Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy											Date: February 2018	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0204228N *I Surface Support*							
COST ($ in Millions)	**Prior Years**	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	39.821	20.595	24.829	11.661	-	11.661	23.589	23.616	15.896	15.166	Continuing	Continuing
3311: *Navigation Systems*	39.821	20.595	24.829	11.661	-	11.661	23.589	23.616	15.896	15.166	Continuing	Continuing

A. Mission Description and Budget Item Justification

The FY 2019 funding request was reduced by $7.239 million to account for the availability of prior year execution balances.

The Surface support RDT&E funding will be used for the research, design, development, integration testing, and documentation of a new Inertial Navigation System (INS) AN/WSN-12 for all Navy platforms. Efforts will include analysis and planning for the alignment and evolution of Afloat Navigation Systems for surface and submarine platforms. 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. The INS provides mission critical ship's 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 absence of GPS. The INS 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 Power Spectral Density (PSD) capability. PSD provides a tighter tolerance for error across a wider frequency range. The ISM being is designed, developed, and procured through competitive contract award to Northrop Grumman in November 2015. The NPM is a Government design. RDT&E funding will support continued system design to create a baseline for Pre-Production Units (PPU) and Low Rate Initial Production (LRIP). The system will go through Critical Design Review (CDR), Test Readiness Review (TRR), and Production Readiness Reviews (PRR). The system will go through extensive testing including Independent Validation and Verification (IV&V), Developmental Testing (DT) and Operational Testing (OT).

Cybersecurity funding will be used for the research, development, documentation and integration testing for cybersecurity hardening and enclave development for navigation systems. Efforts will 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. Conduct of cybersecurity risk and vulnerability assessments including development of system models, threat models, and mission models for representative groupings of Navigation systems and cyber security capabilities. Risk assessments along with requirements development will lead to incremental capability development leveraging the increment 1 EDM delivery with updated architectures and system level modifications. Follow on capabilities will be developed and added to meet existing threats and requirements.

The MK27 gyrocompass provides a backup heading reference for SSBNs and LSD platforms and has become obsolete. The AN/WSN-11 (MK27-Replacement) is a form fit function replacement that provides the same functionality while addressing the obsolescence issues of the original MK27. RDT&E funding supported the development, testing and certification of the AN/WSN-11. Development has been completed and production has transitioned to OPN funding.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy	Date: February 2018
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0204228N *I Surface Support*

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. This funding will be used to conduct a system level Analysis of Alternatives (AoA) and develop a Technical Requirements Document (TRD). These documents will support detailed analysis of the program implementation strategy to replace obsolete TFDS systems in the Fleet including appropriate documentation and contracting strategies. Planned FY19 efforts include release of development contract Request for Information.

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 FY19 efforts include TI-22 requirements definition and HAE2 Engineering Development Model (EDM) integration.

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.

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	21.156	24.829	19.071	-	19.071
Current President's Budget	20.595	24.829	11.661	-	11.661
Total Adjustments	-0.561	0.000	-7.410	-	-7.410
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.561	0.000			
• Program Adjustments	0.000	0.000	-7.239	-	-7.239
• Rate/Misc Adjustments	0.000	0.000	-0.171	-	-0.171

Change Summary Explanation

The FY 2019 funding request was reduced to account for the availability of prior year execution balances.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy									Date: February 2018			
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 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
3311: *Navigation Systems*	39.821	20.595	24.829	11.661	-	11.661	23.589	23.616	15.896	15.166	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 a new Inertial Navigation System (INS) AN/WSN-12 for all Navy platforms. Efforts will include analysis and planning for the alignment and evolution of Afloat Navigation Systems for surface and submarine platforms. 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. The INS provides mission critical ship's 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 absence of GPS. The INS 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 Power Spectral Density (PSD) capability. PSD provides a tighter tolerance for error across a wider frequency range. The ISM being is designed, developed, and procured through competitive contract award to Northrop Grumman in November 2015. The NPM is a Government design. RDT&E funding will support continued system design to create a baseline for Pre-Production Units (PPU) and Low Rate Initial Production (LRIP). The system will go through Critical Design Review (CDR), Test Readiness Review (TRR), and Production Readiness Reviews (PRR). The system will go through extensive testing including Independent Validation and Verification (IV&V), Developmental Testing (DT) and Operational Testing (OT).

