Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy											Date: March 2019	
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 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	363.843	84.507	33.884	34.554	-	34.554	23.693	15.660	14.932	15.232	Continuing	Continuing
3188: *Dual-Band Radar*	105.588	7.151	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	112.739
3232: *Multi-Mission Signal Processor*	158.547	2.378	2.464	2.005	-	2.005	2.987	3.056	3.114	3.176	Continuing	Continuing
3236: *Advanced Radar Technology*	74.317	64.690	23.552	1.933	-	1.933	0.000	0.000	0.000	0.000	0.000	164.492
3301: *Improved Capabilities SPY-1 Radar*	25.391	10.288	7.868	13.116	-	13.116	12.606	11.604	11.818	12.056	Continuing	Continuing
3408: *AN/SPS-49 Technical Refresh*	0.000	0.000	0.000	17.500	-	17.500	8.100	1.000	0.000	0.000	0.000	26.600

A. Mission Description and Budget Item Justification

Dual-Band Radar (DBR) Upgrades: Funding is for Dual Band Radar (DBR) System upgrades to implement cost savings initiatives for Volume Search Radar (VSR) modifications, supportability analysis and associated logistics product updates; future upgrades/technology insertion efforts for Multi-Function Radar (MFR)/VSR as a part of the DBR suite on CVN 78 Class ships and the MFR on DDG 1000 Class ships. Funding is also required to resolve the hardware and software issues discovered during the various test events to include: DTB2-411, SDTS testing, Land Based Testing and pertinent At-Sea test events. The upgrades will include all aspects of the radar system/subsystems, including hardware and software. Specific subsystem areas include the Array, Transmit/Receive (T/R) module, Receiver/Exciter, Signal Data Processor, Radome, and power/cooling systems. Upgrades and technology insertions are required to maintain the level of force protection needed for ship defense against all threats envisioned in the littoral environment. The supportability analysis and logistic products associated with these upgrades will also be developed and updated. DBR CVN 78 Testing and Certification: FY18 requirement supported DBR At-Sea Test and Evaluation (T&E), Environmental Testing DBR Systems Certification for CVN 78 and CVN 78 Waterfront Integration Testing (WIT). The WIT efforts integrate and test the radar with the CVN78 combat system prior to the Self Defense Test Ship (SDTS) risk reduction firings (ET-09) in late FY18. Conducting the WIT allows for early identification of radar issues to ensure the Integrated Combat System (ICS) can meet all objectives to reduce any potential risk to ET-09. FY2018 is the final year of RDT&E funding planned for this program.

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 2020 Navy	Date: March 2019
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 technology refresh, including 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. In FY20, MMSP/ALPS research, development, and integration will provide cost effective radar system-level improvements.

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.

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. FY20 includes completion of ACE Phase 1, continuation of development of ACE Phase 2, SBNCTR Phase 2A, TNC, EA improvements, and Elevated Radar Advanced Calibration Experiment (ERACE) Phase 1/2. Due to reduced SBNCTR funding in FY19, efforts have been deferred to FY20. ERACE certification is targeted to be part of Baseline 9.2.X certification, which is scheduled for 2Q FY22.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
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*

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. Funding will also be used to address potential hardware and software issues discovered during land based test events and integration with the Ship Self Defense System (SSDS).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	87.233	35.635	17.393	-	17.393
Current President's Budget	84.507	33.884	34.554	-	34.554
Total Adjustments	-2.726	-1.751	17.161	-	17.161
• Congressional General Reductions	-	-0.046			
• Congressional Directed Reductions	-	-1.705			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.687	0.000			
• Program Adjustments	0.000	0.000	17.218	-	17.218
• Rate/Misc Adjustments	-0.001	0.000	-0.057	-	-0.057
• Congressional General Reductions Adjustments	-0.038	-	-	-	-

Change Summary Explanation

FY 2018 decrease is due to Small Business Innovation Research (SBIR), Navy Working Capital Fund and Federally Funded Research and Development Center (FFRDC) reductions.

FY 2019 decrease is due to adjustment to the Enterprise Air Surveillance Radar (EASR) program and FFRDC reduction.

FY 2020 increase (+$17.500M) is due to initiation of AN/SPS-49 below deck technology refresh effort and various rate adjustments. FY 2020 also includes a $0.282M Contractor Services Reform reduction.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy				Date: March 2019
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3188 / *Dual-Band Radar*		

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
3188: *Dual-Band Radar*	105.588	7.151	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	112.739
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Dual-Band Radar (DBR) Upgrades: Funding is for Dual Band Radar (DBR) System upgrades to implement cost savings initiatives for Volume Search Radar (VSR) modifications, supportability analysis and associated logistics product updates; future upgrades/technology insertion efforts for Multi-Function Radar (MFR)/VSR as a part of the DBR suite on CVN 78 Class ships and the MFR on DDG 1000 Class ships. Funding is also required to resolve the hardware and software issues discovered during the various test events to include: DTB2-411, SDTS testing, Land Based Testing and pertinent At-Sea test events. The upgrades will include all aspects of the radar system/subsystems, including hardware and software. Specific subsystem areas include the Array, Transmit/Receive (T/R) module, Receiver/Exciter, Signal Data Processor, Radome, and power/cooling systems. Upgrades and technology insertions are required to maintain the level of force protection needed for ship defense against all threats envisioned in the littoral environment. The supportability analysis and logistic products associated with these upgrades will also be developed and updated. DBR CVN 78 Testing and Certification: FY18 requirement supported DBR At-Sea Test and Evaluation (T&E), Environmental Testing DBR Systems Certification for CVN 78 and CVN78 Waterfront Integration Testing (WIT). The WIT efforts integrate and test the radar with the CVN78 combat system prior to the Self Defense Test Ship (SDTS) risk reduction firings (ET-09) scheduled for late FY18. Conducting the WIT allows for early identification of radar issues to ensure the Integrated Combat System (ICS) can meet all objectives to reduce any potential risk to ET-09. FY2018 is the final year of RDT&E funding planned for this program.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: RADAR UPGRADES TECHNOLOGY INSERTION	5.031	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2019 Plans: N/A					
FY 2020 Base Plans: N/A					
FY 2020 OCO Plans: N/A					
Title: RADAR UPGRADES GOVERNMENT ENGINEERING SERVICES	2.024	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2019 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3188 / *Dual-Band Radar*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
N/A ***FY 2020 Base Plans:*** N/A ***FY 2020 OCO Plans:*** N/A					
Title: RADAR UPGRADES PROGRAM MANAGEMENT	0.096	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
FY 2019 Plans: N/A ***FY 2020 Base Plans:*** N/A ***FY 2020 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	7.151	0.000	0.000	0.000	0.000

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• OPN/2980: *BLI 2980/ OPN Items Less Than $5M*	16.350	35.811	21.898	-	21.898	24.271	21.903	17.817	21.670	Continuing	Continuing
• O&M,N/1C1C/0702228N: *0702228N/1C1C/O&M,N*	2.851	9.704	9.210	-	9.210	9.385	9.554	9.588	9.779	Continuing	Continuing

Remarks

D. Acquisition Strategy

Radar Upgrades and logistic products will be developed to address lessons learned and technology refresh for DBR systems on multiple ship classes.

