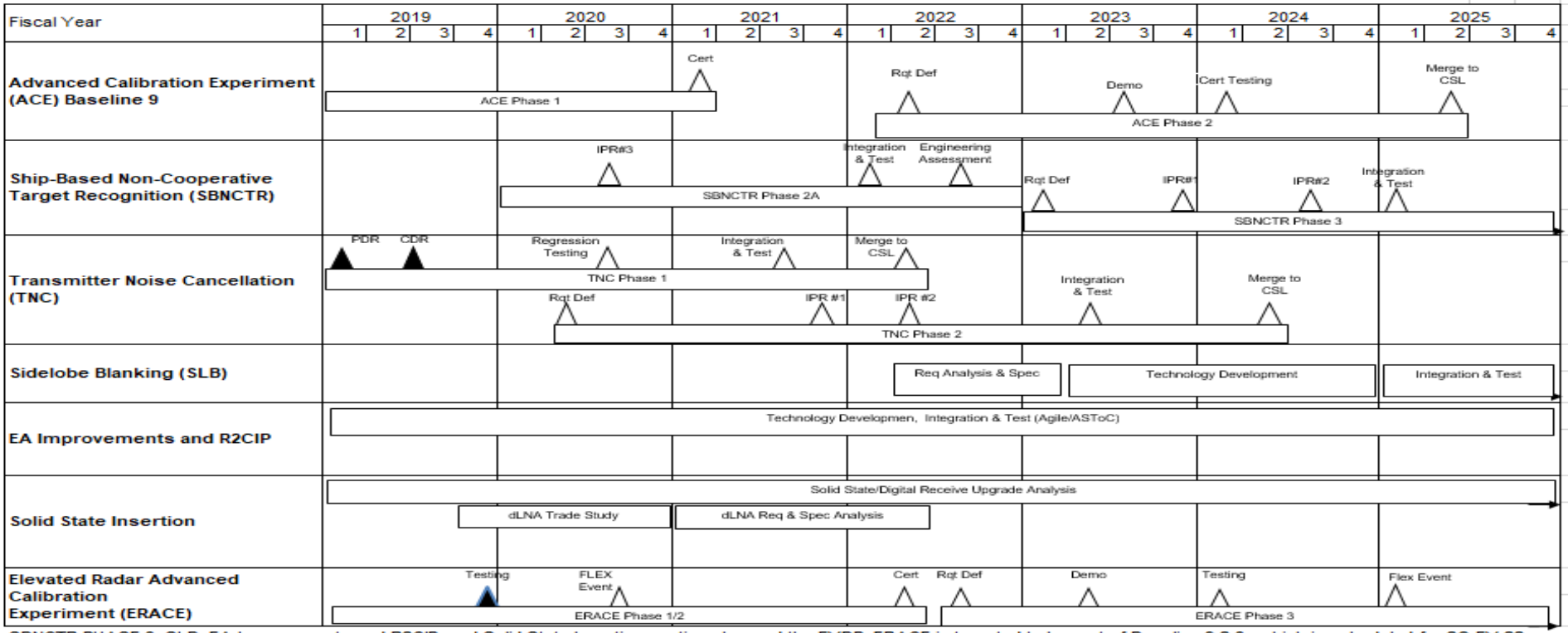
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	PEOIWS2 : Washington, DC	0.019	0.020	Dec 2018	0.020	Oct 2019	0.020	Jan 2021	-		0.020	Continuing	Continuing	Continuing
Support Management Services	C/CPIF	SPA : Washington, DC	0.648	0.200	Dec 2018	0.250	Feb 2020	0.250	Nov 2020	-		0.250	0.000	1.348	-
Support Management Services	SS/CPIF	SPA (Bridge) : Washington, DC	0.181	0.000		0.000		0.000		-		0.000	0.000	0.181	-
		Subtotal	0.848	0.220		0.270		0.270		-		0.270	Continuing	Continuing	N/A

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	35.679	7.642		13.116		11.239		-		11.239	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3301 / *Improved Capabilities SPY-1 Radar*



SBNCTR PHASE 3, SLB, EA Improvements and R2CIP, and Solid State Insertion continue beyond the FYDP. ERACE is targeted to be part of Baseline 9.2.3, which is scheduled for 2Q FY 22. ACE Phase 2 improvements deferred from FY 20 to FY 22 to concentrate on TNC Phase 2 efforts. After the TNC CDR, there was a decision to develop a TNC Phase 2 to capture improvements to Dual Beam processing that were not captured in TNC Phase 1. Historically, Solid State efforts focused on transmitter upgrades; scope has expanded to include Signal Processor and Antenna groups as well as transmitter group. The GAN efforts are included in the overall scope.

