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Exhibit R-2, RDT&E Budget Item Justification: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0604777N / <i>Navigation/Id System</i>
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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	664.136	99.650	45.755	50.180	-	50.180	50.204	44.841	43.173	44.035	Continuing	Continuing
0253: <i>Nav & Electro-Optical Supt</i>	57.984	34.656	36.532	37.391	-	37.391	37.681	38.840	38.625	39.395	Continuing	Continuing
0676: <i>Improve ID Development</i>	49.247	3.372	2.335	10.868	-	10.868	10.566	4.006	2.512	2.563	Continuing	Continuing
0921: <i>NAVSTAR GPS Equipment</i>	369.162	55.897	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	425.059
1253: <i>Combat Ident System</i>	187.743	0.898	1.888	1.921	-	1.921	1.957	1.995	2.036	2.077	Continuing	Continuing
9999: <i>Congressional Adds</i>	0.000	4.827	5.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.827

Note

Funding for the following project has been realigned out of PE 0604777N into PE 0604280N as part of Program Element Consolidation starting in FY 2020: Project 0921 (NAVSTAR GPS Equipment).

A. Mission Description and Budget Item Justification

Reliable and secure navigation and positive identification (ID) systems are essential elements of battle management in the naval environment. The Photonics Imaging System (0253) is a non-hull penetrating replacement for existing optical periscopes. The Photonics Imaging System exploits a wide portion of the electro-magnetic spectrum utilizing advanced Electro-Optic/thermal imaging, and communications intercept/Electronic Warfare Support (ES). The Integrated Submarine Imaging System (ISIS) (0253) is a back fit system to integrate all imaging capabilities on existing submarine classes. The Combat Identification System (CIS) project (1253) for Mark XIIA, and Improved Identification Development (0676) for AN/UPX-29(V), covers the Mark XIIA Mode 5 upgrade to the existing Mark XII family of systems that is Joint and North Atlantic Treaty Organization (NATO) interoperable. Per OSD direction, NATO participation is encouraged and performance data is exchanged to ensure the opportunity for interoperability with allied identification systems is maximized. In addition to distinguishing friend from foe for weapons employment, the Navy requires secure, jam resistant Identification Friend or Foe (IFF) systems for battle group air defense management and air traffic control. Identification is multifaceted and includes information received from several sensors (both cooperative and non-cooperative systems).

Navigation Satellite Timing & Ranging (NAVSTAR) Global Positioning System (GPS) project (0921) encompasses the Navy's efforts to pace the growing threat to GPS Navigation through the fielding of new GPS receivers, Anti-Jam (AJ) Antennas, and Assured Position Navigation and Timing (A-PNT) technologies across all Navy platform types. NAVSTAR GPS is a group of A-PNT systems that provides authorized users with secure, worldwide, all weather, three dimensional position, velocity, and precise time data. NAVSTAR GPS provides A-PNT capability to Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance (C4ISR) and combat systems in standalone and networked architectures throughout air and maritime domains. This project is comprised of four distinct efforts: Sea Navigation Warfare (NAVWAR), GPS-based Position, Navigation, and Timing (PNT) Service (GPNTS), Air Navigation Warfare (NAVWAR) and GPS Modernization. Sea NAVWAR provides AJ antennas and GPNTS provides GPS receivers and A-PNT technology to surface platforms, and Air NAVWAR provides AJ antennas and GPS Modernization provides GPS receivers to air platforms. Research, Development, Testing and Evaluation (RDT&E) funds are used to perform all the non-recurring GPS Surface Ship, Submarine and Aircraft Development, Integration, and Testing efforts in support of NAVSTAR GPS.

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B. Program Change Summary (\$ in Millions)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Previous President's Budget	126.026	40.755	48.907	-	48.907
Current President's Budget	99.650	45.755	50.180	-	50.180
Total Adjustments	-26.376	5.000	1.273	-	1.273
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	5.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-22.578	0.000			
• SBIR/STTR Transfer	-3.798	0.000			
• Program Adjustments	0.000	0.000	1.600	-	1.600
• Rate/Misc Adjustments	0.000	0.000	-0.327	-	-0.327

Congressional Add Details (\$ in Millions, and Includes General Reductions)

Project: 9999: Congressional Adds

Congressional Add: *Micro-IFF Component*

Congressional Add: *Development of lightweight security Identification Friend or Foe transmitter*

Congressional Add Subtotals for Project: 9999

Congressional Add Totals for all Projects

	FY 2019	FY 2020
	4.827	0.000
	0.000	5.000
Congressional Add Subtotals for Project: 9999	4.827	5.000
Congressional Add Totals for all Projects	4.827	5.000

Change Summary Explanation

FY 2021 funding request was reduced by \$.363 million to account for the availability of prior year execution balances.

Beginning in FY20, Project 0921 was realigned from Program Element (PE) 0604777N into PE 0604280N due to budget line item consolidation.

Funding increases in FY 2021 driven by first year funding for DDG 1000 Sensor Suite modernization program, UPX-36 Engineering Change Proposal (ECP) Part I, and Radar Track Discriminator System (RTDS) UPX-34A ECP Part I.

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy										Date: February 2020		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System				Project (Number/Name) 0253 / Nav & Electro-Optical Supt			
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
0253: Nav & Electro-Optical Supt	57.984	34.656	36.532	37.391	-	37.391	37.681	38.840	38.625	39.395	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The FY21 Navigation and Electro-Optical (E-O) program enables littoral operations by procuring Integrated Submarine Imaging Systems (ISIS), production of low profile masts (Low Profile Photonics Mast, Type 20, and Type 24), maintenance and sustainment of periscope and legacy photonic masts, production and sustainment of Universal Modular Mast Systems and Dip Loops, and development of the ISIS inboard processing component of Submarine Warfare Federated Tactical Systems (SWFTS). The Department of the Navy established the ISIS to rapidly field the Type 18 periscope, RADAR rangefinder, Type 8 Mod 4 Infra-Red (IR) periscope systems, and integrate existing periscope imagery systems into a single imaging system for installation on board SSN 688 class and SEAWOLF class submarines. The ISIS baseline also includes the Imaging System with the Photonics mast (PM) and all configurations of low profile masts onboard VIRGINIA and Photonics Mast Variant (PMV) onboard SSGN class submarines. The PM, LPPM, and PMV design exploit a wide portion of the electro-magnetic spectrum through advanced E-O and thermal imaging and Electronic Warfare Support (ES)/communications intercept. The Common Submarine Imaging System (CSIS) capability development document (CDD), that covers both ISIS and Legacy Imaging systems was approved 22 Dec 2011 with an updated CDD approved on 15 Mar 2018. The CDD Annex for Low Profile Digital Photonics Mast, approved on 02 Dec 2019, provides additional specifications for the development of low profile masts within the ISIS system. The \$0.859M FY21 inflation increase continues the FY20 investment in imaging sensors and algorithms to improve submarine operations in high intensity littoral environments, intelligence gathering, real time imagery and support the safe and effective employment of surveillance and weapons systems. In FY21 these funds will commence work on sensitive materials development and Mast Capability Enhancements for the Type 20 Mast. Furthermore, this funding will improve the software algorithms and inboard hardware for processing outboard mast data, including the Type 20 mast, and support non-recurring inboard hardware engineering activities which develop the Technical Insertion kits installed in all submarine classes. Finally, FY21 funds the TI20/APB19 MDEMO and the TI20/APB19 VA Development Testing that verifies software improvements funded in previous fiscal years.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: ISIS and Photonics common software and hardware capabilities development and obsolescence.	6.836	22.589	27.778	0.000	27.778
Articles:	-	-	-	-	-
FY 2020 Plans: The \$15.753M increase is (a) \$0.123M inflationary increase in the annual investment advanced development of sensitive software imaging algorithms to maintain imaging system superiority, and (b) a \$15.63M transfer of non-recurring engineering (NRE) that has been funded in prior years under OPN BLI 0840. This NRE provides the necessary engineering, technical program, project and configuration management of the Technical Insertion (TI) kit (software and hardware) baseline for each class of submarine.					
FY 2021 Base Plans:					

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Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0253 / Nav & Electro-Optical Supt
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>The \$5.189M increase is to (a) commence the TI-22 capability development process, which provides the necessary engineering, technical program, project and configuration management of the hardware and software baseline to incorporate additional sensitive software imaging algorithms, while concluding the development of TI-20 and (b) modify the ISIS architecture to support rapid insertion of new war fighting capabilities and enhanced cyber security protection which are imperative to ensure all systems are protected from cyber security attacks.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: The \$5.189M increase is for the completion of TI-20 capabilities and launch development of sensitive software imaging algorithms for TI-22 to maintain imaging system superiority.</p>					
<p>Title: Type 20 Mast</p> <p align="right">Articles:</p> <p>FY 2020 Plans: The \$13.891M decrease in funding completes the Type 20 mast development, fabrication and verification. Specific efforts include: - Continue the test plans and commencement of test activities - Continue the counter detection vulnerability reduction - Complete fabrication of the Type 20 test article - Develop enhancements to be incorporated into Type 20 mast</p> <p>FY 2021 Base Plans: The \$4.345M decrease in funding is required for follow-on Type 20 Mast Capability Enhancement development efforts including: - Development of specialized materials for the Type 20 Mast. - Selecting and developing technology candidates to engineering change proposals and improvements.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: The \$4.345M decrease is a transition to post Type 20 development including development of specialized materials for the mast and identifying and developing technology candidates to engineering change proposals</p>	27.125	13.234	8.889	0.000	8.889
	1	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
and improvements. Since the Type 20 mast utilizes open architecture and a modular design to reduce life cycle costs and enable flexibility for such capability upgrades. As a modular mast, the Type 20 mast will have these enhancements procured in FY23.					
Title: Imaging Systems Test Efforts.	0.695	0.709	0.724	0.000	0.724
Articles:	-	-	-	-	-
FY 2020 Plans: The \$0.014M increase is for TI-18/APB-17 688 Development Testing (DT) to validate sensitive algorithms incorporated into APB-17.					
FY 2021 Base Plans: The \$0.015M increase is an inflationary increase to fund ISIS and mast system testing including the TI-20/APB19 MDEMO and the TI-20/APB-19 VADT					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: The \$0.015M increase is an inflation adjustment which will fund the design, management, and evaluation results of the TI-20/APB19 MDEMO and the TI-20/APB-19 VADT tests for modernizing boats.					
Accomplishments/Planned Programs Subtotals	34.656	36.532	37.391	0.000	37.391