E. Performance Metrics

- Complete upgrade studies and analyses each fiscal year to determine efficiencies for Hardware (H/W) and Software (S/W) upgrades and to determine appropriate logistics product updates

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3188 / *Dual-Band Radar*

- Complete Electromagnetic Interference (EMI) Testing and Analysis
- Complete upgrade technology insertion
- Complete development of logistics products
- Implement supportability analysis to improve supportability and reduce overall lifecycle cost
- Complete DBR At-Sea Test and Evaluation (T&E)
- Complete planning for DBR Environmental Testing
- Complete DBR Systems Certification
- Complete DBR/SEWIP interface development
- Complete DBR Shipboard Testing
- Complete FY2018 CVN 78 Waterfront Integration Testing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3188 / *Dual-Band Radar*

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering Support	WR	Other Government Activities : Various	1.143	0.000		0.000		0.000		-		0.000	0.000	1.143	-
Government Engineering Support	WR	NSWC/Dahlgren : Dahlgren, VA	16.112	0.958	Oct 2017	0.000		0.000		-		0.000	0.000	17.070	-
Government Engineering Support	WR	NSWC/PHD : Port Hueneme, CA	6.796	0.249	May 2018	0.000		0.000		-		0.000	0.000	7.045	-
Government Engineering Support	WR	NSWC/Crane : Crane, IN	5.281	0.020	Nov 2017	0.000		0.000		-		0.000	0.000	5.301	-
Government Engineering Support	WR	NRL : Washington, DC	3.725	0.000		0.000		0.000		-		0.000	0.000	3.725	-
Government Engineering Support	SS/CPFF	JHU/APL : Columbia, MD	2.092	0.605	Nov 2017	0.000		0.000		-		0.000	0.000	2.697	-
Government Engineering Support	MIPR	NSMA : Arlington, VA	0.903	0.000		0.000		0.000		-		0.000	0.000	0.903	-
Government Engineering Support	SS/CPFF	GTRI : Atlanta, GA	1.158	0.000		0.000		0.000		-		0.000	0.000	1.158	-
Government Engineering Support	WR	NSWC/Carderock : Philadelphia, PA	0.364	0.076	Oct 2017	0.000		0.000		-		0.000	0.000	0.440	-
Government Engineering Support	WR	NSWC/Dam Neck : Dam Neck, VA	1.274	0.000		0.000		0.000		-		0.000	0.000	1.274	-
Government Engineering Support	SS/CPFF	AEGIS Tech Rep : Moorestown, NJ	0.014	0.000		0.000		0.000		-		0.000	0.000	0.014	-
Government Engineering Support	WR	TASC : Andover, MA	0.048	0.000		0.000		0.000		-		0.000	0.000	0.048	-
Government Engineering Support	WR	NSWC/Corona : Corona, CA	0.714	0.116	Feb 2018	0.000		0.000		-		0.000	0.000	0.830	-
Government Engineering Support	WR	NAWC/PT MUGU : PT MUGU, CA	0.586	0.000		0.000		0.000		-		0.000	0.000	0.586	-
Systems Engineering	SS/CPFF	Raytheon : Raytheon, Sudbury, MA	56.686	5.031	Dec 2017	0.000		0.000		-		0.000	0.000	61.717	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3188 / *Dual-Band Radar*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering	SS/CPAF	Raytheon IDS : San Diego, CA	1.500	0.000		0.000		0.000		-		0.000	0.000	1.500	-
Systems Engineering	SS/CPFF	General Dynamics AIS : Fairfax, VA	1.000	0.000		0.000		0.000		-		0.000	0.000	1.000	-
Systems Engineering	SS/CPFF	PMS 320 Syntek : Arlington, VA	0.400	0.000		0.000		0.000		-		0.000	0.000	0.400	-
		Subtotal	99.796	7.055		0.000		0.000		-		0.000	0.000	106.851	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	C/CPIF	SPA (SEAPORT) : Washington, DC	4.719	0.000		0.000		0.000		-		0.000	0.000	4.719	-
DAWDF	Allot	N/A : N/A	0.027	0.000		0.000		0.000		-		0.000	0.000	0.027	-
Travel	Allot	PEOIWS2 : Washington, DC	0.200	0.030	Jul 2018	0.000		0.000		-		0.000	0.000	0.230	-
Program Management Support	C/CPIF	ALION : Washington, DC	0.026	0.000		0.000		0.000		-		0.000	0.000	0.026	-
Program Management Support	C/CPFF	CACI : Washington, DC	0.316	0.000		0.000		0.000		-		0.000	0.000	0.316	-
Program Management Support	C/CPIF	TMB : Washington, DC	0.047	0.000		0.000		0.000		-		0.000	0.000	0.047	-
Program Management Support	C/CPIF	SPA : Washington, DC	0.195	0.066	Dec 2017	0.000		0.000		-		0.000	0.000	0.261	-
Program Management Support	SS/CPIF	SPA (Bridge) : Washington, DC	0.262	0.000		0.000		0.000		-		0.000	0.000	0.262	-
		Subtotal	5.792	0.096		0.000		0.000		-		0.000	0.000	5.888	N/A

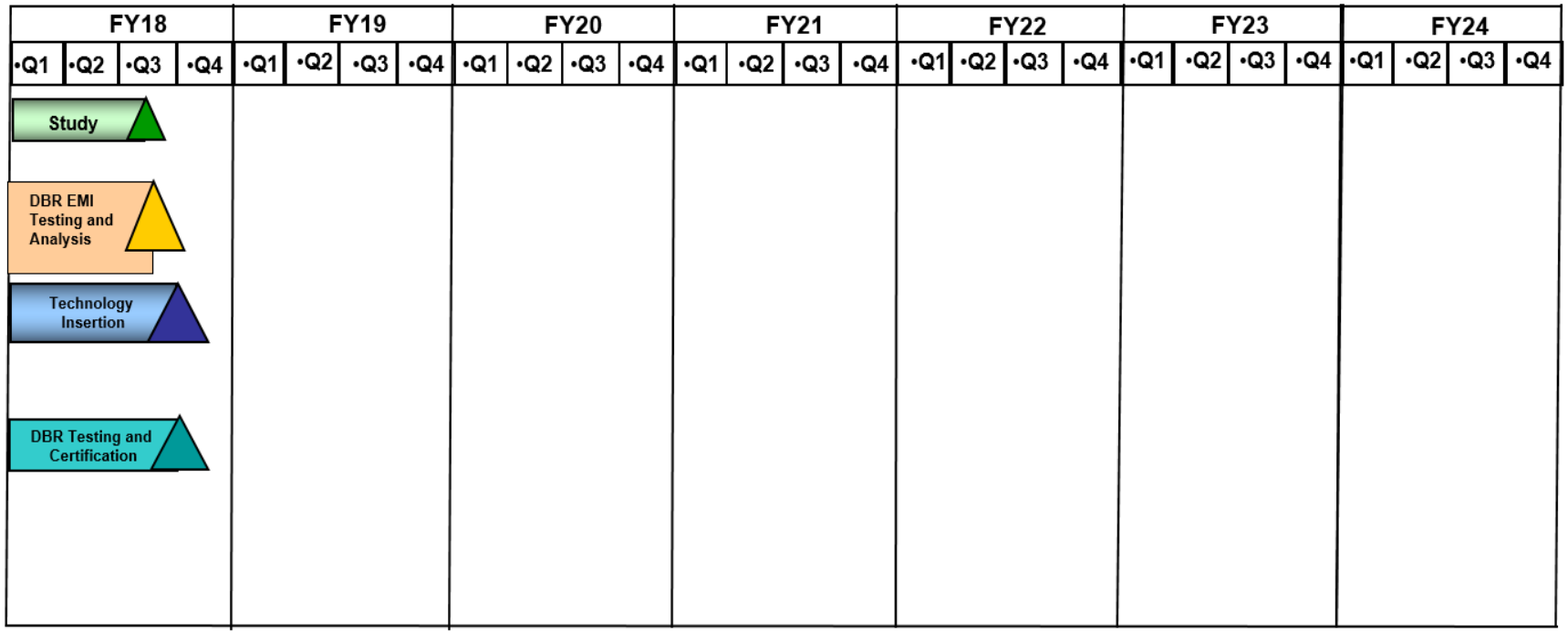
Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3188 / *Dual-Band Radar*	