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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

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

Allied missions. This funding will be used to conduct a system level Analysis of Alternatives (AoA) and develop a Technical Requirements Document (TRD). These documents will support detailed analysis of the program implementation strategy to replace obsolete TFDS systems in the Fleet including appropriate documentation and contracting strategies. Planned FY19 efforts include release of development contract Request for Information.

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 FY19 efforts include TI-22 requirements definition and HAE2 Engineering Development Model (EDM) integration.

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.

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: WSN-12 Inertial Navigation System - Replacement (INS-R)	14.619	11.803	5.291	0.000	5.291
Articles:	-	-	-	-	-
FY 2018 Plans: Conduct ISM/NPM integration testing for EDM software and hardware Conduct the ISM CDR Begin the ISM PPU build Conduct the system level WSN-12 CDR Begin development of the Integrated Logistics (ILS) documents - Life Cycle Sustainment Plan (LCSP) Begin NPM PPU EQT testing Begin ISM PPU EQT testing Begin system level EDM land based testing					
FY 2019 Base Plans: Continue NPM PPU EQT testing Continue ISM PPU EQT testing Complete ISM PPU builds Complete NPM PPU builds Start system level PPU land based performance testing					
FY 2019 OCO Plans: N/A					
FY 2018 to FY 2019 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Decrease is due to FY 2017 underexecution resulting in rephasing of FY 2019 funding.					
Title: Cybersecurity	1.918	4.804	0.500	0.000	0.500
Articles:	-	-	-	-	-
FY 2018 Plans: Develop detailed requirements for boundary defense capabilities Finalize navigation enclave construct Develop controlled interface solution for ECDIS Perform vulnerability assessment on ECDIS VMS source code Develop initial increment 1 design of the enclave boundary defense prototype DDG navigation enclave architecture					
FY 2019 Base Plans: Begin development of increment 2 capabilities of boundary defense capability					
FY 2019 OCO Plans: N/A					
FY 2018 to FY 2019 Increase/Decrease Statement: Decrease is due to FY 2017 underexecution resulting in rephasing of FY 2019 funding.					
Title: Time Frequency Distribution System (TFDS) Replacement	0.800	2.000	0.500	0.000	0.500
Articles:	-	-	-	-	-
FY 2018 Plans: Finalize the AoA Finalize the TRD Develop an acquisition strategy based on AoA results, brief to OPNAV resource sponsors Draft a System Acquisition Management Plan (SAMP) Complete a draft Request for Information (RFI) Begin project documentation planning/development					
FY 2019 Base Plans: Release the RFI					
FY 2019 OCO Plans: N/A					
FY 2018 to FY 2019 Increase/Decrease Statement:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Decrease is due to FY 2017 underexecution resulting in rephasing of FY 2019 funding.					
Title: Military GPS User Equipment	0.000	3.906	4.420	0.000	4.420
Articles:	-	-	-	-	-
FY 2018 Plans: Development of a Technical Requirements Document (TRD) and trade studies for the Military GPS User Equipment (MGUE) integration. Development of a program acquisition strategy and accompanying documentation. Upgrade of the submarine integration lab and upgrade of the Enhanced Control Display Unit (ECDU)					
FY 2019 Base Plans: Finalize the integration plan for MGUE into the ECDU Begin MGUE card integration and software analysis Complete platform level integration studies for munitions and GPS end users					
FY 2019 OCO Plans: N/A					
FY 2018 to FY 2019 Increase/Decrease Statement: Increase to support plans for integration of MGUE into ECDU.					
Title: Submarine Speed Sensors	0.491	0.800	0.250	0.000	0.250
Articles:	-	-	-	-	-
FY 2018 Plans: Complete prototype development and conduct flow tank testing.					
FY 2019 Base Plans: Prepare for At-Sea testing.					
FY 2019 OCO Plans: N/A					
FY 2018 to FY 2019 Increase/Decrease Statement: Decrease is due to FY 2017 underexecution resulting in rephasing of FY 2019 funding.					
Title: Navigation Support	2.767	1.516	0.700	0.000	0.700
Articles:	-	-	-	-	-
FY 2018 Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
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 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Provide engineering, logistics, and programmatic support for, WSN-12, TFDS, Cyber security, Submarine Speed Sensor Support, and Military GPS User Equipment. ***FY 2019 Base Plans:*** Provide engineering, logistics, and programmatic support for, WSN-12, TFDS, Cyber security, Submarine Speed Sensor Support, and Military GPS User Equipment. ***FY 2019 OCO Plans:*** N/A ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Decrease is due to FY 2017 underexecution resulting in rephasing of FY 2019 funding.					
Accomplishments/Planned Programs Subtotals	20.595	24.829	11.661	0.000	11.661