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
• SCN/2013: <i>Photonics Mast</i>	36.398	41.210	39.972	-	39.972	40.772	41.587	42.419	43.267	Continuing	Continuing
• RDT&E/0603562N: <i>Advanced Submarine Support Equipment (ASSEP)</i>	4.264	4.557	4.702	-	4.702	0.000	0.000	0.000	0.000	Continuing	Continuing
• OPN/0840: <i>Sub Periscope, Imaging Equip. and Supt Equip Program</i>	179.293	160.803	204.806	-	204.806	269.548	308.122	290.661	302.296	Continuing	Continuing
• RDT&E/0603595N: <i>COLUMBIA Class Design Development</i>	1.118	1.115	0.898	-	0.898	0.898	0.936	0.954	0.974	Continuing	Continuing

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C. Other Program Funding Summary (\$ in Millions)

<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u> <u>Base</u>	<u>FY 2021</u> <u>OCO</u>	<u>FY 2021</u> <u>Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To</u> <u>Complete</u>	<u>Total Cost</u>
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Remarks

D. Acquisition Strategy

The Acquisition Strategy for AN/BVY-1 Integrated Submarine Imaging System (ISIS) is dated 07 Jul 2003. The Acquisition Program Baseline Agreement for ISIS Advanced Processor Builds 11, 13 and 15 is dated 07 Mar 2013. The Single Acquisition Management Plan (SAMP) for the LPPM is dated 01 Jul 2013. The ISIS will provide mission critical, all weather, visual, and electronic search, digital image management, indication, warning, and platform architecture interface capabilities for SSN 688, SSN 21, SSN 774 and SSGN class submarines. The Single Acquisition Management Plan (SAMP) for the Type 20 Mast is dated 07 Jul 2017.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy												Date: February 2020			
Appropriation/Budget Activity						R-1 Program Element (Number/Name)				Project (Number/Name)					
1319 / 5						PE 0604777N / Navigation/Id System				0253 / Nav & Electro-Optical Supt					
Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Software Development	C/CPIF	Lockheed Martin : Manassas, VA	18.840	2.177	Dec 2018	9.444	Dec 2019	12.296	Dec 2020	-		12.296	Continuing	Continuing	Continuing
Systems Engineering	WR	NUWC : Newport, RI	17.534	2.323	Dec 2018	2.354	Nov 2019	4.475	Dec 2020	-		4.475	Continuing	Continuing	Continuing
Hardware Development	C/CPIF	Lockheed Martin : Manassas, VA	10.324	2.289	Dec 2018	10.743	Dec 2019	10.958	Dec 2020	-		10.958	Continuing	Continuing	Continuing
Hardware Development - Type 20/Mast Capability Enhancements	C/CPIF	Lockheed Martin : Manassas, VA	1.002	27.125	Dec 2018	13.234	Dec 2019	8.889	Dec 2020	-		8.889	Continuing	Continuing	Continuing
Subtotal			47.700	33.914		35.775		36.618		-		36.618	Continuing	Continuing	N/A
Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Development Test & Evaluation	WR	NUWC : Newport, RI	8.244	0.435	Oct 2018	0.444	Oct 2019	0.453	Oct 2020	-		0.453	Continuing	Continuing	Continuing
Development Test & Evaluation	WR	COMOPTEVFOR : Norfolk, VA	1.415	0.260	Oct 2018	0.265	Oct 2019	0.271	Oct 2020	-		0.271	Continuing	Continuing	Continuing
Subtotal			9.659	0.695		0.709		0.724		-		0.724	Continuing	Continuing	N/A
Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Travel	WR	NAVSEA : Washington, DC	0.625	0.047	Oct 2018	0.048	Oct 2019	0.049	Oct 2020	-		0.049	Continuing	Continuing	Continuing
Subtotal			0.625	0.047		0.048		0.049		-		0.049	Continuing	Continuing	N/A
Project Cost Totals			57.984	34.656		36.532		37.391		-		37.391	Continuing	Continuing	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

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	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
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Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0253 / Nav & Electro-Optical Supt
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Major Milestones	FY19				FY20				FY21				FY22				FY23				FY24				FY25			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
ISIS Technology Insertion			▲								▲								▲									▲
			TI-18								TI-20								TI-22									TI-24
Type 24															▲													
Type 24															Type 24													
Developments																												
ISIS APB		TI-18					TI-20								TI-22								TI-24					TI-26
Type 20			Type 20					Type 20 - Mast Capability Enhancements																				
Type 24																Type 24								Type 24 - Mast Capability Enhancements				
Mast Procurement																												
LPPM		▲																										
		BACKFIT 2-4																										
Type 20							▲			▲				▲					▲									
							CCM, POR 1			POR 2				POR 3-6					POR CCM, 7-11									
Type 24																							▲				▲	
																							POR 1 - 4				POR 5-9	
Test & Evaluation																												
ISIS (TI/APB)			▲				▲				▲				▲												▲	
			TI16/APB15 VA DT				TI18/APB17 688 DT				TI20/APB19 VA DT				TI22/APB21 688 DT												TI24/APB23 VA DT	
			▲				▲				▲				▲												▲	
			TI16/APB15 VA OT				TI18/APB17 688 OPEVAL				TI20/APB19 MDEMO				TI22/APB21 688 OPEVAL												TI24/APB23 VA OT	

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Nav & Electro-Optical Supt</i>				
Major Milestones: ISIS Technology Insertion: ISIS Technology Insertion Fielding (TI-18)	3	2019	3	2019
Major Milestones: ISIS Technology Insertion: ISIS Technology Insertion Fielding (TI-20)	3	2021	3	2021
Major Milestones: ISIS Technology Insertion: ISIS Technology Insertion Fielding (TI-22)	3	2023	3	2023
Major Milestones: ISIS Technology Insertion: ISIS Technology Insertion Fielding (TI-24)	3	2025	3	2025
Major Milestones: Type 24: Contract Award	3	2022	3	2022
Developments: ISIS APB: ISIS TI-18	1	2019	1	2019
Developments: ISIS APB: ISIS TI-20	4	2019	1	2021
Developments: ISIS APB: ISIS TI-22	4	2021	1	2023
Developments: ISIS APB: ISIS TI-24	4	2023	1	2025
Developments: ISIS APB: ISIS TI-26	4	2025	4	2025
Developments: LPPM Development: Type 20	1	2019	2	2020
Developments: LPPM Development: Type 20 Mast Capability Enhancements (MCE)	4	2020	2	2022
Developments: LPPM Development: Type 24	4	2022	2	2024
Developments: LPPM Development: Type 24 Mast Capability Enhancements (MCE)	4	2024	4	2025
Mast Procurement: LPPM (Buy): Backfit 2 - 4	2	2019	2	2019
Mast Procurement: Type 20 (Buy): CCM / POR 1	3	2020	3	2020
Mast Procurement: Type 20 (Buy): POR 2	2	2021	2	2021
Mast Procurement: Type 20 (Buy): POR 3-6	2	2022	2	2022
Mast Procurement: Type 20 (Buy): POR CCM, 7-11	2	2023	2	2023

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Mast Procurement: Type 24 (Buy): POR 1-4	3	2024	3	2024
Mast Procurement: Type 24 (Buy): POR 5-9	3	2025	3	2025
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-16/APB 15 VA DT	3	2019	3	2019
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-16/APB 15 VA OT	3	2019	3	2019
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-18/APB 17 688 DT	3	2020	3	2020
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-18/APB 17 688 OPEVAL	4	2020	4	2020
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-20/APB 19 MDEMO	1	2021	1	2021
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-20/APB 19 VA DT	3	2021	3	2021
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-20/APB 19 VA OT	1	2022	1	2022
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-22/APB 21 688 DT	2	2023	2	2023
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-22/APB 21 688 OPEVAL	3	2023	3	2023
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-24/APB 23 VA DT	2	2025	2	2025
Test & Evaluation: ISIS (TI/APB): Test & Evaluation - ISIS TI-24/APB 23 VA OT	3	2025	3	2025

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy										Date: February 2020		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System				Project (Number/Name) 0676 / Improve ID Development			
COST (\$ in Millions)	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	FY 2022	FY 2023	FY 2024	FY 2025	Cost To Complete	Total Cost
0676: <i>Improve ID Development</i>	49.247	3.372	2.335	10.868	-	10.868	10.566	4.006	2.512	2.563	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

Reliable and secure navigation and positive identification (ID) systems are essential elements of battle management in the naval environment. In addition to providing platform identification for weapons employment, the Navy requires secure, jam resistant Identification Friend or Foe (IFF) systems for battle group air defense management and Air Traffic Control. The Improved ID Development project addresses the Mark XIIA Mode 5 and Mode S upgrades to the existing AN/UPX-29(V) Mark XII family of systems that is Joint and North Atlantic Treaty Organization interoperable, as well as modernization of the DDG 1000 Zumwalt Class IFF Sensor Suite . The AN/UPX-29(V) Interrogator System is comprised of the Interrogator Set AN/UPX-24(V), OE-120()/UPX Antenna Group, and Mark XII or Mark XIIA equipment such as AN/UPX-37, AN/UPX-41(C) or AN/UPX-45(C) Digital Interrogators and associated equipment. The DDG 1000 IFF Sensor Suite is comprised of three electronically scanned array (ESA) antennas, one UPX-42(C) Interrogator, and three RT-1912(C)/APX Transponders. Additionally, the Improved ID Development project may include product improvements designed to be installed through upgrade and deficiency correction studies, which in turn become engineering changes to other IFF solutions.