Acronyms:

CDR: Critical Design Review
CSL: Common Source Library
DMSMS: Diminishing Manufacturing Sources and Material Shortages
EA: Electronic Attack
ERACE: Elevated Radar ACE
FLEX: Fleet Exercise
IPR: In-Process Review
MWT: Microwave Tube
PDR: Preliminary Design Review
R2CIP: Rapid Radar Capability Improvement Program
SS: Solid State
GaN: Gallium Nitride
dLNA: digital Low Noise Amplifier (previously DRE)
SRR: System Requirements Review
TIM: Technical Interchange Meeting
ASToC: AEGIS Speed to Capability

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3301 / *Improved Capabilities SPY-1 Radar*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3301				
ACE Phase 1 Development	1	2019	1	2020
TNC Phase 1 PDR	1	2019	1	2019
EA Improvements and R2CIP Technology Development, Integration & Test	1	2019	4	2025
Solid State Digital Receive Upgrade Analyses	1	2019	4	2025
TNC Phase 1 CDR	3	2019	3	2019
digital Low Noise Amplifier (dLNA) Trade Study	4	2019	4	2020
ERACE Phase 1/2 Testing	4	2019	4	2019
TNC Phase 2 Requirements Definition	2	2020	2	2020
SBNCTR Phase 2A IPR #3	3	2020	3	2020
TNC Phase 1 Regression Testing	3	2020	3	2020
ERACE Phase 1/2 Flex Event	3	2020	3	2020
digital Low Noise Amplifier (dLNA) Requirements & Specification Analysis	1	2021	2	2022
ACE Phase 1 Certification	1	2021	1	2021
TNC Phase 1 Integration & Test	3	2021	3	2021
TNC Phase 2 IPR #1	4	2021	4	2021
SBNCTR Phase 2A Integration & Test	1	2022	1	2022
ACE Phase 2 Requirements Definition	2	2022	2	2022
TNC Phase 1 Merge to Common Source Library	2	2022	2	2022
TNC Phase 2 IPR #2	2	2022	2	2022
SLB Requirements Analysis and Specification	2	2022	1	2023
ERACE Phase 1 / 2 Certification	2	2022	2	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3301 / *Improved Capabilities SPY-1 Radar*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
SBNCTR Phase 2A Engineering Assessment	3	2022	3	2022
ERACE Phase 3 Requirements Definition	3	2022	3	2022
SBNCTR Phase 3 Requirements Definition	1	2023	1	2023
SLB Technology Development	2	2023	4	2024
TNC Phase 2 Integration and Test	2	2023	2	2023
ERACE Phase 3 Demo	2	2023	2	2023
ACE Phase 2 Demo	3	2023	3	2023
SBNCTR Phase 3 IPR #1	4	2023	4	2023
ERACE Phase 3 Testing	1	2024	1	2024
ACE Phase 2 Certification Testing	1	2024	1	2024
TNC Phase 2 merge to CSL	2	2024	2	2024
SBNCTR Phase 3 IPR #2	3	2024	3	2024
SBNCTR Phase 3 Integration and Test	1	2025	1	2025
SLB Integration and Test	1	2025	4	2025
ERACE Phase 3 Flex Event	1	2025	1	2025
ACE Phase 2 merge to CSL	2	2025	2	2025

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3408 / *AN/SPS-49 Technical Refresh*	

COST ($ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
3408: *AN/SPS-49 Technical Refresh*	0.000	0.000	13.125	8.096	-	8.096	0.994	0.000	0.000	0.000	0.000	22.215
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