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
• OPN/0670: *Other Navigation*	62.970	65.943	63.330	-	63.330	84.002	83.908	74.832	76.476	Continuing	Continuing

Remarks

D. Acquisition Strategy

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). Planned FY19 efforts include delivery of PPU.

E. Performance Metrics

FY17
Completed the WSN-12 Inertial Sensor Module (ISM) ISM Engineering Development Models (EDMs).
Began the WSN-12 ISM EDM and NPM EDM hardware and software integration.
WSN-12 Environmental Qualification Test (EQT) Submarine test plan completed.
Awarded the WSN-12 ISM Critical Design Review (CDR) CLIN.
Began the WSN-12 Pre Production Unit (PPU) build for the Navigation Processor Module (NPM) units
Completed the WSN-12 ISM thermal redesign effort

Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

Develop Cybersecuirty Top Level Requirements document, capabilities roadmap, and prototype deployment schedule
Continued work on the TFDS Analysis of Alternatives (AoA)
Completed first draft of the TFDS Technical Requirements Document (TRD)
Conducted a TFDS Enterprise Stakeholders Integrated Product Team (IPT) meetings
Completed the TFDS Diminishing manufacturing sources and material shortages (DMSMS) Plan
Started TFDS market research activities

FY18
Conduct WSN-12 Critical Design Review (CDR).
Develop Cybersecurity Prototype increment 1 design, ECDIS controlled interface completed design, and ECDIS source code vulnerability report.
Execute TFDS Program of Record activities.
Develop GPS MGUE TRD
Completion of GPS MGUE Trade Studies
Complete Submarine Speed Sensor temporary alteration efforts.

FY19
Complete ISM PPU builds and deliver
Complete NPM PPU builds and deliver
Start WSN-12 system level PPU land based performance testing
Receive M-Code receiver and begin early integration with HAE2 Level Card