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/UPX-29 (V) - OE-120()/UPX Antenna Tech Refresh	2.577	1.544	1.080	0.000	1.080
Articles:	-	-	-	-	-
Description: Engineering and integration development for antenna group OE-120()/UPX antenna tech refresh. Develop design studies and Analysis of Alternatives, draft specifications, and perform system development and integration efforts and support mission requirements, to include engineering investigations and Engineering Change Proposal (ECP) development to support mission readiness for IFF systems.					
FY 2020 Plans: Conduct platform integration testing at In-Service Engineering Activity lab and land-based test sites.					
FY 2021 Base Plans: Complete platform integration testing at In-Service Engineering Activity lab and land-based test sites.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Decrease is due to the expected conclusion of the OE-120()/UPX antenna tech refresh engineering change proposal (ECP).					
Title: Mark XIIA Mode 5 and Mode S Improvement for AN/UPX-29(V)	0.371	0.378	0.672	0.000	0.672

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0676 / Improve ID Development
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Articles:	-	-	-	-	-
<p>Description: Engineering, development, and integration of improvements to Mark XIIA Shipboard Identification Friend or Foe (IFF) Systems, including, but not limited to the AN/UPX-29(V) Interrogator System, which is comprised of the Interrogator Set AN/UPX-24, OE-120()/UPX Antenna Group, and Mark XII or Mark XIIA equipment such as AN/UPX-37, AN/UPX-41 or AN/UPX-45 Digital Interrogators. Funds development and integration of Mark XIIA Mode 5 and Mode Select (S) Improvements to the AN/UPX-29(V) systems on CG47, DDG51, LHD1, LPD17, LHA6, and CVN68, CVN78, and future ship classes. Correct software and performance deficiencies from Integrated Test and Operational Test, Aegis, and other Combat System Integration events to support Combat System integration with Aegis Weapon Systems (AWS), Ship Self Defense System (SSDS), Advanced Combat Direction System (ACDS), or Air Traffic Control Systems using Mark XIIA equipment to include engineering investigations, Engineering Change Proposal development, and testing. Provides core Integrated Logistics Support documentation; formalizes hardware/software configuration: finalizes technical/ design data, resolves testing anomalies, and integrates with shipboard training systems.</p> <p>FY 2020 Plans: Continue AN/UPX-29(V) Interrogator System integration testing with Mode 5/Mode S capable AN/UPX-45 Digital Interrogator in preparation for deployment to Aegis platforms. Evaluate inter-operability test data to validate planned combat system software design changes.</p> <p>FY 2021 Base Plans: Continue AN/UPX-29(V) Interrogator System integration testing with Mode 5/Mode S capable AN/UPX-45 Digital Interrogator in preparation for deployment to Aegis platforms. Begin integration testing on Ship Self Defense System (SSDS) platforms. Evaluate inter-operability test data to validate planned combat system software design changes.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: Increase due to the start of integration testing of the Self Defense System (SSDS) platforms and new Aegis baseline configurations. The FY 2021 funding request was reduced by \$0.363M to account for the availability of prior year execution balances.</p>					
Title: AN/UPX-29(V) Management Support	0.424	0.413	0.681	0.000	0.681
Articles:	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy	Date: February 2020
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
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<p>Description: Engineering and Program Management of the AN/UPX 29(V). Perform system integration efforts.</p> <p>FY 2020 Plans: Support logistics and technical data management for the AN/UPX 29(V) Mode 5/Mode S integration. Develop and submit ship change documents for OE-120 retro-fit.</p> <p>FY 2021 Base Plans: Continue logistics and technical data management for the AN/UPX 29(V) Mode 5/Mode S integration. Develop and submit ship change documents for OE-120 and AN/UPX-45 retro-fit. Evaluate designs and implementations of cyber security controls.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: Increase is due to addition of cyber security requirements.</p>					
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<p>Title: DDG 1000 Modernization</p> <p align="right">Articles:</p> <p>Description: The IFF System will transition from a Contractor Furnished Equipment (CFE) suite to a government (organically) supported IFF System. Establish engineering support and Integrated Product Support (IPS) elements for transition of the DDG 1000 ship class' Contractor Furnished Equipment (CFE) IFF sensor suite to an organically supported and documented system.</p> <p>FY 2020 Plans: N/A</p> <p>FY 2021 Base Plans: Develop IPS elements, artifacts, and plans needed to transition DDG 1000 IFF sensor suite to organic support. Evaluate Diminishing Manufacturing Sources and Material Shortages (DMSMS), obsolescence, and performance risks.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement:</p>	0.000	0.000	1.600	0.000	1.600
	-	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
FY21 is the first year of funding for DDG 1000 Sensor Suite modernization program.					

<p>Title: UPX-36 Engineering Change Proposal - Mode 5 Capable</p> <p align="right">Articles:</p> <p>Description: Upgrade the AN/UPX-36(V) from Mark XII to Mark XIIA with Mode 5 capability. The AN/UPX-36(V) is a centralized Identification Friend or Foe (IFF) interrogator system consisting of a processor, dedicated IFF antennas, and Mark XII interrogation capability providing identification of friendly and neutral contacts via cooperative means. System installations are limited to the 12 LSD41/49 class ships currently in-service.</p> <p>FY 2020 Plans: N/A</p> <p>FY 2021 Base Plans: Begin ECP to upgrade platform unique Mode 4 Shipboard IFF interrogator systems to a common Mark XIIA Mode 5 configuration.</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: FY21 is the first year of funding for UPX-36 ECP Part I.</p>	0.000	0.000	1.483	0.000	1.483
	-	-	-	-	-

<p>Title: Radar Track Discriminator System (RTDS) UPX-34A ECP Part I</p> <p align="right">Articles:</p> <p>Description: Capability upgrades to the AN/UPX-34A(V) RTDS, which is installed on CG47 Class Aegis Cruisers and provides high fidelity, long range, Non-cooperative Target Recognition (NCTR) capability to support the Air-Sea battle by providing timely tactical engagement decisions by Aegis action officers.</p> <p>FY 2020 Plans: N/A</p> <p>FY 2021 Base Plans: Expand established library databases and perform hardware updates to reduce Rules of Engagement (ROE) concerns. These changes will provide enhanced overall Combat ID capability within the Battle Group.</p> <p>FY 2021 OCO Plans:</p>	0.000	0.000	5.352	0.000	5.352
	-	-	-	-	-

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: FY21 is the first year of funding for RTDS UPX-34A ECP Part I.					
Accomplishments/Planned Programs Subtotals	3.372	2.335	10.868	0.000	10.868

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021 Base</u>	<u>FY 2021 OCO</u>	<u>FY 2021 Total</u>	<u>FY 2022</u>	<u>FY 2023</u>	<u>FY 2024</u>	<u>FY 2025</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• OPN/2851: ID Systems	22.777	25.506	23.815	-	23.815	48.381	58.509	57.862	59.071	Continuing	Continuing

Remarks

D. Acquisition Strategy

The acquisition strategy is to develop Mode 5 Engineering Change Proposals for modern Mark XII Identification Friend or Foe (IFF) equipment and integrate into all Navy Combat Weapons systems platforms and augment the Navy's Cooperative Identification Capability to include Mode 5.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0676 / Improve ID Development
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Primary Hardware Development	WR	NAWCAD : St Inigoes, MD	9.313	0.000		0.312	Nov 2019	1.118	Nov 2020	-		1.118	Continuing	Continuing	Continuing
Ship Integration	WR	NAWCAD : St Inigoes, MD	2.462	0.000		0.117	Nov 2019	0.120	Nov 2020	-		0.120	0.000	2.699	-
Systems Engineering	WR	NAWCAD : St Inigoes, MD	6.229	0.000		0.365	Nov 2019	0.774	Nov 2020	-		0.774	0.000	7.368	-
DDG 1000 Development	C/FFP	Raytheon : Tewksbury, MA	0.000	0.000		0.000		1.262	Dec 2020	-		1.262	0.000	1.262	-
OE-120 Tech Refresh	SS/FFP	BAE : Nashua, NH	15.483	2.577	Nov 2018	0.750	Nov 2019	0.000		-		0.000	0.000	18.810	15.483
RTDS UPX-34A ECP Part I	WR	NAWCAD : St Inigoes, MD	0.000	0.000		0.000		5.152	Nov 2020	-		5.152	0.000	5.152	-
UPX-36 ECP Part I	WR	NAWCAD : St Inigoes, MD	0.000	0.000		0.000		1.283	Nov 2020	-		1.283	0.000	1.283	-
Subtotal			33.487	2.577		1.544		9.709		-		9.709	Continuing	Continuing	N/A

Remarks
 Decrease in FY19 for OE-120 Tech Refresh efforts is due to the transition from OEM to USG. Primary Hardware Development, Ship Integration, and Systems Engineering increases in FY19 are due to the transition from OEM to USG for establishment of OE-120 Tech Refresh configuration at In-Service Engineering Activity (ISEA) and Land Base Test Site (LBTS) labs. Primary Hardware Development and Systems Engineering increase from FY20 to FY21 is due to increased efforts in AN/UPX-29 integration with Ship Self Defense System and DDG 1000 and RTDS UPX-34A ECP Part 1 development efforts starting.

Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Configuration Management	WR	NAWCAD : St Inigoes, MD	0.169	0.000		0.000		0.000		-		0.000	0.000	0.169	-
ILS	WR	NAWCAD : St Inigoes, MD	2.786	0.075	Nov 2018	0.076	Nov 2019	0.078	Nov 2020	-		0.078	0.000	3.015	-
Software Development	WR	NAWCAD : St Inigoes, MD	5.535	0.197	Nov 2018	0.201	Nov 2019	0.297	Nov 2020	-		0.297	0.000	6.230	-
Technical Data	WR	NAWCAD : St Inigoes, MD	1.969	0.099	Nov 2018	0.101	Nov 2019	0.103	Nov 2020	-		0.103	0.000	2.272	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0676 / Improve ID Development
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Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Training	WR	NAWCAD : St Inigoes, MD	0.200	0.000		0.000		0.000		-		0.000	0.000	0.200	-
Engineering	WR	NAWCAD : PAX River, MD	0.244	0.000		0.000		0.000		-		0.000	0.000	0.244	-
Subtotal			10.903	0.371		0.378		0.478		-		0.478	0.000	12.130	N/A

Remarks
Software development cost increases for evaluation of Mode 5/Mode S interoperability test data from combat system software design changes.

Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Prior Year T&E costs no longer funded in FYDP	WR	NAWCAD : St Inigoes, MD	2.559	0.000		0.000		0.000		-		0.000	0.000	2.559	-
Subtotal			2.559	0.000		0.000		0.000		-		0.000	0.000	2.559	N/A

Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management Support	C/CPFF	American Electronics : California, MD	2.298	0.424	Nov 2018	0.413	Nov 2019	0.681	Nov 2020	-		0.681	0.000	3.816	2.813
Subtotal			2.298	0.424		0.413		0.681		-		0.681	0.000	3.816	N/A

Remarks
FY20 to FY21 increase is due to increased support for DDG 1000 and RTDS UPX-34A ECP Part 1 projects starting.

Project Cost Totals	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
	49.247	3.372	2.335	10.868	-	10.868	Continuing	Continuing	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy	Date: February 2020
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	Prior Years	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
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<u>Remarks</u>									
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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0676 / Improve ID Development
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	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Mode 5 Improv Identification Dev																												
Acquisition Milestones																												
Milestones																												
Test & Evaluation Milestones																												
	IT Events for additional platforms																											
Deliveries																												
	Mode 5 Prod. Line Insertion																											
	Mode 5 SCDs																											
	Mode 5 Host Platform Integration																											
	Mode 5 FRP Deliveries																											
System Development																												
	Establish OE-120 test labs				Platform integration testing																							
RTDS UPX-34A																												
	System Development (UPX-34A ECP)																											
UPX-36																												
	System Development (UPX-36 ECP)																											
DDG 1000 Modernization																												
	Development of Integrated Product Support elements																											

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Mode 5 Improv Identification Dev				
Test & Evaluation Milestones: IT Events for additional platforms	1	2019	3	2021
Deliveries: Mode 5 - Production Line Insertion	1	2019	4	2025
Deliveries: Mode 5 - Prepare and Evaluate ECPs/SCDs	1	2019	4	2025
Deliveries: Mode 5 - Host Platform Integrations	1	2019	4	2025
Deliveries: Mode 5 - FRP Deliveries	1	2019	4	2025
System Development: Establish ISEA and LBTS OE-120 tech refresh labs.	1	2019	4	2019
System Development: Platform integration testing	1	2020	2	2021
RTDS UPX-34A: System Development (UPX-34A ECP)	1	2021	4	2025
UPX-36: System Development (UPX-36 ECP)	1	2021	4	2025
DDG 1000 Modernization: Development of Integrated Product Support elements	1	2021	4	2023

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy										Date: February 2020		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System				Project (Number/Name) 0921 / NAVSTAR GPS Equipment			
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
0921: NAVSTAR GPS Equipment	369.162	55.897	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	425.059
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Note

Funding has been realigned out of PE 0604777N Project 0921 (NAVSTAR GPS Equipment), into PE 0604280N as part of RDTEN PE Consolidation starting in FY 2020.

A. Mission Description and Budget Item Justification

Navigation Satellite Timing & Ranging (NAVSTAR) Global Positioning System (GPS) project (0921) encompasses the Navy's efforts to pace the growing threat to GPS Navigation through the fielding of new GPS receivers, Anti-Jam (AJ) Antennas, and Assured-Positioning Navigation and Timing (A-PNT) technologies across all Navy platform types. NAVSTAR GPS is a group of A-PNT systems that provides authorized users with secure, worldwide, all weather, three dimensional position, velocity, and precise time data. NAVSTAR GPS provides A-PNT capability to Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance (C4ISR) and combat systems in standalone and networked architectures throughout air and maritime domains. This project is comprised of four distinct efforts: Sea Navigation Warfare (NAVWAR), GPS-based PNT Service (GPNTS), Air NAVWAR and GPS Modernization. Sea NAVWAR provides AJ antennas and GPNTS provides GPS Receivers and A-PNT technology to surface platforms, and Air NAVWAR provides AJ antennas and GPS Modernization provides GPS receivers to air platforms. Research, Development, Testing and Evaluation (RDT&E) funds are used to perform all the non-recurring GPS Surface Ship, Submarine and Aircraft Development, Integration, and Testing efforts in support of NAVSTAR GPS.

The Air and Sea NAVWAR programs provide continued access to GPS information in a denied or impeded electronic environment. Development efforts for both programs provide improvements to various platform type antennas and ensure compatibility with the new Military Code (M-Code) signal. The Air NAVWAR program continues integration efforts using GPS Antenna System (GAS-1), Advanced Digital Antenna Production (ADAP), and other AJ antennas on air platforms while investigating smaller AJ antennas for space constrained platforms and aircraft with unique requirements. The Sea NAVWAR program integrates AJ antennas onto surface and subsurface platforms. The Sea NAVWAR program will continue to research the viability and development of smaller AJ antennas for space-constrained platforms. The program continues to support the Submarine Anti-Jam GPS Enhancement (SAGE) antenna development which integrates AJ capability into the submarine Multi-Function Mast (OE-538B) antenna system.

The GPNTS system is being developed to serve as the primary A-PNT system for the surface Navy to ensure reliable PNT capability and interoperability insertion into GPS receivers and associated C4ISR and Combat Systems in a denied environment. GPNTS pairs with AJ antennas and provides precise A-PNT data required for combat, weapons, command, control, communications, navigation, and other systems, as well as providing the time synchronization critical for network environments. GPNTS will back fit current PNT/GPS systems as well as serve as a forward fit for new platforms. GPNTS is an Open Architecture (OA) development, enabling rapid software and hardware based capability improvements to be inserted without a requirement for single-source contracting. GPNTS will host the Air Force GPS Directorate-developed Military GPS User Equipment (MGUE) card, allowing access to the new GPS M-Code signal. GPNTS will provide more robust and secure GPS/PNT capabilities than is currently in the Fleet. The system will provide the capability to migrate non-real time GPS data toward a Common Computing Environment

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Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / <i>Navigation/Id System</i>	Project (Number/Name) 0921 / <i>NAVSTAR GPS Equipment</i>
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(CCE) and provide a path for the integration of advanced navigation systems and sensors. GPNTS provides A-PNT capability to C4ISR and Combat Systems in standalone and networked architectures throughout maritime domains.

GPS Modernization executes the Navy's integration of MGUE being developed by the Air Force GPS Directorate on Navy air platforms. This effort provides Navy platforms improved access to GPS signals in challenged and jammed environments. Because of the number and diversity of all of the Navy's air and weapons platforms, this project will consist of multiple parallel efforts that integrate different M-code GPS receivers into different type model series aircraft across many program offices with central coordination and management of funding and priorities by GPS Modernization. Each platform will require unique prime vendor integration and testing that includes software updates to avionics and mission computers as well as modifications to the airframe based on Size, Weight and Power and Cost (SWaP-C) requirements. Modernized Global Positioning System (GPS) receivers will utilize the new M-Code GPS Signal in Space, incorporate enhanced cryptology, deliver greater position and time accuracy, and provide improved protection against signal spoofing as compared to legacy receivers. Additionally, GPS Modernization delivers increased GPS Anti-Jam (AJ) protection and enables blue force GPS electronic attack. This effort supports Navy compliance with Public Law 111-383 which prohibits spending funds on non-Military Code (M-Code) GPS user equipment after FY 2017.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Sea Navigation Warfare (NAVWAR)	4.043	0.000	0.000	0.000	0.000
Articles:	-	-	-	-	-
<p>Description: Sea NAVWAR provides the Warfighter continued access to GPS through the use of AJ Antenna Systems designed to counter GPS Electronic Warfare threats due to intentional and unintentional interference on surface and subsurface platforms through the continued development of AJ antennas. Program currently supports two (2) efforts: Increment 2 Advanced Digital Antenna Production (ADAP) antenna for surface platforms, and the Submarine Anti-Jam GPS Enhancement (SAGE) antenna for subsurface platforms. Increment 2 ADAP continues to research the viability and development of smaller AJ antennas for surface platforms with Size, Weight and Power and Cost (SWaP-C) restrictions and will ensure compatibility with the Military Code (M-Code) signal. Increment 2 ADAP received acquisition authority (November 2018) to add a small antenna variant to the program baseline. Program is continuing the SAGE antenna development, which integrates AJ capability into the submarine Multi-Function Mast (OE-538B).</p> <p>FY 2020 Plans: FY 2020 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.</p> <p>FY 2021 Base Plans: FY 2021 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.</p> <p>FY 2021 OCO Plans:</p>					