AN/SPS-49 Technology Refresh: As the only Air Surveillance Radar on the LSD 41/49 class ships, continued degradation and increasingly low radar availability of the AN/SPS-49 Radar is greatly impacting deployed missions, impacting safety of flight and affecting LSD Air Warfare capability and operations. Funding is to complete development, test and evaluation, validation and integration of a technology refresh of the below deck hardware for the AN/SPS-49A(V)1 Long Range Air Surveillance Radar. This technology refresh will include Reliability, Maintainability, and Availability (RM&A) improvements and solid state technology insertions which will reduce cascading failures and mitigate obsolescence issues. In addition, this effort replaces key components to include: transmitter, receiver, exciter, antenna elevation servo control, radar system control, display and signal data processor (SDP). A digital receiver/exciter (DREX) with high-performance computing technology will be a key component in the new system. The current SPS-49 radar has no software so new software is being developed to mimic the current radar functions to maintain compatibility with internal and external interfaces. This effort will improve SPS-49 electronic protection, have increased surveillance range and increased slow moving small target detection, as well as reduce total ownership cost with lower unit cost and smaller size/weight/power requirements.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: AN/SPS-49 Technology Refresh	0.000	13.125	8.096	0.000	8.096
Articles:	-	-	-	-	-
FY 2020 Plans: - Initiate system hardware and software design and development - Close out Preliminary Design Review (PDR) - Conduct Critical Design Review (CDR) - Complete top level drawings/models - Commence collection of Reliability, Availability and Maintainability data - Commence development of provisioning technical data - Complete interface design - Complete software test description					
FY 2021 Base Plans: - Close out CDR - Receive prototype Build of Material (BOM) - Begin installing for integration tests at NRL and Crane					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3408 / *AN/SPS-49 Technical Refresh*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
- Conduct Test Readiness Reviews as required for integration testing - Build prototype to validate models - Begin developing training support plan - Continue collection of Reliability, Availability and Maintainability data - Continue development of provisioning technical data - Begin integration of DREX with Signal Data Processor (SDP) and transmitter designs ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** FY21 decrease is due to the ramp down to completion of development of the technology refresh of the AN/SPS-49 radar.					
Accomplishments/Planned Programs Subtotals	0.000	13.125	8.096	0.000	8.096

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

To accomplish the SPS-49 Tech Refresh, the Navy is leveraging an Other Transactional Authority (OTA) contract for Industrial Base Analysis and Sustainment Program (IBAS) Radar Systems Should Cost Model/Prototypes for Defense Affordability and Industrial Base Resiliency awarded by OSD in Q4 FY18.

Early start development of technologies funded using Small Business Innovative Research (SBIR), Rapid Insertion Funds (RIF), Technology Insertion Funds (TIF) and OSD's Industrial Base Analysis and Sustainment (IBAS) programs will be integrated to provide a below deck technology refresh of the AN/SPS-49 Long Range Air Surveillance Radar. Funds will be used to perform Initial Technical Review, Analysis of Alternatives, System Requirements Review, System Functional Review, Preliminary Design Review and Critical Design Review.

Funding for the OTA contract is required to complete subsystem development to include transmitter, receiver/exciter, processor and antenna control unit, integration of the subsystems, and integration with the legacy radar including the antenna, conduct test readiness reviews, full system test and evaluation for factory acceptance, and delivery of one Engineering Development Model (EDM).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3408 / *AN/SPS-49 Technical Refresh*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2019 Cost	FY 2019 Award Date	FY 2020 Cost	FY 2020 Award Date	FY 2021 Base Cost	FY 2021 Base Award Date	FY 2021 OCO Cost	FY 2021 OCO Award Date	FY 2021 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
System Engineering	MIPR	Army : Picatinny, NJ	0.000	0.000		13.125	Mar 2020	8.096	Nov 2020	-		8.096	0.000	21.221	-
		Subtotal	0.000	0.000		13.125		8.096		-		8.096	0.000	21.221	N/A

