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 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0204228N *I Surface Support*							
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	81.003	9.328	34.602	33.482	-	33.482	20.005	15.273	15.581	15.894	Continuing	Continuing
3311: *Navigation Systems*	81.003	9.328	34.602	33.482	-	33.482	20.005	15.273	15.581	15.894	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Surface Support RDT&E funding will be used for the research, design, development, integration testing, and documentation of the Inertial Navigation System (INS) AN/WSN-12 for all Navy platforms. The INS provides mission critical ship position and attitude data to shipboard sensors (such as radars), combat systems, gun, and missile systems. The INS uses data from the Global Positioning System (GPS) to periodically update (i.e., reset) its position and internal clock. The INS is the ship's primary position source in the absence of GPS. The INS AN/WSN-12 consists of an Inertial Sensor Module (ISM) and a Navigation Processing Module (NPM) that will provide a significant improvement with respect to attitude and velocity data over previous INS through the use of a Power Spectral Density (PSD) capability. PSD provides a tighter tolerance for error across a wider frequency range. The ISM is being designed, developed, and procured through a competitive contract awarded to Northrop Grumman in November 2015. The NPM is a Government design. The government will serve as integration agent prior to the next AN/WSN-12 competitive contract award. RDT&E funding will support continued system design to create a baseline for Pre-Production Units (PPU), Low Rate Initial Production (LRIP), and Full Rate Production (FRP). The system has completed Critical Design Review (CDR) and will go through Production Readiness Review (PRR). The system will undergo extensive testing including Independent Validation and Verification (IV&V), Developmental Testing (DT) and Operational Testing (OT). Planned FY 2021 efforts include AN/WSN-12 technical manual development and Independent Logistics Assessment (ILA) certification, completion of AN/WSN-12 Risk Management Framework Cybersecurity accredidation, an ISM PRR, system-level PRR and LRIP.

Cybersecurity funding will be used for the research, development, documentation and integration testing for cybersecurity hardening and enclave development for navigation systems. Efforts include the development of boundary defense capabilities, platform specific architectures, Navy-Electronic Chart Display and Information System (Navy-ECDIS) secure solution for existing unclassified configurations and CYBERSAFE implementation and conduct of cybersecurity risk and vulnerability assessments including development of system models, threat models, and mission models for representative groupings of Navigation systems and cybersecurity capabilities. Risk assessments along with requirements development will lead to incremental capability development leveraging the Increment 1 Engineering Development Model (EDM) delivery with updated architectures and system level modifications. Follow on capabilities will be developed and added to meet existing threats and requirements. Planned FY 2021 efforts include continuation of Cross Domain Solution (CDS) and cyber capability Increment 2 development.

Time and Frequency Distribution System-Replacement (TFDS-R) funding will be used for the research, development, documentation, and integration testing for the Submarine TFDS-R system. TFDS is a Commercial Off the Shelf (COTS) timing system utilizing the precision source signals of GPS to discipline two redundant Rubidium clocks to Universal Coordinated Time (UTC). TFDS provides common time to submarine equipment that utilizes clocking pulses or sinusoidal waveforms for proper operation and maintains accurate time in the event of loss of GPS input (holdover). TFDS Uses multiple input power sources for redundancy and provides a built in battery backup. TFDS generates and distributes Precision Time and Timing Interval (PTTI) reference signals to support C4I capabilities needed for Joint, Naval and Allied missions. Planned FY 2021 efforts include a Critical Design Review (CDR), Environmental Qualification Testing (EQT), PRR and LRIP.

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 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0204228N *I Surface Support*

Military GPS User Equipment (MGUE) will provide assured Positioning, Navigation and Timing (PNT) in a GPS degraded environment. Funding will be used for development of interface and performance requirements, shipboard system architecture definition, and MGUE integration into SSNs, Tomahawk, and Advanced Anti-Radiation Guided Missile (AARGM). Planned FY 2021 efforts include the completion of integration testing and MGUE testing and integration with Technical Insertion-22 (TI-22) platforms to include SSN 688i and SSBN 726 class submarines.