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy			Date: February 2020		
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment			
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)					
N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Program decrease is due to realigning funds as part of PE Consolidation. FY 2021 justification and change explanation is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).					
Title: Global Positioning System (GPS) - Based Positioning, Navigation and Timing (PNT) Service (GPNTS)					
Articles:					
Description: GPNTS is the Navy's next generation Assured Position Navigation and Timing (A-PNT) system. GPNTS will provide more robust and secure GPS/PNT capabilities than is currently in the Fleet. GPNTS will replace Navigation Sensor System Interface (NAVSSI) and WRN-6 systems on surface ships. GPNTS will back fit current PNT/GPS systems as well as serve as a forward fit for new platforms. The system contains Selective Availability Anti-spoofing Security Module (SAASM) GPS security architecture with a planned migration to GPS M-Code.					
FY 2020 Plans: FY 2020 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.					
FY 2021 Base Plans: FY 2021 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.					
FY 2021 OCO Plans: N/A					
FY 2020 to FY 2021 Increase/Decrease Statement: Program decrease is due to realigning funds as part of PE Consolidation. FY 2021 justification and change explanation is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).					
Title: Air Navigation Warfare (NAVWAR)					
Articles:					
Description: Air NAVWAR provides the Warfighter continued access to GPS through the use of Anti-Jam (AJ) Antenna Systems designed to counter GPS Electronic Warfare threats due to intentional and unintentional interference. Air NAVWAR efforts include investigation and testing of emerging technologies to improve AJ capability and technologies such as development of miniaturized very small antenna systems to allow for the					
	30.396	0.000	0.000	0.000	0.000
	-	-	-	-	-
	7.484	0.000	0.000	0.000	0.000
	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy	Date: February 2020
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Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
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capability on small variant aircraft. Efforts will also include development to ensure antennas can accept the new Military Code (M-Code) signal.

FY 2020 Plans:

FY 2020 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.

FY 2021 Base Plans:

FY 2021 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.

FY 2021 OCO Plans:

N/A

FY 2020 to FY 2021 Increase/Decrease Statement:

Program decrease is due to realigning funds as part of PE Consolidation. FY 2021 justification and change explanation is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

Title: Global Positioning System (GPS) Modernization

Articles:

13.974	0.000	0.000	0.000	0.000
27	-	-	-	-

Description: GPS Modernization delivers increased GPS Anti-Jam (AJ) protection through modernized GPS receivers that will utilize the new Military Code (M-Code) GPS Signal in Space, incorporate enhanced cryptology, enable blue force GPS electronic attack, deliver greater position and time accuracy, and provide improved protection against signal spoofing as compared to legacy receivers. This project funds the Navy's integration of M-Code capable GPS receivers being developed by the United States Air Force (USAF) GPS Directorate into various receivers on Navy air platforms. This effort supports Navy's compliance with Public Law 111-383, which requires that all GPS user equipment be capable of receiving the new GPS M-Code signal after FY 2017.

To meet the Navy's mandate, system engineering and requirement development efforts must begin before actual delivery of Military GPS User Equipment (MGUE). The integration timeline of modernized GPS receivers is 5+ years from planning to test and is dependent on platform type. Each platform uses a unique GPS receiver, and has a unique GPS system configuration, which requires separate parallel efforts to include software updates to avionics and mission computers as well as modifications to the airframe based on Size, Weight and Power and Cost (SWaP-C) requirements; coordination with each Program Management Air (PMA) organization; management, oversight and support of the effort; and contracting and working with the identified Prime Vendor

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Integrator for the platform. Project currently consists of five (5) parallel efforts that integrate two (2) different M-Code GPS receivers into five (5) different type model series aircraft.					
<i>FY 2020 Plans:</i> FY 2020 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.					
<i>FY 2021 Base Plans:</i> FY 2021 funding has been realigned to PE 0604280N Project 0921 (NAVSTAR GPS Equipment) as part of PE Consolidation.					
<i>FY 2021 OCO Plans:</i> N/A					
<i>FY 2020 to FY 2021 Increase/Decrease Statement:</i> Program decrease is due to realigning funds as part of PE Consolidation. FY 2021 justification and change explanation is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).					
Accomplishments/Planned Programs Subtotals	55.897	0.000	0.000	0.000	0.000

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/2657: NAVSTAR GPS Receivers (Space)	10.703	23.294	38.043	-	38.043	34.052	30.331	36.702	41.964	Continuing	Continuing
• APN/0577: Common Avionics Changes	11.722	8.118	19.235	-	19.235	24.615	34.443	37.233	55.169	111.951	705.445

Remarks

D. Acquisition Strategy
Both the Navigation Warfare (NAVWAR) Air and Sea programs continue to integrate improved anti-jam (AJ) capability onto air and sea platforms and ensure compatibility with new Military Code (M-Code) signal.

Global Positioning System (GPS)-based Positioning, Navigation, and Timing (PNT) Service (GPNTS) program will develop, acquire, and field GPNTS, a scalable Selective Availability/Anti-Spoofing Module (SAASM) GPS-based service-oriented architecture PNT system that will provide an open, extensible, modernized replacement for the current fleet PNT systems. GPNTS will also integrate Military GPS User Equipment (MGUE) and the Office of Naval Research (ONR) developed

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy		Date: February 2020
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / <i>Navigation/Id System</i>	Project (Number/Name) 0921 / <i>NAVSTAR GPS Equipment</i>
<p>Non-GPS Aided Positioning for Surface Ships (NoGAPSS) capabilities. A firm fixed price contract was awarded March 2018 to procure Low Rate Initial Production (LRIP) and Full Rate Production (FRP) systems.</p> <p>GPS Modernization manages the non-recurring engineering required to conduct systems engineering, integration and test of modernized GPS receivers and utilize United States Air Force (USAF) hardware contracts, and Navy air platform integration contracts.</p>		

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Air NAVWAR Development	MIPR	Mayflower : Fort Eustis, VA	0.000	0.780	Feb 2019	0.000		0.000		-		0.000	0.000	0.780	-
Air NAVWAR Development Support	WR	NAWC : Pax River, MD	2.215	0.500	Dec 2018	0.000		0.000		-		0.000	0.000	2.715	-
Air NAVWAR Govt Eng Support	WR	NAWC : Pax River, MD	2.566	1.089	Dec 2018	0.000		0.000		-		0.000	0.000	3.655	-
Sea NAVWAR Development	C/CPIF	Lockheed : Marion, MA	12.161	0.400	Jan 2019	0.000		0.000		-		0.000	0.000	12.561	-
Sea NAVWAR Development Support	WR	NIWC PAC, NUWC : San Diego, Newport	1.484	0.800	Dec 2018	0.000		0.000		-		0.000	0.000	2.284	-
Sea NAVWAR Govt Eng Support	WR	NIWC PAC, NUWC : San Diego, Newport	0.345	0.620	Dec 2018	0.000		0.000		-		0.000	0.000	0.965	-
GPNTS HW / SW Development	C/CPIF	Raytheon : San Diego, CA	43.528	8.780	Dec 2018	0.000		0.000		-		0.000	0.000	52.308	-
GPNTS HW Product Development	C/CPFF	Sechan Electronics : Lititz, PA	0.660	0.000		0.000		0.000		-		0.000	0.000	0.660	-
GPNTS SW / NoGAPSS Development	C/CPFF	TBD : TBD	0.000	3.388	Jul 2019	0.000		0.000		-		0.000	0.000	3.388	-
GPNTS Development Support	WR	NIWC PAC : San Diego, CA	2.658	1.752	Dec 2018	0.000		0.000		-		0.000	0.000	4.410	-
GPNTS Govt Eng Support	WR	NIWCPAC : San Diego, CA	4.750	3.453	Dec 2018	0.000		0.000		-		0.000	0.000	8.203	-
GPS Mod Development F/ A-18E/F MAGR2K-M	C/CPIF	Boeing : St Louis, MO	1.780	0.000	Apr 2019	0.000		0.000		-		0.000	0.000	1.780	-
GPS Mod Development F/ A-18E/F & EA-18G ANAV	C/CPIF	Boeing : St Louis, MO	0.502	0.000	Feb 2019	0.000		0.000		-		0.000	0.000	0.502	-
GPS Mod Development E-2D	C/CPIF	Northrup Gruman : Pax River, MD	0.500	0.800	Feb 2019	0.000		0.000		-		0.000	0.000	1.300	-
GPS Mod Development MV-22B,CMV-22B	C/CPIF	Bell Boeing : Amarillo, TX	0.500	2.700	Feb 2019	0.000		0.000		-		0.000	0.000	3.200	-
GPS Mod Hardware F/ A-18E/F MAGR2K-M	C/FFP	TBD : TBD	0.000	0.000	Jul 2019	0.000		0.000		-		0.000	0.000	0.000	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
GPS Mod Hardware E-2D	C/FFP	AFLCMC : Warner Robins AFB, GA	0.000	0.696	Jun 2019	0.000		0.000		-		0.000	0.000	0.696	-
GPS Mod Hardware CH-53K	C/FFP	AFLCMC : Warner Robins AFB, GA	0.000	0.696	Jun 2019	0.000		0.000		-		0.000	0.000	0.696	-
GPS Mod Development Support	WR	NIWC PAC, NAWC : San Diego, Pax River	5.673	2.500	Dec 2018	0.000		0.000		-		0.000	0.000	8.173	-
GPS Mod Govt Eng Support	WR	NIWC PAC, NAWC : San Diego, Pax River	3.741	2.904	Dec 2018	0.000		0.000		-		0.000	0.000	6.645	-
Product Development	WR	GPS Directorate : Los Angeles, CA	6.224	0.957	Dec 2018	0.000		0.000		-		0.000	0.000	7.181	-
Systems Engineering	WR	Govt, Contractor : San Diego, Newport	29.176	0.699	Nov 2018	0.000		0.000		-		0.000	0.000	29.875	-
Product Development	Various	Various : Various	105.606	0.000		0.000		0.000		-		0.000	0.000	105.606	-
GPS Mod TBD	TBD	Various : Various	0.000	0.000		0.000		0.000		-		0.000	0.000	0.000	-
Subtotal			224.069	33.514		0.000		0.000		-		0.000	0.000	257.583	N/A