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
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 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering/ Design	WR	SPAWAR Atlantic : Little Creek, VA	5.570	0.480	Feb 2017	3.977	Jan 2018	2.308	Jan 2019	-		2.308	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	SPAWAR Pacific : San Diego, CA	0.440	0.220	Feb 2017	0.720	Jan 2018	0.635	Jan 2019	-		0.635	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	WR Systems : Norfolk, VA	7.737	1.739	Sep 2017	3.539	Jan 2018	3.898	Jan 2019	-		3.898	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	Penn State/ARL : Warminster, PA	2.550	0.925	Jun 2017	0.600	Jan 2018	0.365	Jan 2019	-		0.365	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Dahlgren : Dahlgren, VA	0.643	0.000		0.339	Dec 2017	0.210	Jan 2019	-		0.210	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Dam Neck : Dam Neck, VA	0.340	0.000		2.000	Dec 2017	0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC PHD : Port Hueneme, CA	0.000	0.122	Mar 2017	0.000		0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NUWC Newport : Newport, RI	0.180	0.000		0.000		0.000		-		0.000	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	15.338	12.204	Sep 2017	9.359	Dec 2017	2.250	Jan 2019	-		2.250	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	SPAWAR Atlantic : Charleston, SC	1.530	0.000		0.196	Dec 2017	0.000		-		0.000	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Philadelphia : Philadelphia, PA	0.110	0.440	Jun 2017	0.660	Dec 2017	0.080	Jan 2019	-		0.080	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	0.000	1.638	May 2017	1.816	Dec 2017	0.660	Jan 2019	-		0.660	Continuing	Continuing	Continuing
Systems Engineering/ Design	C/CPFF	Draper : Cambridge, MA	1.475	0.000		0.000		0.060	Jan 2019	-		0.060	Continuing	Continuing	Continuing
Systems Engineering/ Design	WR	NSWC Crane : Crane, IN	0.000	0.060	Jan 2017	0.000		0.000		-		0.000	0.000	0.060	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy			Date: February 2018
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 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Systems Engineering/ Design	WR	Submarine Special Projects : Washington, DC	0.000	0.000		0.000		0.495	Jan 2019	-		0.495	0.000	0.495	-
		Subtotal	37.316	17.828		23.206		10.961		-		10.961	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2017 Cost	FY 2017 Award Date	FY 2018 Cost	FY 2018 Award Date	FY 2019 Base Cost	FY 2019 Base Award Date	FY 2019 OCO Cost	FY 2019 OCO Award Date	FY 2019 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management	C/CPFF	Various : Not Specified	2.505	2.767	Sep 2017	1.623	Jan 2018	0.700	Jan 2019	-		0.700	Continuing	Continuing	Continuing
		Subtotal	2.505	2.767		1.623		0.700		-		0.700	Continuing	Continuing	N/A

	Prior Years	FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	39.821	20.595		24.829		11.661		-		11.661	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