Submarine Speed Sensors will provide investigation, development, testing and integration of new Own-Ship Speed sensors to address new capabilities, reduce detection, and improve reliability. Planned FY 2021 efforts include the completion of prototype hardware and software development efforts.

Assured Positioning, Navigation, and Timing (APNT) funding will be used for Alternate GPS-independent sources of Positioning, Velocity, Attitude, and Timing (PVAT) data required to provide fire control solutions, ensure safety of navigation, and support aircraft and combat operations in a GPS degraded/denied environment. This effort provides a secure navigation method using the Cooperative Engagement Capability (CEC) network and corresponding time and navigation resources being developed via Office of Naval Research (ONR) Future Naval Capabilities (FNC) activity. CEC is a critical component of Naval Integrated Fire Control (NIFC) efforts and Integrated Air and Missile Defense (IAMD).

Automated Celestial Navigation System (ACNS) funding will be used for the research, development, Engineering Development Model (EDM), documentation and integration testing of the celestial navigation solution for the NoGAPSS navigation implementation on the fleet. Efforts will leverage ONR celestial navigation research into a reproducible ruggedized system fully integrated into the navigation suite. FY 2021 efforts include completion of system drawings and architectures, ruggedization of an ONR prototype and shipboard installation of an initial ACNS capability.

Navigation Suite funding will be used to conduct analyses and studies on impact of the PVAT Navy Integrating Capability Construct (NICC) to validate, verify and test latency requirements to combat systems consumers. Efforts will include analysis and planning for the alignment and evolution of Afloat Navigation Systems for surface and submarine platforms and development of Capability Phasing Planning (CPP) processes to drive engineering analysis. The program will implement systems engineering processes to investigate major navigation system error sources, define new functions, research new technologies, algorithms, and techniques to improve system performance, conduct analyses of alternatives, create preliminary and final design concepts, develop new hardware components and associated software, and conduct land based and shipboard testing.

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 7: *Operational Systems Development*		R-1 Program Element (Number/Name) PE 0204228N *I Surface Support*			
B. Program Change Summary ($ in Millions)	**FY 2019**	**FY 2020**	**FY 2021 Base**	**FY 2021 OCO**	**FY 2021 Total**
Previous President's Budget	9.708	36.389	33.116	-	33.116
Current President's Budget	9.328	34.602	33.482	-	33.482
Total Adjustments	-0.380	-1.787	0.366	-	0.366
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-1.787			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.380	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.366	-	0.366

Change Summary Explanation

FY 2021 decrease due to reduction in overall program requirements.

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 0204228N / *Surface Support*	Project (Number/Name) 3311 / *Navigation Systems*	

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
3311: *Navigation Systems*	81.003	9.328	34.602	33.482	-	33.482	20.005	15.273	15.581	15.894	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Surface Support RDT&E funding will be used for the research, design, development, integration testing, and documentation of the Inertial Navigation System (INS) AN/WSN-12 for all Navy platforms. The INS provides mission critical ship position and attitude data to shipboard sensors (such as radars), combat systems, gun, and missile systems. The INS uses data from the Global Positioning System (GPS) to periodically update (i.e., reset) its position and internal clock. The INS is the ship's primary position source in the absence of GPS. The INS AN/WSN-12 consists of an Inertial Sensor Module (ISM) and a Navigation Processing Module (NPM) that will provide a significant improvement with respect to attitude and velocity data over previous INS through the use of a Power Spectral Density (PSD) capability. PSD provides a tighter tolerance for error across a wider frequency range. The ISM is being designed, developed, and procured through a competitive contract awarded to Northrop Grumman in November 2015. The NPM is a Government design. The government will serve as integration agent prior to the next AN/WSN-12 competitive contract award. RDT&E funding will support continued system design to create a baseline for Pre-Production Units (PPU), Low Rate Initial Production (LRIP), and Full Rate Production (FRP). The system has completed Critical Design Review (CDR) and will go through Production Readiness Review (PRR). The system will undergo extensive testing including Independent Validation and Verification (IV&V), Developmental Testing (DT) and Operational Testing (OT). Planned FY 2021 efforts include AN/WSN-12 technical manual development and Independent Logistics Assessment (ILA) certification, completion of AN/WSN-12 Risk Management Framework Cybersecurity accredidation, an ISM PRR, system-level PRR and LRIP.