Remarks

FY 2020 and FY 2021 cost data is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Contract Engineering Services	WR	BAH : San Diego, Pax River, China Lake	1.830	0.710	Nov 2018	0.000		0.000		-		0.000	0.000	2.540	-
Engineering Services	WR	NIWC PAC, NAWC : San Diego, Pax River	1.875	4.606	Nov 2018	0.000		0.000		-		0.000	0.000	6.481	-
Integrated Logistics Support	WR	NIWC PAC, NAWC : San Diego, Pax River	1.735	2.955	Dec 2018	0.000		0.000		-		0.000	0.000	4.690	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Technical Data	WR	Various : Various	0.401	0.000		0.000		0.000		-		0.000	0.000	0.401	-
Support	Various	Various : Various	56.370	0.474	Nov 2019	0.000		0.000		-		0.000	0.000	56.844	-
Subtotal			62.211	8.745		0.000		0.000		-		0.000	0.000	70.956	N/A

Remarks
FY 2020 and FY 2021 cost data is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Air NAVWAR Test & Evaluation	WR	NAWC : Pax River	2.250	3.043	Dec 2018	0.000		0.000		-		0.000	0.000	5.293	-
Sea NAVWAR Test & Evaluation	WR	NIWC PAC, NUWC : San Diego, Newport	0.138	1.460	Dec 2018	0.000		0.000		-		0.000	0.000	1.598	-
GPNTS Test & Evaluation	WR	NIWC PAC : San Diego	3.187	4.350	Dec 2018	0.000		0.000		-		0.000	0.000	7.537	-
GPS Mod Test & Evaluation	WR	NIWC PAC, NAWC : San Diego, Pax River	0.250	1.000	Dec 2018	0.000		0.000		-		0.000	0.000	1.250	-
Test & Evaluation	Various	Various : Various	49.282	0.000		0.000		0.000		-		0.000	0.000	49.282	-
Subtotal			55.107	9.853		0.000		0.000		-		0.000	0.000	64.960	N/A

Remarks
FY 2020 and FY 2021 cost data is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management Support	C/CPAF	BAH : San Diego, Pax River, China Lake	7.552	3.785	Nov 2018	0.000		0.000		-		0.000	0.000	11.337	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Management Services	Various	Various : Various	20.223	0.000		0.000		0.000		-		0.000	0.000	20.223	-
Subtotal			27.775	3.785		0.000		0.000		-		0.000	0.000	31.560	N/A

Remarks
FY 2020 and FY 2021 cost data is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

	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	369.162	55.897	0.000	0.000	-	0.000	0.000	425.059	N/A

Remarks
FY 2020 and FY 2021 cost data is provided under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

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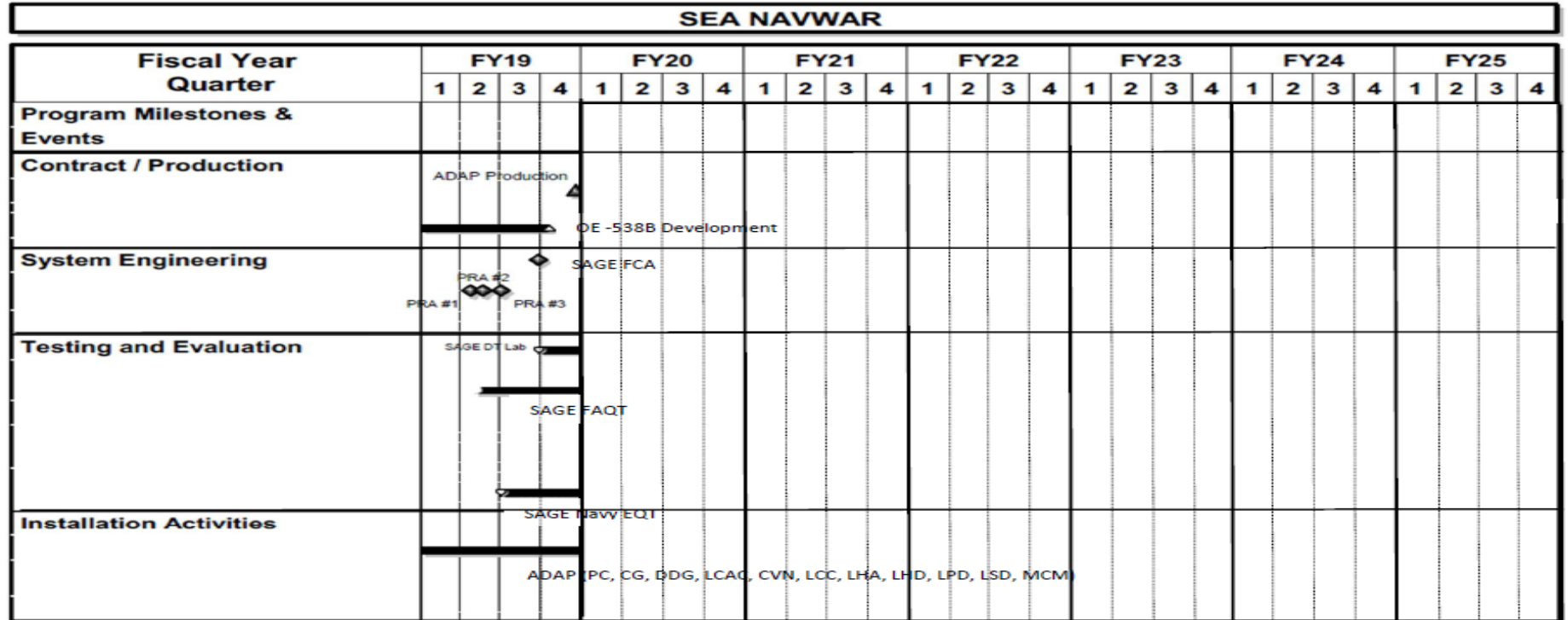
Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy

Date: February 2020

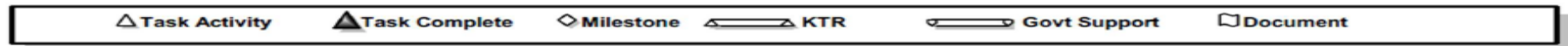
Appropriation/Budget Activity
1319 / 5

R-1 Program Element (Number/Name)
PE 0604777N / Navigation/Id System

Project (Number/Name)
0921 / NAVSTAR GPS Equipment



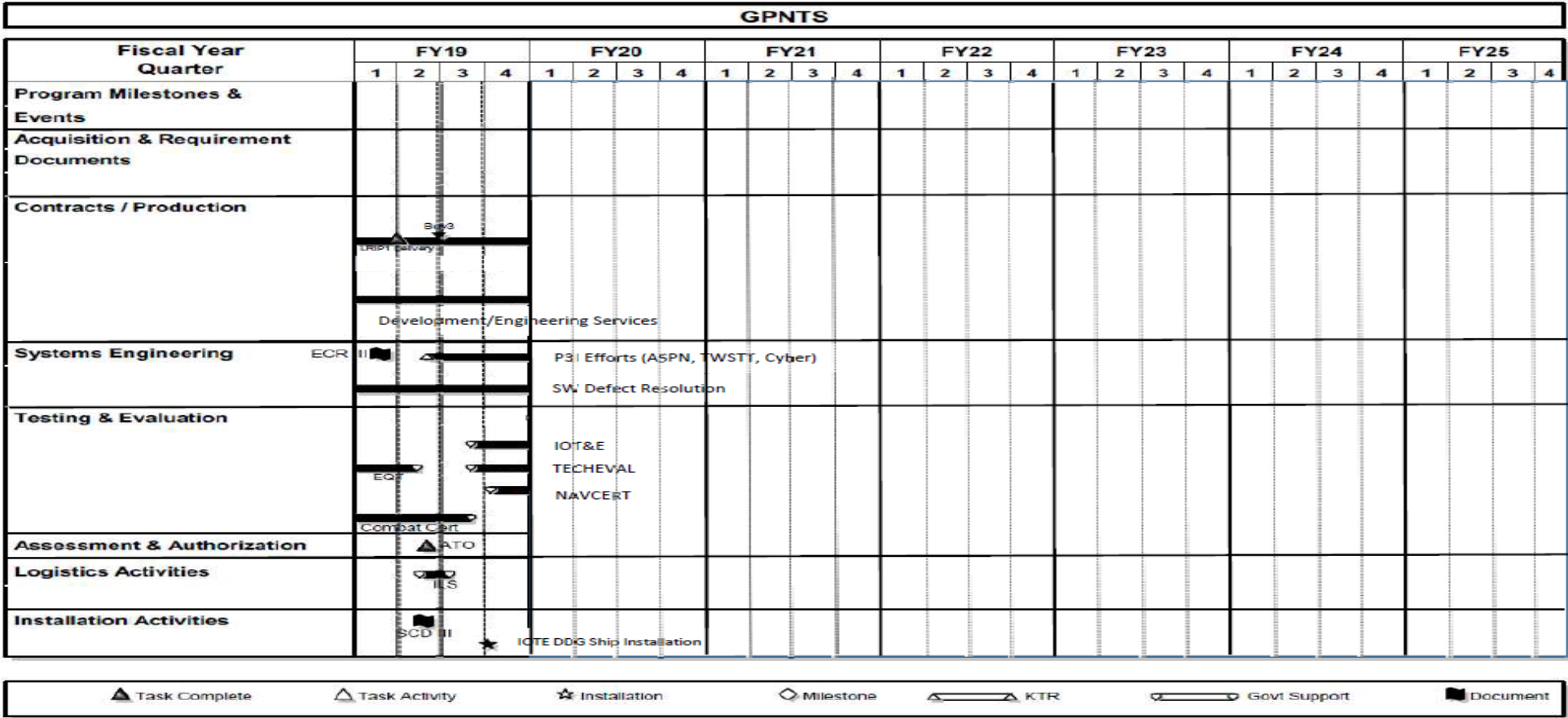
Efforts in FY20 and out are funded under PE 0604280N Project 0921 (NAVSTAR GPS Equipment)