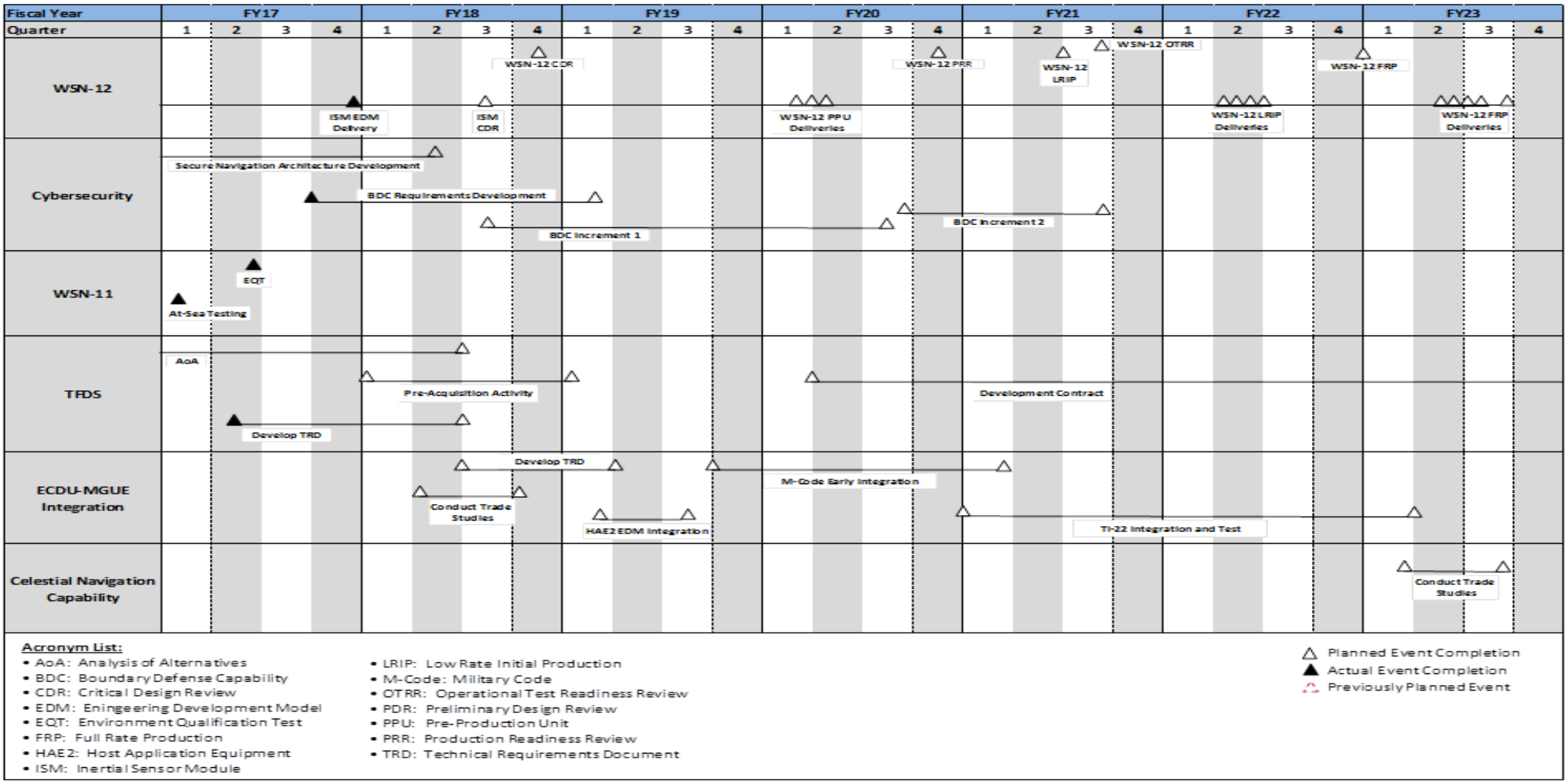

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
Appropriation/Budget Activity 1319 / 7	**R-1 Program Element (Number/Name)** PE 0204228N / *Surface Support*	**Project (Number/Name)** 3311 / *Navigation Systems*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 3311				
ISM EDM Delivery	4	2017	4	2017
ISM CDR	3	2018	3	2018
WSN-12 CDR	4	2018	4	2018
WSN-12 PPU Deliveries	1	2020	2	2020
WSN-12 PRR	4	2020	4	2020
WSN-12 LRIP	2	2021	2	2021
WSN-12 OTRR	3	2021	3	2021
WSN-12 LRIP Deliveries	2	2022	2	2022
WSN-12 FRP	4	2022	4	2022
WSN-12 FRP Deliveries	2	2023	3	2023
Cybersecurity Secure Navigation Architecture Development	1	2017	2	2018
Cybersecurity BDC Requirements Development	1	2017	2	2018
Cybersecurity BDC Increment 1	3	2018	3	2020
Cybersecurity BDC Increment 2	3	2020	3	2021
WSN-11 At Sea Testing	1	2017	1	2017
WSN-11 Environmental Qualification Testing (EQT)	2	2017	2	2017
TFDS AoA	1	2017	2	2018
TFDS Develop TRD	2	2017	2	2018
TFDS Pre-Acquisition Activity	1	2018	1	2019
TFDS Development Contract	2	2020	4	2023
MGUE Trade Studies	2	2018	4	2018
MGUE Develop TRD	3	2018	2	2019

Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy		Date: February 2018
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**
MGUE HAE2 EDM Integration	1	2019	3	2019
MGUE M-Code Early Integration	4	2019	1	2021
MGUE TI-22 Integration and Test	1	2021	2	2023
Celestial Navigation Capability Trade Studies	1	2023	3	2023