	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	105.588	7.151	0.000	0.000	-	0.000	0.000	112.739	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3188 / *Dual-Band Radar*

DBR System Upgrades



Note: Supportability Analysis is conducted in conjunction with the Study.

DBR At-Sea T&E, Planning for Environmental Testing, DBR System Certification, and CVN 78 DBR Waterfront Integration Testing are included in the DBR Testing and Certification Support

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3188 / *Dual-Band Radar*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3188				
DBR System Upgrade Studies and Analysis	1	2018	3	2018
DBR EMI Testing and Analysis	1	2018	3	2018
DBR System Upgrade Technology Insertion	1	2018	4	2018
DBR Testing and Certification	1	2018	4	2018

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
3232: *Multi-Mission Signal Processor*	158.547	2.378	2.464	2.005	-	2.005	2.987	3.056	3.114	3.176	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 technology refresh, including 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. In FY20, MMSP/ALPS research, development, and integration will provide cost effective radar system-level improvements.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: SYSTEMS ENGINEERING	2.378	2.464	2.005	0.000	2.005
Articles:	-	-	-	-	-
FY 2019 Plans: - Continue MMSP-R development to support AEGIS Modernization due to DMSMS and obsolescence issues. - Complete MMSP-R ACB16 integration and test. - Conduct MMSP-R ACB16 Multi-Mission Exercise (MMEX). - Conduct MMSP-R Demo.					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
- Continue to maintain alignment with the Ballistic Missile Defense (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. ***FY 2020 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. - Continue to support ACB16 MMSP improvements. - Complete MMSP-R ECPs. - Perform MMSP/ALPS concept development. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease in FY2020 is due to completion of MMSP-R ACB16 integration and test.					
Accomplishments/Planned Programs Subtotals	2.378	2.464	2.005	0.000	2.005

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• OPN/0900: *BLI 0900/ OPN DDG Modernization*	592.644	462.908	551.140	-	551.140	555.525	812.338	1,042.482	1,107.075	2,558.665	10,373.593

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.

E. Performance Metrics

- Complete DDG Commercial Off The Shelf (COTS) Refresh - Engineering Change Proposal (ECP) for MMSP on Destroyers

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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*

- Complete ACB16 Phase 1 certification
- Complete ACB16 Phase 2 certification
- Complete ACB16 COTS Refresh
- Complete MMSP-R Design and Development
- Complete MMSP-R Radar integration and test
- Complete MMSP-R ACB16 integration and test
- Complete MMSP-R ACB16 MMEX
- Complete MMSP-R Demo
- Complete MMSP-R ECPs
- Complete MMSP/ALPS concept development
- Complete MMSP/ALPS requirements analysis and specifications update
- Complete MMSP/ALPS technology development

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 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	5.341	0.150	Mar 2018	0.150	Nov 2018	0.150	Dec 2019	-		0.150	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	SS/FP	APL/JHU : Laurel, MD	4.911	0.120	Aug 2018	0.080	Feb 2019	0.075	Nov 2019	-		0.075	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	CSCS : Dahlgren, VA	1.580	0.062	Jun 2018	0.062	Nov 2018	0.062	Jun 2020	-		0.062	0.000	1.766	-
SYSTEM ENGINEERING	WR	NRL : Washington, DC	3.058	0.106	Nov 2017	0.132	Dec 2018	0.126	Nov 2019	-		0.126	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	8.806	0.334	Oct 2017	0.400	Nov 2018	0.372	Oct 2019	-		0.372	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	4.147	1.388	Oct 2017	1.369	Nov 2018	0.960	Oct 2019	-		0.960	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NSWC/PHD : Port Hueneme, CA	4.149	0.121	Nov 2017	0.172	Nov 2018	0.161	Oct 2019	-		0.161	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	154.429	2.281		2.365		1.906		-		1.906	Continuing	Continuing	N/A

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	PEOIWS2 : Washington, DC	0.238	0.010	Nov 2017	0.010	Jan 2019	0.010	Oct 2019	-		0.010	Continuing	Continuing	Continuing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy		Date: March 2019
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*