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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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Efforts in FY20 and out are funded under PE 0604280N, Project 0921 (NAVSTAR GPS Equipment)

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy

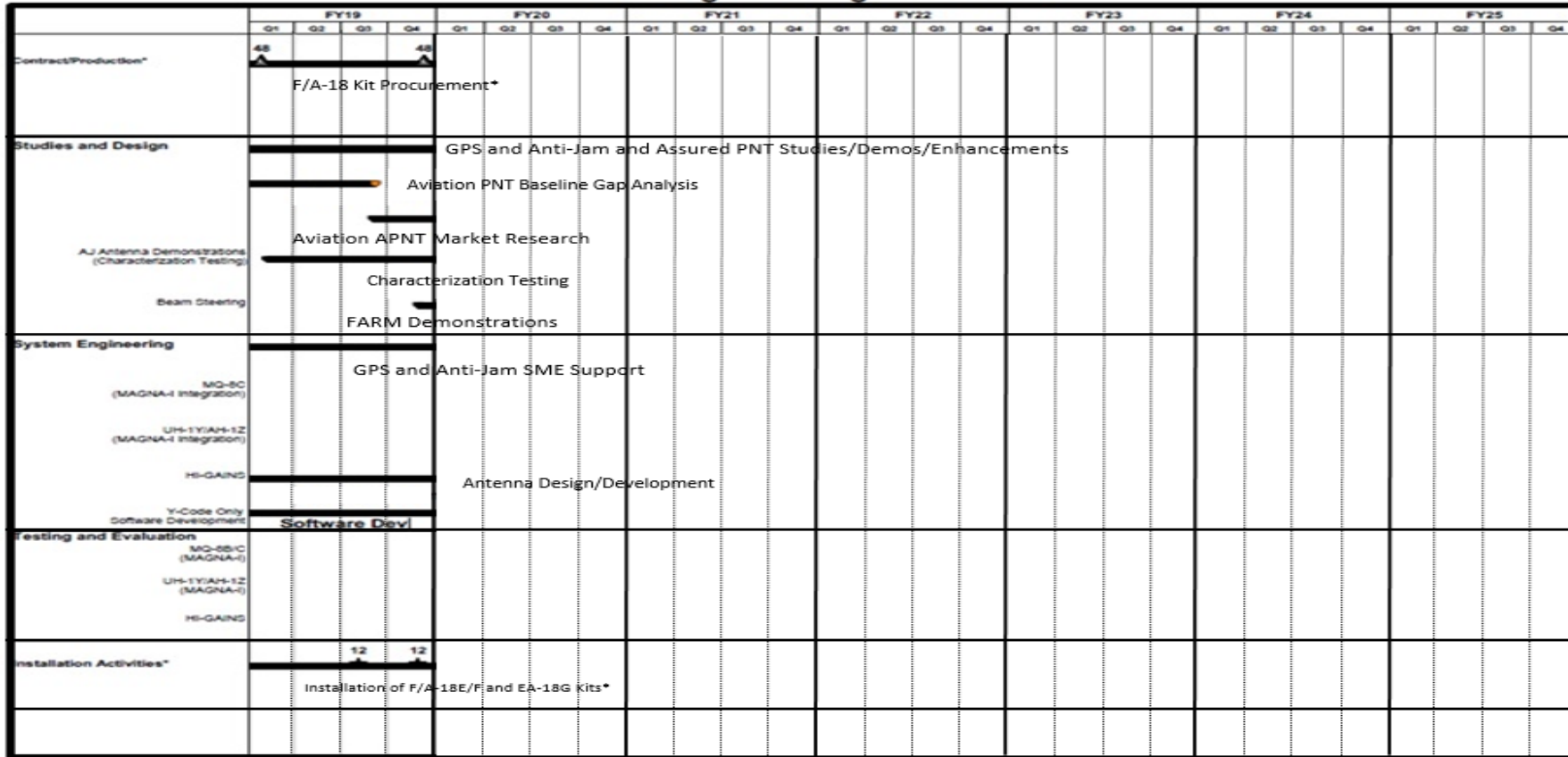
Date: February 2020

Appropriation/Budget Activity
1319 / 5

R-1 Program Element (Number/Name)
PE 0604777N / Navigation/Id System

Project (Number/Name)
0921 / NAVSTAR GPS Equipment

Air Navigation Program Schedule



* These Schedule activities are funded with APN Efforts in FY20 and out are funded under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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GPS Modernization

Fiscal Year Quarter	FY19				FY20				FY21				FY22				FY23				FY24				FY25			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Decision Points	◆ M-Code Mandate																											
Systems Engineering & Integration																												
MV-22B MAGR2K-M Ramt. Dev & SE	█																											
CMV-22B MAGR2K-M Ramt. Dev & SE	█																											
E-2D LN-351 (EGI-M*) Ramt. Dev & SE	PRU Buy** ▲																											
CH-53K LN-351 (EGI-M*) Ramt. Dev & SE	PRU Buy** ▲																											
Testing & Evaluation																												

- * EGI-M Platforms will conduct critical Early Integration Efforts in FY19 and FY20
- ** EGI-M PRU Procurements in FY19 are for Lab and government early integration efforts. Other EGI-M PRU buys shown are notional and based on current vendor projections.

Efforts in FY20 and out are funded under PE 0604280N Project 0921 (NAVSTAR GPS Equipment).

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / <i>Navigation/Id System</i>	Project (Number/Name) 0921 / <i>NAVSTAR GPS Equipment</i>
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 0921				
Sea NAVWAR: Sea Navigation ADAP Follow On Production FY19	4	2019	4	2019
Sea NAVWAR: Sea Navigation OE-538B Development	1	2019	4	2019
Sea NAVWAR: Sea Navigation Functional Configurion Audit (FCA)	4	2019	4	2019
Sea NAVWAR: Sea Navigation Production Representative Article (PRA) Delivery 1	2	2019	2	2019
Sea NAVWAR: Sea Navigation Production Representative Article (PRA) Delivery 2	2	2019	2	2019
Sea NAVWAR: Sea Navigation Production Representative Article (PRA) Delivery 3	3	2019	3	2019
Sea NAVWAR: Sea Navigation Development Test (DT) LAB	3	2019	4	2019
Sea NAVWAR: Sea Navigation First Article Qualification Testing (FAQT)	2	2019	4	2019
Sea NAVWAR: Sea Navigation SWaP-C Engineering Qualification Testing (EQT)	3	2019	4	2019
Sea NAVWAR: Sea Navigation ADAP Installations	1	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS Production Contract	1	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS Buy 3	2	2019	2	2019
GPS-based PNT Service (GPNTS): GPNTS Development/ Engineering Services	1	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS Engineering Change Request (ECR) Phase III	1	2019	1	2019
GPS-based PNT Service (GPNTS): GPNTS P3I Efforts	2	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS SW Defect Resolution	1	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS Initial Operational Test and Evaluation (IOT&E)	3	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS Environmental Quality Testing (EQT)	1	2019	2	2019
GPS-based PNT Service (GPNTS): GPNTS Technical Evaluation	3	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS NAVCERT	4	2019	4	2019