Cybersecurity funding will be used for the research, development, documentation and integration testing for cybersecurity hardening and enclave development for navigation systems. Efforts include the development of boundary defense capabilities, platform specific architectures, Navy-Electronic Chart Display and Information System (Navy-ECDIS) secure solution for existing unclassified configurations and CYBERSAFE implementation and conduct of cybersecurity risk and vulnerability assessments including development of system models, threat models, and mission models for representative groupings of Navigation systems and cybersecurity capabilities. Risk assessments along with requirements development will lead to incremental capability development leveraging the Increment 1 Engineering Development Model (EDM) delivery with updated architectures and system level modifications. Follow on capabilities will be developed and added to meet existing threats and requirements. Planned FY 2021 efforts include continuation of Cross Domain Solution (CDS) and cyber capability Increment 2 development.

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Military GPS User Equipment (MGUE) will provide assured Positioning, Navigation and Timing (PNT) in a GPS degraded environment. Funding will be used for development of interface and performance requirements, shipboard system architecture definition, and MGUE integration into SSNs, Tomahawk, and Advanced Anti-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

Radiation Guided Missile (AARGM). Planned FY 2021 efforts include the completion of integration testing and MGUE testing and integration with Technical Insertion-22 (TI-22) platforms to include SSN 688i and SSBN 726 class submarines.

Submarine Speed Sensors will provide investigation, development, testing and integration of new Own-Ship Speed sensors to address new capabilities, reduce detection, and improve reliability. Planned FY 2021 efforts include the completion of prototype hardware and software development efforts.

Assured Positioning, Navigation, and Timing (APNT) funding will be used for Alternate GPS-independent sources of Positioning, Velocity, Attitude, and Timing (PVAT) data required to provide fire control solutions, ensure safety of navigation, and support aircraft and combat operations in a GPS degraded/denied environment. This effort provides a secure navigation method using the Cooperative Engagement Capability (CEC) network and corresponding time and navigation resources being developed via Office of Naval Research (ONR) Future Naval Capabilities (FNC) activity. CEC is a critical component of Naval Integrated Fire Control (NIFC) efforts and Integrated Air and Missile Defense (IAMD).

Automated Celestial Navigation System (ACNS) funding will be used for the research, development, Engineering Development Model (EDM), documentation and integration testing of the celestial navigation solution for the NoGAPSS navigation implementation on the fleet. Efforts will leverage ONR celestial navigation research into a reproducible ruggedized system fully integrated into the navigation suite. FY 2021 efforts include completion of system drawings and architectures, ruggedization of an ONR prototype and shipboard installation of an initial ACNS capability.

Navigation Suite funding will be used to conduct analyses and studies on impact of the PVAT Navy Integrating Capability Construct (NICC) to validate, verify and test latency requirements to combat systems consumers. Efforts will include analysis and planning for the alignment and evolution of Afloat Navigation Systems for surface and submarine platforms and development of Capability Phasing Planning (CPP) processes to drive engineering analysis. The program will implement systems engineering processes to investigate major navigation system error sources, define new functions, research new technologies, algorithms, and techniques to improve system performance, conduct analyses of alternatives, create preliminary and final design concepts, develop new hardware components and associated software, and conduct land based and shipboard testing.