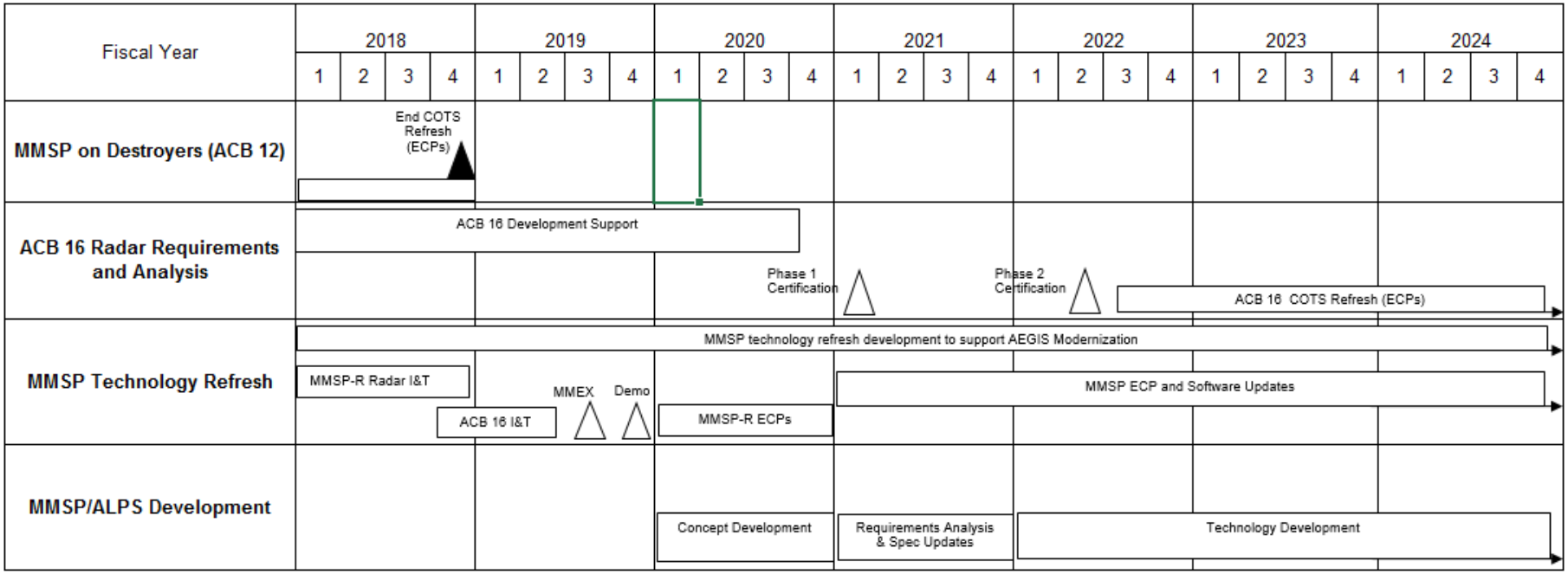
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Support Management Services	C/CPIF	SPA : Washington, DC	0.078	0.087	Jul 2018	0.089	Dec 2018	0.089	Nov 2019	-		0.089	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	4.118	0.097		0.099		0.099		-		0.099	Continuing	Continuing	N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	158.547	2.378		2.464		2.005		-		2.005	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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 2020 Navy		Date: March 2019
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				
DDG Commercial Off The Shelf (COTS) Refresh - Engineering Change Proposals (ECP)	1	2018	4	2018
ACB16 Development Support	1	2018	3	2020
MMSP Technology Refresh to Support AEGIS Modernization	1	2018	4	2024
MMSP-R Radar Integration and Test	1	2018	4	2018
MMSP-R ACB16 Integration and Test	4	2018	2	2019
MMSP-R ACB16 Multi-Mission Exercise (MMEX)	3	2019	3	2019
MMSP-R Demo	4	2019	4	2019
MMSP-R ECPs	1	2020	4	2020
MMSP/ALPS Concept Development	1	2020	4	2020
ACB16 Phase 1 Certification	1	2021	1	2021
MMSP ECP and Software Updates	1	2021	4	2024
MMSP/ALPS Requirements Analysis and Specifications Update	1	2021	4	2021
MMSP/ALPS Technology Development	1	2022	4	2024
ACB16 Phase 2 Certification	2	2022	2	2022
ACB16 COTS Refresh (ECPs)	3	2022	4	2024

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
3236: *Advanced Radar Technology*	74.317	64.690	23.552	1.933	-	1.933	0.000	0.000	0.000	0.000	0.000	164.492
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: SYSTEMS ENGINEERING - EASR	49.586	8.236	0.545	0.000	0.545
Articles:	-	-	-	-	-
FY 2019 Plans: - Conduct EASR Technical Interchange Meetings (TIMs) - Continue EASR Simulator System Testing - Complete Test Readiness Review for DT-3 - Complete Subsystem Level Testing for DT-2 - Commence combat system integration with the emulator - Continue EASR Integrated Product Teams (IPTs) and Working Groups (WGs) to facilitate successful integration of the radar with the ships and combat system - Commence land-based testing - Receive Long Lead Material Authorization for Low-Rate Initial Production (LRIP) units					
FY 2020 Base Plans: - Complete DT-3 testing					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
- Conduct System Verification Review (SVR), Functional Configuration Audit (FCA), Production Readiness Review (PRR), and the Transition CDR ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The decrease in FY20 is primarily due to reduced testing of the EASR system and transition to production in FY20.					
Title: GOVERNMENT ENGINEERING SERVICES - EASR	13.840	13.499	1.201	0.000	1.201
Articles:	-	-	-	-	-
FY 2019 Plans: - Continue analysis and assessment of EASR E&MD contract deliverables - Continue support of EASR IPTs and WGs - Continue EASR Program Management Reviews - Continue support of DT-3 testing - Complete support of EASR interface integration with the combat system suite - Support EASR cost, schedule, and performance management contract administration, contract oversight, risk identification and risk mitigation - Complete support to EASR TIMs ***FY 2020 Base 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 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The decrease in FY20 is primarily due to the reduction of engineering services activities and reduced testing support needed in FY20.					
Title: PROGRAM MANAGEMENT SUPPORT - EASR	1.264	1.817	0.187	0.000	0.187

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Articles:	-	-	-	-	-
FY 2019 Plans: - Support EASR IPTs and WGs - Continue the analysis and assessment of EASR E&MD contract deliverables - Continue EASR Program Management Reviews - Continue support of EASR schedule and performance management contract administration, contract oversight, risk identification and risk mitigation - Support EASR TIMs ***FY 2020 Base Plans:*** - Complete support of EASR IPTs and WGs - Complete the analysis and assessment of EASR E&MD contract deliverables - Complete CLIN 0001 closeout ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease in FY20 is primarily due to reduced testing of the EASR system and the transition to production in FY20.					
Accomplishments/Planned Programs Subtotals	64.690	23.552	1.933	0.000	1.933

C. Other Program Funding Summary ($ in Millions)

N/A

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+, FFG(X) and LX(R) for Forward-Fit
- CVN, LHA and LHD for back-fit

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604501N / *Advanced Above Water Sensors*	**Project (Number/Name)** 3236 / *Advanced Radar Technology*

E. Performance Metrics

EASR E&MD
EASR E&MD Transition CDR and SVR/FCA/PRR
EASR DT-2
EASR E&MD DT-3
EASR Production Authorization
EASR Test Readiness Review (TRR)
Long Lead Material Authorization