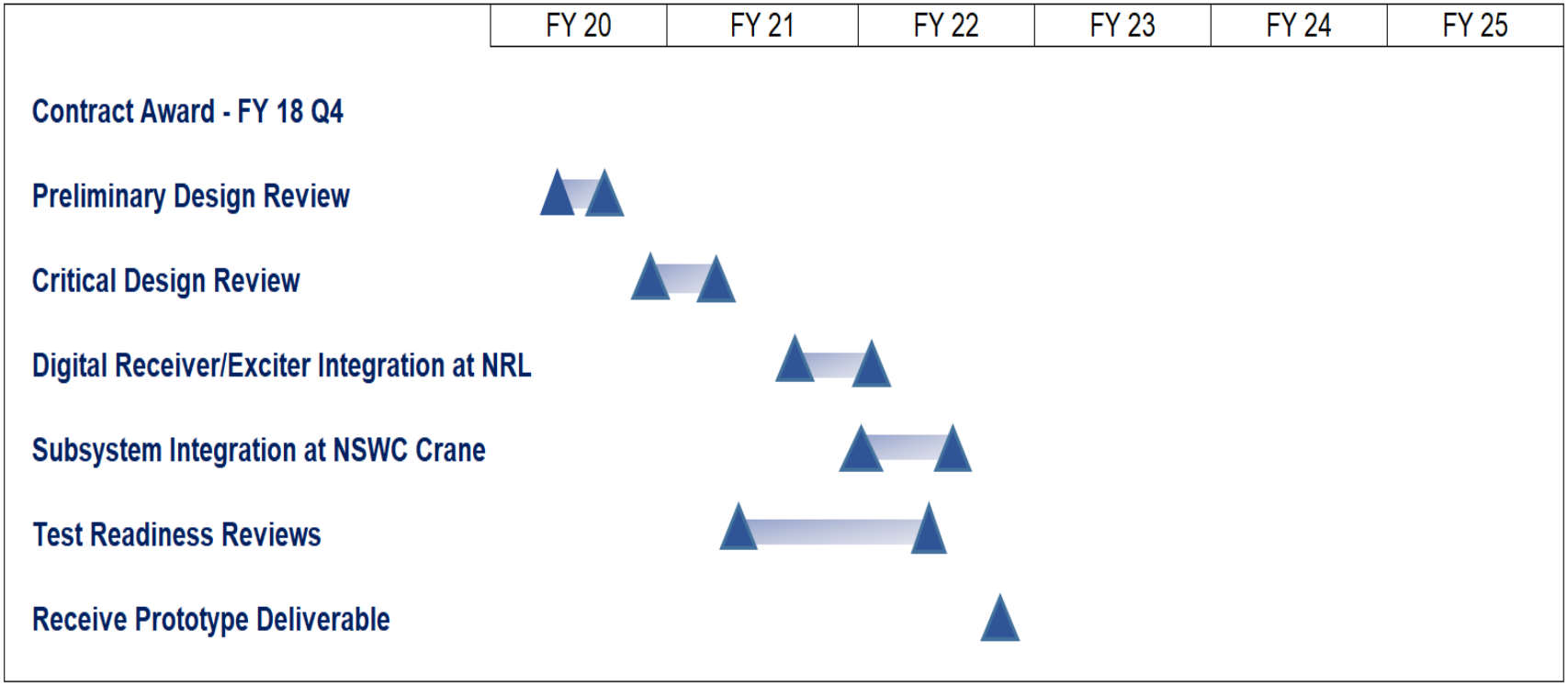
Remarks

Due to funding reductions since FY 2020 President's Budget request, FY20 and FY21 funding is being realigned to the prime contractor to complete subsystem development including transmitter, receiver/exciter, processor and antenna control unit. The contracted efforts are part of an early start development of technologies comprising SBIR, RIF, TIF and OSD's IBAS program funds.

	Prior Years	FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		13.125		8.096		-		8.096	0.000	21.221	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3408 / *AN/SPS-49 Technical Refresh*



Contract PoP AUG 2022

Budget profile capitaizes on early development contracts funded by Small Business Innovation Research (SBIR), Rapid Innovation Funds (RIF), OSD Industrial Base Analysis and Sustainment (IBAS) Programs

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3408 / *AN/SPS-49 Technical Refresh*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3408				
Preliminary Design Review (PDR)	2	2020	4	2020
Critical Design Review (CDR)	4	2020	2	2021
Test Readiness Reviews (TRR)	2	2021	2	2022
Digital Receiver/Exciter Integration/Test at NRL	3	2021	1	2022
System/Subsystem Integration Testing at NSWC Crane	4	2021	2	2022
Receive Prototype	4	2022	4	2022