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/WSN-12 Inertial Navigation System - Replacement (INS-R)	7.648	7.800	6.119	0.000	6.119
Articles:	-	-	-	-	-
FY 2020 Plans: Complete PPU EQT testing Complete integration and interface testing Begin Developmental Testing Begin OT with land based test sites for combat system integration					
FY 2021 Base Plans: AN/WSN-12 technical manual development Independent Logistics Assessment (ILA) certification					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Completion of AN/WSN-12 Risk Management Framework Cybersecurity accredidation ISM Production Readiness Review (PRR) System-level PRR Low Rate Initial Production ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease due to completion of ISM and NPM fabrication, PPU EQT and integration and interface testing events.					
Title: Cybersecurity	0.500	5.016	2.867	0.000	2.867
Articles:	-	-	-	-	-
FY 2020 Plans: Complete BDC Increment 1 capability Continue CDS development Begin Integrated Positioning Navigation, and Timing (iPNT) development Conduct surface integration Begin development of Increment 2 capabilities of boundary defense Field cyber pilot ***FY 2021 Base Plans:*** Continue development of BDC Increment II capability Complete CDS development and begin integration efforts ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Decrease due to completion of BDC Inc I development and cyber pilot and surface integration planning					
Title: Time Frequency Distribution System (TFDS) Replacement	0.200	1.900	1.900	0.000	1.900
Articles:	-	-	-	-	-
FY 2020 Plans: Release OTA proposal Award OTA contract Conduct System Requirements Review (SRR)					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Conduct Preliminary Design Review (PDR) ***FY 2021 Base Plans:*** Conduct Critical Design Review (CDR) TI-22 development and testing Completion of Environmental Qualification and Test (EQT) events Completion of Integrated Logistics Support (ILS) products Conduct Production Readiness Review (PRR) Low Rate Initial Production ***FY 2021 OCO Plans:*** N/A					
Title: Military GPS User Equipment (MGUE)	0.680	5.003	5.760	0.000	5.760
Articles:	-	-	-	-	-
FY 2020 Plans: Begin MGUE card integration into ECDU Complete platform level integration studies for munitions and GPS end users Begin TI-22 EDM integration testing with combat system users ***FY 2021 Base Plans:*** Complete M-Code integration testing Conduct TI-22 integration and test events ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase due to planned FY20 requirements deferred to FY21					
Title: Submarine Speed Sensors (SSS)	0.000	1.200	1.500	0.000	1.500
Articles:	-	-	-	-	-
FY 2020 Plans: Fabricate initial prototype Begin prototype HW/SW development ***FY 2021 Base Plans:*** Finalize hardware and software design					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Finalize Integrated Logistics Development ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** Increase required to support prototype HW/SW development.					
Title: Assured Positioning, Navigation, and Timing (APNT)	0.000	3.600	3.600	0.000	3.600
Articles:	-	-	-	-	-
FY 2020 Plans: Conduct ACNS/GPNTS/WSN Focused Demos ***FY 2021 Base Plans:*** ACNS Processing and Distribution Cabinet and ACNS integration efforts Begin early integration of ACNS Sensor into the ACNS Processing and Distribution cabinet ***FY 2021 OCO Plans:*** N/A					
Title: Automated Celestial Navigation System (ACNS)	0.000	3.200	6.040	0.000	6.040
Articles:	-	-	-	-	-
FY 2020 Plans: Finalize System Requirements Document Conduct Preliminary Design Review Conduct Critical Design Review Finalize external interface description/controls ***FY 2021 Base Plans:*** Fabricate Pre-Production Units Conduct System EQT and integration testing Conduct initial prototype shipboard installation and test ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Increase due to PPU fabrication, integration and test events.					
Title: Navigation Suite	0.000	4.700	3.667	0.000	3.667
Articles:	-	-	-	-	-
FY 2020 Plans: Conduct studies and analyses on platform integration improvements Conduct integration of chart services for use by Combat Systems, mission planning tools and other shipboard systems Develop and plan for integrated navigation Land Based Test Site (LBTS) Develop future integrated PVAT suite architecture Develop navigational awareness improvements including integration of a Secondary Control Display Unit (SCDU) Develop horizontal plotter display capability for ECDIS Improve navigation situational awareness including collision avoidance technology measures and surface track commonality Research capability to correlate AIS and radars for a common surface contact picture Collaborate with external organizations like DARPA and DIU to research availability of automated collision avoidance systems					
FY 2021 Base Plans: Complete studies and analysis on platform integration improvements Complete integration of chart services for use by Aegis combat system Continue development of integrated PVAT suite architecture Continue SCDU development and integration Begin integration of chart services for use by SSDS combat system Continue development of horizontal plotter display capability for ECDIS Continue collision avoidance technology improvement initiatives					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Decrease due to reduced requirement for continuing efforts.					
Title: Navigation Support	0.300	2.183	2.029	0.000	2.029
Articles:	-	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY 2020 Plans: Provide engineering, logistics, and programmatic support for, AN/WSN-12, Cybersecurity, TFDS, MGUE, SSS, ACNS, APNT, and Navigation Suite. ***FY 2021 Base Plans:*** N/A ***FY 2021 OCO Plans:*** N/A ***FY 2020 to FY 2021 Increase/Decrease Statement:*** The Navigation Support amount is a derivative of the total amount of other RDT&E efforts. The FY 2021 amount is required to meet support requirements for the FY 2021 RDT&E efforts reflected in this exhibit and is adjusted for inflation.					
Accomplishments/Planned Programs Subtotals	9.328	34.602	33.482	0.000	33.482