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 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 : Marborough, MA	51.593	49.586	Nov 2017	8.236	Nov 2018	0.545	Nov 2019	-		0.545	0.000	109.960	-
Systems Engineering - EXI	SS/CPFF	Raytheon : Portsmouth, RI	1.910	0.000		0.000		0.000		-		0.000	0.000	1.910	-
		Subtotal	54.111	49.586		8.236		0.545		-		0.545	0.000	112.478	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering - EASR	WR	NSWC/DD : Dahlgren, VA	7.012	3.211	Oct 2017	6.429	Nov 2018	0.512	Nov 2019	-		0.512	0.000	17.164	-
Government Engineering - EASR	WR	NSWC/CR : Crane, IN	1.675	0.621	Jan 2018	0.327	Nov 2018	0.036	Nov 2019	-		0.036	0.000	2.659	-
Government Engineering - EASR	WR	NSWC/PHD : Port Huneme, CA	1.098	0.690	Feb 2018	1.390	Nov 2018	0.153	Nov 2019	-		0.153	0.000	3.331	-
Government Engineering - EASR	WR	NSWC/ PHI : Philadelphia, PA	0.135	0.078	Nov 2017	0.067	Nov 2018	0.000		-		0.000	0.000	0.280	-
Government Engineering - EASR	WR	NRL : Washington, DC	0.918	0.307	Nov 2017	0.437	Nov 2018	0.048	Nov 2019	-		0.048	0.000	1.710	-
Government Engineering - EASR	SS/CPFF	JHU/APL : Baltimore, MD	4.429	2.608	Nov 2017	2.624	Dec 2018	0.288	Dec 2019	-		0.288	0.000	9.949	-
Government Engineering - EASR	WR	SCSC : Wallops Island, VA	0.232	0.000		0.000		0.000		-		0.000	0.000	0.232	-
Government Engineering - EASR	WR	NSWC/CD : Bethesda, Maryland	0.481	0.045	Nov 2017	0.221	Mar 2019	0.024	Nov 2019	-		0.024	0.000	0.771	-
Engineering Support - EASR	WR	NAVFAC : Washington, DC	0.036	4.721	Feb 2018	0.000		0.000		-		0.000	0.000	4.757	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Engineering Support - EASR	WR	SPAWAR : San Diego, CA	0.000	0.331	Feb 2018	0.000		0.000		-		0.000	0.000	0.331	-
Engineering Support - EASR	C/CPIF	SPA : Washington, DC	0.963	1.228	Nov 2017	1.274	Dec 2018	0.140	Nov 2019	-		0.140	0.000	3.605	-
Engineering Support - EASR	WR	CIVIL AIR PATROL : TBD	0.000	0.000		0.060	Mar 2019	0.000		-		0.000	0.000	0.060	-
Engineering Support - EASR	WR	NSWC/COR : Corona, CA	0.000	0.000		0.159	Dec 2018	0.000		-		0.000	0.000	0.159	-
Engineering Support - EASR	WR	DOI : Boise, ID	0.000	0.000		0.511	Mar 2019	0.000		-		0.000	0.000	0.511	-
		Subtotal	16.979	13.840		13.499		1.201		-		1.201	0.000	45.519	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 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

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Support Management Services	C/CPIF	SPA : Washington, DC	0.877	0.752	Nov 2017	0.947	Nov 2018	0.104	Nov 2019	-		0.104	0.000	2.680	-
Travel	Allot	TRAVEL : Washington, DC	0.090	0.012	Feb 2018	0.100	Nov 2018	0.011	Nov 2019	-		0.011	0.000	0.213	-
Support Management Services	C/CPIF	CACI : Washington, DC	0.313	0.100	Dec 2017	0.075	Nov 2018	0.000		-		0.000	0.000	0.488	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604501N / *Advanced Above Water Sensors*	Project (Number/Name) 3236 / *Advanced Radar Technology*	

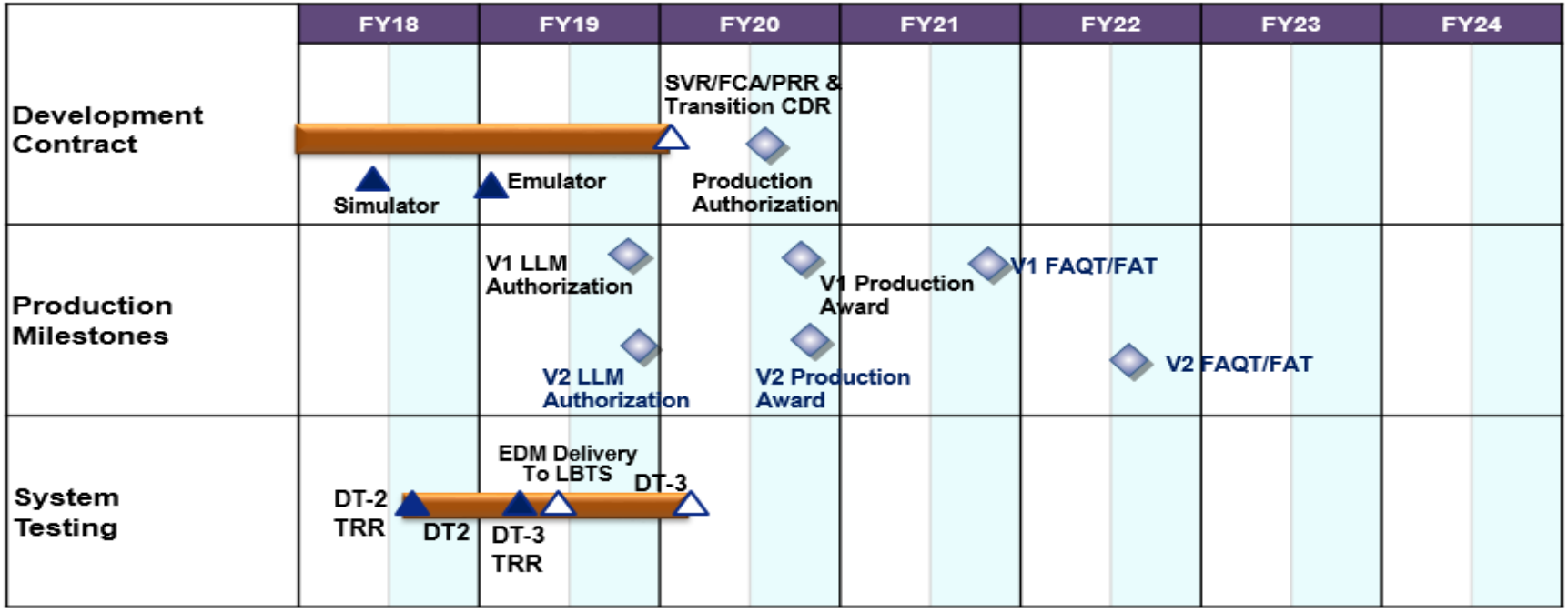
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
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	0.388	0.074	Oct 2017	0.177	Nov 2018	0.019	Nov 2019	-		0.019	0.000	0.658	-
Support Management Services	C/CPIF	STRATEGIC INSIGHT : Washington, DC	0.082	0.035	Jan 2018	0.035	Dec 2018	0.000		-		0.000	0.000	0.152	-
Support Management Services	WR	NSWC/DD : Dahlgren, VA	0.270	0.291	Oct 2017	0.483	Dec 2018	0.053	Oct 2019	-		0.053	0.000	1.097	-
		Subtotal	2.645	1.264		1.817		0.187		-		0.187	0.000	5.913	N/A

	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	74.317	64.690		23.552		1.933		-		1.933	0.000	164.492	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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
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 2020 Navy		Date: March 2019
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				
Delivery of EASR Simulator	2	2018	2	2018
EASR Test Readiness Review (TRR) and (DT) 2	3	2018	4	2018
EASR TRR and DT3	1	2019	1	2020
Delivery of EASR Emulator	1	2019	1	2019
EASR EDM Delivery to LBTS	2	2019	2	2019
EASR V1 Long Lead Material Authorization	4	2019	4	2019
EASR V2 Long Lead Material Authorization	4	2019	4	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 2020 Navy			Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
3301: *Improved Capabilities SPY-1 Radar*	25.391	10.288	7.868	13.116	-	13.116	12.606	11.604	11.818	12.056	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.

FY20 includes completion of ACE Phase 1, continuation of development of ACE Phase 2, SBNCTR Phase 2A, TNC, EA improvements, and Elevated Radar Advanced Calibration Experiment (ERACE) Phase 1/2. Due to reduced SBNCTR funding in FY19, efforts have been deferred to FY20. ERACE certification is targeted to be part of Baseline 9.2.X certification, which is scheduled for 2Q FY22.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Improved Capabilities SPY-1 Radar	10.288	7.868	13.116	0.000	13.116
Articles:	-	-	-	-	-
FY 2019 Plans:					
- Continue development of additional cost reduction initiatives					
- Continue TNC development and conduct Preliminary Design Review (PDR) and Critical Design Review (CDR)					
- Initiate EA improvements technology development					
- Continue Radar Integrated Product Team (IPT) support for all baselines					
- Continue ACE Phase 1 development					
- Continue ERACE Phase V2 development					
- Conduct ERACE Phase 1/2 testing					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
- Continue solid state technology insertion analysis ***FY 2020 Base Plans:*** -Conduct ACE Phase 1 Certification Baseline 9 -Complete ACE Phase 1 development Baseline 9 -Initiate ACE Phase 2 development -Complete ACE Phase 2 Requirements Definition -Restart SBNCTR Phase 2A development; includes integration of other sensors and threats -Conduct SBNCTR Phase 2A IPR#3 -Conduct TNC qualification testing -Continue EA improvements technology development -Initiate GaN solutions development for MWT DMSMS, to include solid state component replacement of analog vacuum tube equipment -Continue ERACE Phase 1/2 development -Conduct ERACE Phase 1/2 FLEX Event to test multiple sensors in an at-sea operational environment -Continue Solid State Technology Insertion Analysis ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY20 increase is due to restart of SBNCTR Phase 2 program, initiation of GaN solutions for Microwave Tube (MWT) DMSMS and increased scope to conduct ERACE FLEX event.					
Accomplishments/Planned Programs Subtotals	10.288	7.868	13.116	0.000	13.116

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• O&MN/1C1C/0702228N: *O&M,N AEGIS Wholeness SPY Transmitter Reliability*	4.155	4.188	4.358	-	4.358	4.276	4.400	4.427	4.514	Continuing	Continuing

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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*

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, 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, ACE and ERACE) and reliability improvements will be incorporated into Baseline 7, Baseline 9 and follow.

E. Performance Metrics

- Complete Advanced Calibration Experiment (ACE) Baseline (BL) 9 Phase 1 demo
- Complete Transmitter Noise Cancellation (TNC) System Requirements Review (SRR)
- Complete ACE Baseline 9 Phase 1 testing
- Complete TNC Preliminary Design Review (PDR)
- Complete EA studies and R2CIP requirements analysis and spec updates
- Complete SBNCTR Phase 2A integration and test
- Complete TNC Critical Design Review (CDR)
- Complete Sidelobe Blanking (SLB) requirements analysis
- Complete SBNCTR Phase 2A EA
- Complete ACE Phase 1 certification and development
- Complete EA and R2CIP technology development
- Complete TNC integration and test
- Complete TNC merge to Common Source Library (CSL)
- Complete ACE Phase 2 requirements definition
- Complete ACE Phase 2 demo
- Complete ACE Phase 2 certification testing
- Complete EA improvements and R2CIP implementation and testing
- Complete SBNCTR Phase 3 requirements definition
- Complete ERACE Phase 1/2 requirements definition
- Complete ERACE Phase 1/2 Flex Event
- Complete ERACE Phase 1/2 testing
- Complete ERACE Phase 1/2 certification
- Complete ERACE Phase 3 requirements definition
- Complete ERACE Phase 3 demos
- Complete ERACE Phase 3 testing
- Complete GaN solutions for MWT DMSMS concept development
- Complete GaN solutions for MWT DMSMS requirements analysis and specifications updates
- Complete GaN solutions for MWT DMSMS technology development

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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*

- Complete SBNCTR Phase 2A IPR #3
- Complete SBNCTR Phase 3 IPR #1
- Complete SBNCTR Phase 3 IPR #2
- Complete TNC qualification testing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy		Date: March 2019
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 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 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	12.865	1.347	Oct 2017	3.734	Dec 2018	3.684	Nov 2019	-		3.684	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	SS/CPFF	Lockheed Martin : Moorestown, NJ	5.046	5.584	Jan 2018	1.597	Jan 2019	5.670	Dec 2019	-		5.670	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	SS/CPFF	AEGIS Techrep : Moorestown, NJ	0.439	0.337	Nov 2017	0.222	Nov 2018	0.354	Dec 2019	-		0.354	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	SS/FP	APL/JHU : Laurel, MD	0.465	0.370	Mar 2018	0.365	Feb 2019	0.384	Nov 2019	-		0.384	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	CSCS : Dahlgren, VA	0.194	0.148	Jun 2018	0.062	Dec 2018	0.062	Jun 2020	-		0.062	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NRL : Washington, DC	0.375	0.282	Nov 2017	0.283	Dec 2018	0.396	Nov 2019	-		0.396	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	MIPR	MIT/LL : Lexington, MA	0.450	0.450	Jun 2018	0.204	Jan 2019	0.450	Mar 2020	-		0.450	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NSWC DD : Dahlgren, VA	1.674	1.302	Oct 2017	0.995	Nov 2018	1.677	Nov 2019	-		1.677	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	WR	NSWC/PHD : Port Hueneme, CA	0.195	0.124	Nov 2017	0.136	Nov 2018	0.169	Nov 2019	-		0.169	Continuing	Continuing	Continuing
SYSTEM ENGINEERING	MIPR	DTIC : Fort Belvior, VA	0.050	0.182	Oct 2018	0.050	Mar 2019	0.050	Dec 2019	-		0.050	0.000	0.332	-
		Subtotal	24.694	10.126		7.648		12.896		-		12.896	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy		Date: March 2019
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*