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/0670: *Other Navigation*	70.270	72.744	74.084	-	74.084	75.176	76.864	65.852	67.156	Continuing	Continuing

Remarks

D. Acquisition Strategy

AN/WSN-12 Inertial Sensor Module (ISM) CPIF/CPFF/FFP contract competitively awarded in FY 2016. Contract includes options for conducting R&D milestones, manufacture of Engineering Development Models (EDM) and Pre-Production Units (PPU), and manufacture of Low Rate Initial Production (LRIP) and Full Rate Production (FRP).

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy			Date: February 2020
Appropriation/Budget Activity 1319 / 7	R-1 Program Element (Number/Name) PE 0204228N / *Surface Support*	Project (Number/Name) 3311 / *Navigation Systems*	

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/ Design	WR	SPAWAR Atlantic : Little Creek, VA	8.030	1.762	Jan 2019	7.053	Dec 2019	8.950	Oct 2020	-		8.950	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	SPAWAR Pacific : San Diego, CA	1.275	0.000		0.600	Dec 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	WR Systems : Norfolk, VA	14.627	1.350	Jan 2019	3.650	Mar 2020	3.500	Oct 2020	-		3.500	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	Penn State/ARL : Warminster, PA	4.168	0.000		0.500	Dec 2019	0.500	Oct 2020	-		0.500	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Dahlgren : Dahlgren, VA	0.643	0.000		2.000	Dec 2019	4.316	Oct 2020	-		4.316	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Dam Neck : Dam Neck, VA	0.340	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC PHD : Port Hueneme, CA	0.122	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NUWC Newport : Newport, RI	0.180	0.000		0.500	Dec 2019	0.400	Oct 2020	-		0.400	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	Old Dominion University : Suffolk, VA	0.450	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	Northrop Grumman : Charlottesville, VA	34.986	4.736	Jan 2019	2.800	Mar 2020	3.500	Oct 2020	-		3.500	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	SPAWAR Atlantic : Charleston, SC	1.530	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Philadelphia : Philadelphia, PA	0.737	0.000		0.500	Dec 2019	0.300	Oct 2020	-		0.300	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	Electric Boat : Groton, CA	0.953	0.000		0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	John Hopkins, APL : Laurel, MD	4.980	1.180	Jan 2019	10.216	Dec 2019	7.851	Oct 2020	-		7.851	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	Draper : Cambridge, MA	1.475	0.000		4.200	Dec 2019	2.136	Oct 2020	-		2.136	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Crane : Crane, IN	0.121	0.000		0.000		0.000		-		0.000	0.000	0.121	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

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/ Design	WR	Submarine Special Projects : Washington, DC	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Systems Engineering/ Design	MIPR	COMOPTEVFOR : Norfolk, VA	0.021	0.000		0.000		0.000		-		0.000	0.000	0.021	-
Systems Engineering/ Design	WR	SPAWAR 5.0 : San Diego, CA	0.093	0.000		0.000		0.000		-		0.000	0.000	0.093	-
Systems Engineering/ Design	TBD	Carnegie Mellon : Not Specified	0.000	0.000		0.400	Dec 2019	0.000		-		0.000	0.000	0.400	-
		Subtotal	74.731	9.028		32.419		31.453		-		31.453	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
Program Management	C/CPFF	Various : Not Specified	6.272	0.300	Jan 2019	2.183	Jan 2020	2.029	Oct 2020	-		2.029	Continuing	Continuing	Continuing
		Subtotal	6.272	0.300		2.183		2.029		-		2.029	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	81.003	9.328		34.602		33.482		-		33.482	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

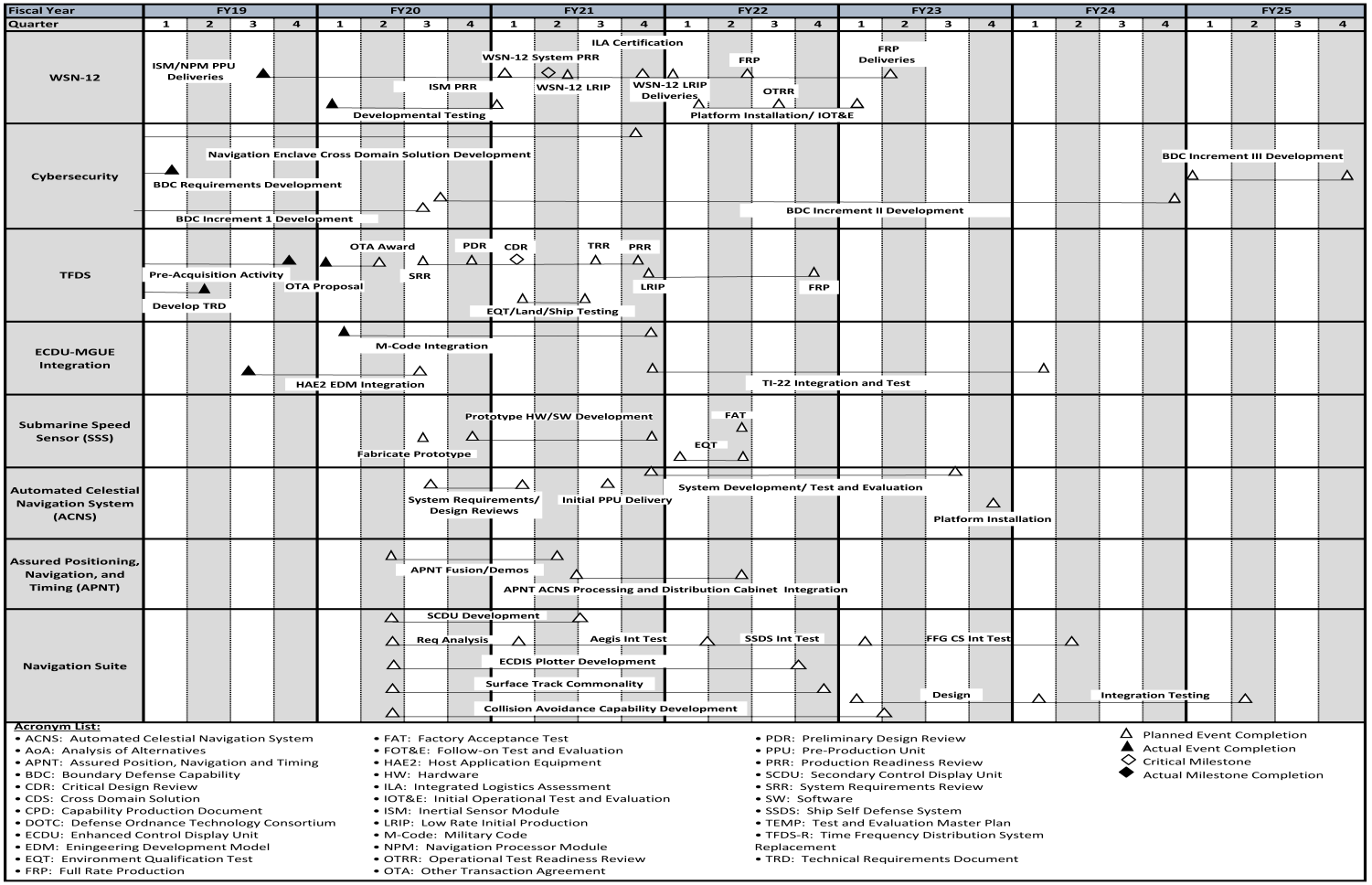

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3311				
AN/WSN-12 ISM/NPM PPU Deliveries	3	2019	3	2019
AN/WSN-12 Developmental Testing	1	2020	1	2021
AN/WSN-12 ISM PRR	1	2021	1	2021
AN/WSN-12 System PRR	2	2021	2	2021
AN/WSN-12 LRIP	2	2021	2	2021
AN/WSN-12 ILA Certification	1	2019	1	2025
AN/WSN-12 Platform Installation and IOT&E	1	2022	1	2023
AN/WSN-12 OTRR	3	2022	3	2022
AN/WSN-12 LRIP Deliveries	1	2022	1	2022
AN/WSN-12 FRP	2	2022	2	2022
AN/WSN-12 FRP Deliveries	2	2023	2	2023
Cybersecurity Cross Doman Solution Development	1	2019	4	2021
Cybersecurity BDC Requirements Development	1	2019	1	2019
Cybersecurity BDC Increment 1	1	2019	3	2020