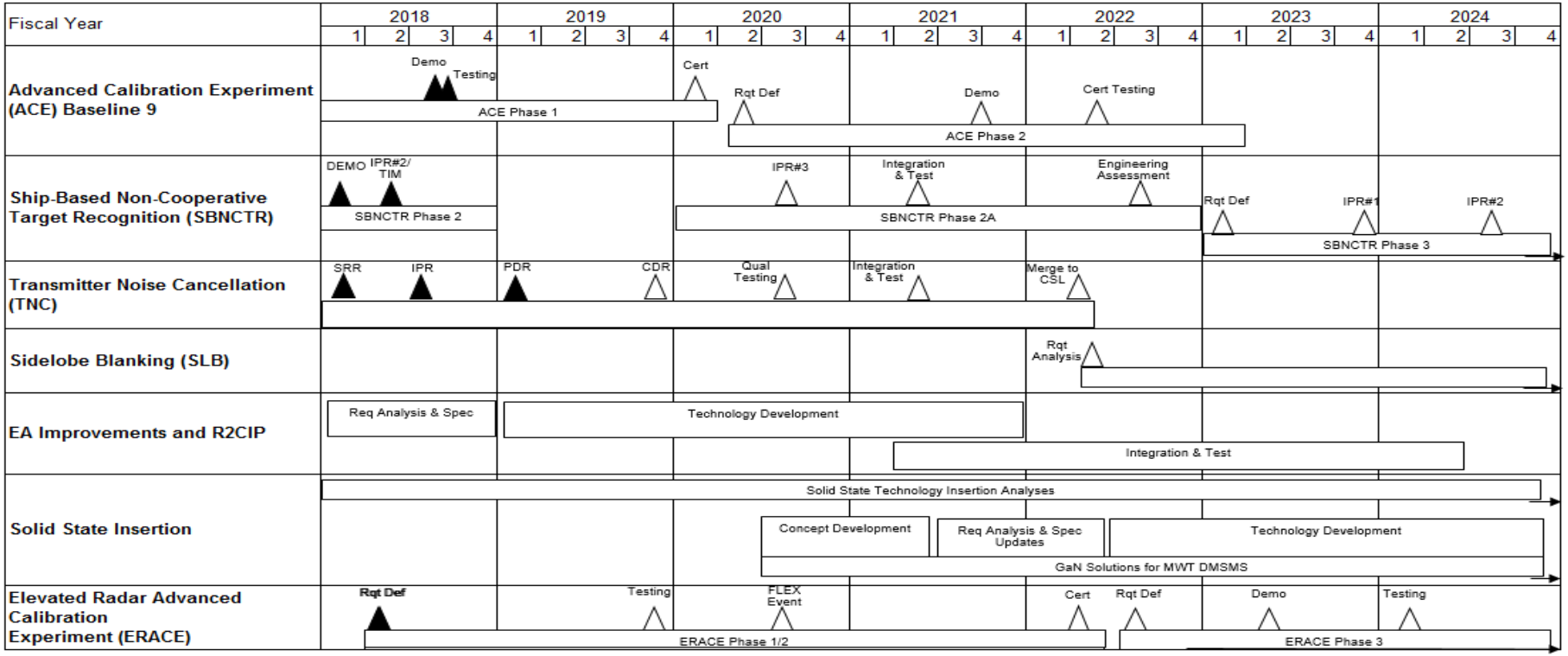
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	Allot	PEOIWS2 : Washington, DC	0.010	0.020	Jan 2018	0.020	Dec 2018	0.020	Jan 2020	-		0.020	Continuing	Continuing	Continuing
Support Management Services	C/CPIF	SPA : Washington, DC	0.506	0.142	Nov 2017	0.200	Dec 2018	0.200	Nov 2019	-		0.200	0.000	1.048	-
Support Management Services	SS/CPIF	SPA (Bridge) : Washington, DC	0.181	0.000		0.000		0.000		-		0.000	0.000	0.181	-
		Subtotal	0.697	0.162		0.220		0.220		-		0.220	Continuing	Continuing	N/A

	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	25.391	10.288		7.868		13.116		-		13.116	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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.X, which is scheduled for 2Q FY 22."

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
GaN: Gallium Nitride
IPR: In-Progress Review
MWT: Microwave Tube
PDR: Preliminary Design Review
R2CIP: Rapid Radar Capability Improvement Program
SS: Solid State
SRR: System Requirements Review
TIM: Technical Interchange Meeting

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
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				
Solid State Technology Insertion Analyses	1	2018	4	2024
TNC SRR	1	2018	1	2018
EA Improvements and R2CIP Rqt Analysis & Specification Updates	1	2018	4	2018
SBNCTR Phase 2 Demo	1	2018	1	2018
ERACE Phase 1/2 Requirements Definition	2	2018	2	2018
SBNCTR Phase 2 IPR #2/TIM	2	2018	2	2018
ACE Phase 1 Demo	3	2018	3	2018
TNC IPR	3	2018	3	2018
ACE Phase 1 Testing	3	2018	3	2018
EA Improvements and R2CIP Technology Development	1	2019	4	2021
TNC PDR	1	2019	1	2019
TNC CDR	4	2019	4	2019
ERACE Phase 1/2 Testing	4	2019	4	2019
ACE Phase 1 Certification	1	2020	1	2020
ACE Phase 2 Requirements Definition	2	2020	2	2020
SBNCTR Phase 2A IPR #3	3	2020	3	2020
TNC Qualification Testing	3	2020	3	2020
Gan Solutions Development for MWT DMSMS Concept Development	3	2020	2	2021
ERACE Phase 1/2 Flex Event	3	2020	3	2020
SBNCTR Phase 2A Integration & Test	2	2021	2	2021
TNC Integration & Test	2	2021	2	2021

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
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**
EA Improvements and R2CIP Integration and Test	2	2021	2	2024
ACE Phase 2 Demo	3	2021	3	2021
GaN Solutions Development for MWT DMSMS Req Analysis & Spec Updates	3	2021	2	2022
ERACE Phase 1 / 2 Certification	2	2022	2	2022
ACE Phase 2 Certification Testing	2	2022	2	2022
TNC Merge to Common Source Library	2	2022	2	2022
SLB Requirements Analysis	2	2022	2	2024
SBNCTR Phase 2A Engineering Assessment	3	2022	3	2022
ERACE Phase 3 Requirements Definition	3	2022	3	2022
GaN Solutions Development for MWT DMSMS Technology Development	3	2022	4	2024
SBNCTR Phase 3 Requirements Definition	1	2023	1	2023
ERACE Phase 3 Demo	2	2023	2	2023
SBNCTR Phase 3 IPR #1	4	2023	4	2023
ERACE Phase 3 Testing	1	2024	1	2024
SBNCTR Phase 3 IPR #2	3	2024	3	2024

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
3408: *AN/SPS-49 Technical Refresh*	0.000	0.000	0.000	17.500	-	17.500	8.100	1.000	0.000	0.000	0.000	26.600
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

This is a new start. SPS-49 tech refresh was funded in FY18 and FY19 leveraging OSD Other Transactional Authority (OTA) contract for Industrial Base Analysis and Sustainment Program (IBAS).

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. Funding will also be used to address potential hardware and software issues discovered during land based test events and integration with the Ship Self Defense System (SSDS).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: AN/SPS-49 Technology Refresh	0.000	0.000	17.500	0.000	17.500
Articles:	-	-	-	-	-
FY 2019 Plans: N/A					
FY 2020 Base Plans: - Initiate system hardware and software design and development - Conduct Critical Design Review (CDR) - Conduct Test Readiness Review (TRR) - Receive prototype Build of Material (BOM) - Complete top level drawings/models					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
- Build prototype to validate models - Commence collection of Reliability, Availability and Maintainability data - Commence development of provisioning technical data - Complete interface design - Commence integration of DREX with Signal Data Processor (SDP) and transmitter designs - Complete software test description ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY20 is the first year of funding for this effort.					
Accomplishments/Planned Programs Subtotals	0.000	0.000	17.500	0.000	17.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Technology developed 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 below deck technology refresh of the AN/SPS-49 Long Range Air Surveillance Radar. Integration of the technologies, final design, procurement of three Engineering Development Models (EDM) (procured under prior efforts funded by OSD) and test and evaluation will be accomplished utilizing an Other Transactional Authority (OTA) contract. In conjunction with the prime contractor, the government will integrate the EDM with external interfaces and perform test and evaluation of hardware and software at a Land Based Test Site (LBTS) at Wallops Island. Final integration into the combat system and combat systems certification will be accomplished at the LBTS during the LSD 41 SSDS qualification event in Q3FY21.