Cybersecurity BDC Increment 2	3	2020	4	2024
Cybersecurity BDC Increment 3	1	2019	1	2025
TFDS-R Develop TRD	1	2019	2	2019
TFDS-R Pre-Acquisition Activity	1	2019	4	2019
OTA Proposal	1	2020	1	2020
OTA Award	2	2020	2	2020
TFDS-R SRR	3	2020	3	2020
TFDS-R PDR	4	2020	4	2020

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
TFDS-R CDR	1	2021	1	2021
TFDS-R EQT/Land/Ship Testing	1	2021	3	2021
TFDS-R TRR	3	2021	3	2021
TFDS-R PRR	4	2021	4	2021
TFDS-R LRIP	4	2021	4	2021
TFDS-R FRP	4	2022	4	2022
MGUE HAE2 EDM Integration	3	2019	3	2020
MGUE M-Code Integration	1	2020	4	2021
MGUE TI-22 Integration and Test	4	2021	1	2024
SSS Fabricate Prototype	3	2020	3	2020
SSS Prototype HW/SW Development	4	2020	4	2021
SSS EQT	1	2022	2	2022
SSS FAT	2	2022	2	2022
ACNS System Requirements Design Reviews	3	2020	1	2021
ACNS Initial PPU Delivery and Prototype Installation	3	2021	3	2021
ACNS System Development Test and Evaluation	4	2021	3	2023
ACNS Platform Installation	4	2023	4	2023
APNT Fusion/Demos	1	2020	4	2020
APNT ACNS Processing and Distribution Cabinet Integration	1	2021	1	2022
Navigation Suite SCDU Development	2	2020	2	2021
Navigation Suite Requirements Analysis	2	2020	1	2021
Navigation Suite Aegis Integration Testing	1	2021	1	2022
Navigation Suite SSDS Integration Testing	1	2022	1	2023
Navigation Suite FFG CS Integration Testing	1	2023	2	2024
Navigation Suite ECDIS Plotter Development	2	2020	3	2022
Navigation Suite Surface Track Commonality	2	2020	4	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Navigation Suite Collision Avoidance Capability Development	2	2020	1	2023
Navigation Suite Design	1	2023	1	2024
Navigation Integration Testing	1	2024	2	2025