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 to the Army (Picatinny). OSD IBAS provided start-up funding for the first three phases. Phase 1 and 2 were completed in FY18 (including Analysis of Alternatives and efforts through Preliminary Design Review) and Phase 3 (efforts through Critical Design Review) will be completed in FY19. Phase 4 and 5 executed in FY20, will complete Non Recurring Engineering (NRE), Technical Readiness Review (TRR), Functional Configuration Audit (FCA), Physical Configuration Audit (PCA), shock, Electromagnetic Interference (EMI) and combat system integration/validation.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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*

E. Performance Metrics

Complete Contract Award
Complete AN/SPS-49 technology refresh development
Complete Critical Design Review (CDR)
Conduct Test Readiness Review (TRR)
Complete system/subsystem integration testing
Complete Wallops Island SSDS integration testing
Complete Functional Configuration Audit (FCA)
Complete Physical Configuration Audit (PCA)
Complete Shock and Electromagnetic Interference (EMI) Testing

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
System Engineering	MIPR	Army : Picatinny, NJ	0.000	0.000		0.000		14.440	Nov 2019	-		14.440	0.000	14.440	-
Government Engineering	WR	NRL : Washington, DC	0.000	0.000		0.000		0.100	Oct 2019	-		0.100	0.000	0.100	-
		Subtotal	0.000	0.000		0.000		14.540		-		14.540	0.000	14.540	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering	WR	NRL : Washington, DC	0.000	0.000		0.000		0.375	Oct 2019	-		0.375	0.000	0.375	-
Government Engineering	WR	NSWC/CR : Crane, IN	0.000	0.000		0.000		0.300	Oct 2019	-		0.300	0.000	0.300	-
Government Engineering	WR	NSWC/PHD : Port Huneme, CA	0.000	0.000		0.000		0.235	Oct 2019	-		0.235	0.000	0.235	-
		Subtotal	0.000	0.000		0.000		0.910		-		0.910	0.000	0.910	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Government Engineering	WR	NRL : Washington, DC	0.000	0.000		0.000		0.600	Oct 2019	-		0.600	0.000	0.600	-
Government Engineering	WR	NSWC/CR : Crane, IN	0.000	0.000		0.000		0.500	Oct 2019	-		0.500	0.000	0.500	-
Government Engineering	WR	NSWC/PHD : Port Huneme, CA	0.000	0.000		0.000		0.400	Oct 2019	-		0.400	0.000	0.400	-
		Subtotal	0.000	0.000		0.000		1.500		-		1.500	0.000	1.500	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Navy			Date: March 2019
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*	

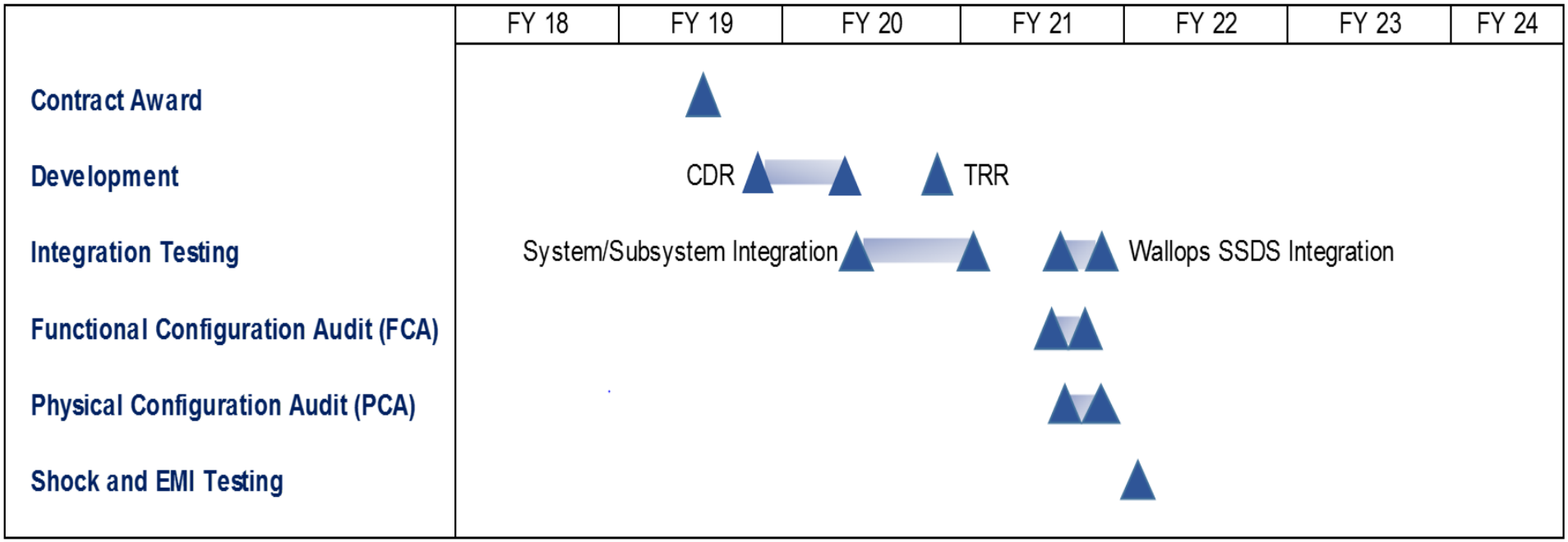
Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Support Management Services	C/CPIF	ICI : Washington, DC	0.000	0.000		0.000		0.150	Nov 2019	-		0.150	0.000	0.150	-
Support Management Services	C/CPIF	TMB : Washington, DC	0.000	0.000		0.000		0.150	Nov 2019	-		0.150	0.000	0.150	-
Support Management Services	C/CPIF	CACI : Washington, DC	0.000	0.000		0.000		0.075	Nov 2019	-		0.075	0.000	0.075	-
Support Management Services	C/CPIF	SPA : Washington, DC	0.000	0.000		0.000		0.150	Nov 2019	-		0.150	0.000	0.150	-
Travel	Sub Allot	PEOIWS2 : Washington, DC	0.000	0.000		0.000		0.025	Oct 2019	-		0.025	0.000	0.025	-
		Subtotal	0.000	0.000		0.000		0.550		-		0.550	0.000	0.550	N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	0.000	0.000		0.000		17.500		-		17.500	0.000	17.500	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Navy		Date: March 2019
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*



This budget funds the test and integration into a SPS-49 radar system and integration during the SSDS qualification event in Q3FY21.

Budget profile capitalizes on early development funded by Small Business Innovation Research (SBIR), Rapid Innovation Funds (RIF), OSD Industrial Base Analysis and Sustainment (IBAS) Program in FY 19.

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Navy		Date: March 2019
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				
Contract Award	3	2019	3	2019
Technology Refresh Development	1	2020	4	2020
Critical Design Review (CDR)	4	2019	1	2020
Test Readiness Review (TRR)	4	2020	4	2020
System/Subsystem Integration Testing	4	2020	1	2021
Wallops Island Ship Self Defense System (SSDS) Integration	3	2021	4	2021
Functional Configuration Audit	3	2021	4	2021
Physical Configuration Audit	3	2021	4	2021
Shock and Electro Magnetic Interference (EMI) Testing	1	2022	1	2022