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 0921 / NAVSTAR GPS Equipment
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
GPS-based PNT Service (GPNTS): GPNTS Combat Certification	1	2019	4	2019
GPS-based PNT Service (GPNTS): GPNTS Authority to Operate (ATO)	2	2019	2	2019
GPS-based PNT Service (GPNTS): GPNTS ILS	2	2019	3	2019
GPS-based PNT Service (GPNTS): GPNTS SCD III	2	2019	2	2019
GPS-based PNT Service (GPNTS): GPNTS DDG Installation for IOT&E	4	2019	4	2019
Air NAVWAR: Air Navigation F/A-18 Kit Procurement	1	2019	4	2019
Air NAVWAR: Air Navigation F/A-18 Kit First Procurement 2019	1	2019	1	2019
Air NAVWAR: Air Navigation F/A-18 Kit Second Procurement 2019	4	2019	4	2019
Air NAVWAR: Air Navigation GPS Ainti-Jam and Assured PNT Studies/Demos/ Enhancements	1	2019	4	2019
Air NAVWAR: Air Navigation Aviation PNT Baseline Gap Analysis	1	2019	3	2019
Air NAVWAR: Air Navigation Aviation APNT Market Research	3	2019	4	2019
Air NAVWAR: Air Navigation Characterization Testing	1	2019	4	2019
Air NAVWAR: Air Navigation FARM Demonstration	4	2019	4	2019
Air NAVWAR: Air Navigation GPS and Anti-Jam SME Support	1	2019	4	2019
Air NAVWAR: Air Navigation HI-GAINS Antenna Design/Development	1	2019	4	2019
Air NAVWAR: Air Navigation Software Development	1	2019	4	2019
Air NAVWAR: Air Navigation Installation of F/A-18E/F & EA-18G Kits	1	2019	4	2019
GPS Modernization: GPS Modernization M-Code Mandate	1	2019	1	2019
GPS Modernization: GPS Modernization MV-22B MAGR2K-M Rqmt. Dev & SE	1	2019	4	2019
GPS Modernization: GPS Modernization CMV-22B MAGR2K-M Rqmt. Dev & SE	1	2019	4	2019
GPS Modernization: GPS Modernization E-2D LN-351 Rqmt. Dev & SE	1	2019	4	2019
GPS Modernization: GPS Modernization E-2D LN-351 PRU Buy 1	2	2019	2	2019
GPS Modernization: GPS Modernization CH-53K LN-351 Rqmt. Dev & SE	1	2019	4	2019
GPS Modernization: GPS Modernization CH-53K LN-351 PRU Buy 1	2	2019	2	2019

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy										Date: February 2020		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System				Project (Number/Name) 1253 / Combat Ident System			
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
1253: <i>Combat Ident System</i>	187.743	0.898	1.888	1.921	-	1.921	1.957	1.995	2.036	2.077	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

MARK (MK) XIIA Mode 5 provides improved secure cooperative combat identification via Identification Friend or Foe (IFF). Mode 5 is developed in cooperation with North Atlantic Treaty Organization, with the DoD implementation governed by AIMS 03-1000A, AIMS 03-1000B and USN requirements defined in ORD # 577-06-01. IFF product improvements are designed to be installed through upgrade and deficiency correction studies, which in turn, become engineering changes to IFF interrogators and transponders and their associated cryptographic material.

The Navy MK XIIA Mode 5 program was approved for entry in Systems Development and Demonstration phase in August 2003 and into the Production and Deployment Phase and Low Rate Initial Production in July 2006, and Full Rate Production July 2012. The Navy Mode 5 program achieved Initial Operational Capability (IOC) in 2012 in accordance with the ORD. Mode 5 capable equipment was fielded in USN/USMC platforms in accordance with Joint Requirements Oversight Council Memorandums (047-07, 122-08 and 108-13) in support of Joint Mode 5 IOC in 2014 and is expected to meet Joint Full Operational Capability in FY2020.

RDT&E articles include Mode 5 cryptographic modules and associated hardware and software changes for IFF interrogators and transponders, including, but not limited to: AN/APX-118/123, AN/APX-119, and AN/APX-111 equipment. RDT&E units are required for government and contractor labs to support aircraft and ship integrations, test sites, test aircraft, and unmanned aircraft systems.

B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)

	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
Title: Mode 5 prototype hardware, cryptographic module	0.049	0.096	0.000	0.000	0.000
Articles:	-	-	-	-	-
Description: Develop kits for installation into existing fleet assets including AN/APX-118/123 Common Digital Transponder, and AN/APX-111 Combined Interrogator Transponder or other interrogator/transponder equipment to include small form factors. Repair and correct deficiencies identified during integration and test. Procure IFF interrogators and transponders, including, but not limited to: AN/APX-123, AN/APX-119, AN/APX-111, cryptographic modules and Mode 5 modification kits to support platform integration and testing. Perform platform integration efforts of Mode 5 equipment for various Type/Model/Series aircraft.					
FY 2020 Plans: Complete integration and certification efforts of the Mode 5 capability in the CH-53K aircraft. Prototyping of small form factor IFF transponder for unmanned aircraft systems.					
FY 2021 Base Plans:					

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 1253 / Combat Ident System
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2019	FY 2020	FY 2021 Base	FY 2021 OCO	FY 2021 Total
<p>Description: Perform Mode 5 integrated and operational test phases for AN/APX-123 Common Transponder, AN/APX-119 Transponder, small form factor IFF for unmanned aircraft systems, and AN/APX-111 Combined Interrogator Transponder.</p> <p>FY 2020 Plans: Begin small form factor IFF transponder testing. Testing of Mode 5 mitigating solutions for deploying platforms that will not meet Joint Full Operational Capability (JFOC).</p> <p>FY 2021 Base Plans: Continue small form factor IFF transponder testing. Continue testing of Mode 5 mitigating solutions for deploying platforms that did not meet Joint Full Operational Capability (JFOC).</p> <p>FY 2021 OCO Plans: N/A</p> <p>FY 2020 to FY 2021 Increase/Decrease Statement: Increase is due to increased testing requirements of the small form factor IFF transponder.</p>					
Accomplishments/Planned Programs Subtotals	0.898	1.888	1.921	0.000	1.921

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/2851: ID Systems	22.777	25.506	23.815	-	23.815	48.381	58.509	57.862	59.071	Continuing	Continuing
• APN/0582: ID Sys	39.133	41.437	35.999	-	35.999	13.529	9.793	9.997	5.197	0.005	517.450

Remarks

D. Acquisition Strategy
The Acquisition Strategy is to develop Mode 5 Engineering Change Proposals to modernize Mark XII Identification Friend or Foe (IFF) equipment or insert Mode 5 into existing platforms by JROC memorandums (047-07, 122-08 and 108-13). After integration into all Navy Combat Weapons systems platforms, the Navy will transition Cooperative Identification Capability to Mode 5.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 1253 / Combat Ident System
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Systems Engineering	WR	NAWCAD : PAX River, MD	15.829	0.211	Nov 2018	0.056	Nov 2019	0.006	Nov 2020	-		0.006	Continuing	Continuing	Continuing
Systems Engineering	WR	NAWCAD : St Inigoes, MD	14.853	0.000		0.628	Nov 2019	0.231	Nov 2020	-		0.231	Continuing	Continuing	Continuing
Primary Hardware Development	Various	Sikorsky : Stratford, CT	3.776	0.000		0.096	Jan 2020	0.000		-		0.000	0.164	4.036	4.200
Prior Year Prod Dev Services costs no longer funded in FYDP	Various	Various : Various	90.857	0.000		0.000		0.000		-		0.000	0.000	90.857	43.213
Subtotal			125.315	0.211		0.780		0.237		-		0.237	Continuing	Continuing	N/A

Support (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
ILS	Various	Various : Various	5.123	0.148	Nov 2018	0.073	Nov 2019	0.000		-		0.000	Continuing	Continuing	Continuing
Prior Year Support Services costs no longer funded in FYDP	Various	Various : Various	2.761	0.000		0.000		0.000		-		0.000	0.000	2.761	2.761
Subtotal			7.884	0.148		0.073		0.000		-		0.000	Continuing	Continuing	N/A

Test and Evaluation (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Developmental T & E	WR	NAWCAD : PAX River, MD	29.778	0.539	Nov 2018	1.035	Nov 2019	1.684	Nov 2020	-		1.684	7.705	40.741	-
Prior Year T&E costs no longer funded in FYDP	Various	Various : Various	20.370	0.000		0.000		0.000		-		0.000	0.000	20.370	3.456
Subtotal			50.148	0.539		1.035		1.684		-		1.684	7.705	61.111	N/A

Remarks

Increase from FY20 to FY21 is due to increased testing requirements of the small form factor IFF transponder.

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / <i>Navigation/Id System</i>	Project (Number/Name) 1253 / <i>Combat Ident System</i>
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Combat Identification Systems</i>				
Acquisition Milestones: Milestones: Mode 5 JFOC	4	2020	4	2020
Systems Development: Hardware Development: Prepare & Evaluate ECPs/SCDs	1	2019	4	2025
Systems Development: Hardware Development: Small Form Factor	1	2019	4	2020
Test and Evaluation: Technical Evaluation: CH-53K	1	2019	1	2019
Test and Evaluation: Technical Evaluation: Small Form Factor	4	2019	2	2022
Test and Evaluation: Operational Evaluation: Follow-on Test and Evaluation	1	2019	4	2025
Deliveries: FRP Deliveries	1	2019	4	2025

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Exhibit R-2A, RDT&E Project Justification: PB 2021 Navy										Date: February 2020		
Appropriation/Budget Activity 1319 / 5					R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System				Project (Number/Name) 9999 / Congressional Adds			
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
9999: <i>Congressional Adds</i>	0.000	4.827	5.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.827
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

MARK (MK) XIIA Mode 5 provides improved secure cooperative combat identification via Identification Friend or Foe (IFF). Mode 5 is developed in cooperation with North Atlantic Treaty Organization, with the DoD implementation governed by AIMS 03-1000A, AIMS 03-1000B and USN requirements defined in ORD # 577-06-01. Research, development, and acquisition to support lightweight and micro IFF transponders with Mode 5 in order to meet the space, weight, and power (SWaP) requirements for Group 2 and 3 Unmanned Aerial Vehicles (UAVs), other unmanned systems, and manned systems.

B. Accomplishments/Planned Programs (\$ in Millions)

	FY 2019	FY 2020
Congressional Add: Micro-IFF Component	4.827	0.000
FY 2019 Accomplishments: Development of prototype, testing and certification of Mode 5 Micro IFF transponder.		
FY 2020 Plans: N/A		
Congressional Add: Development of lightweight security Identification Friend or Foe transmitter	0.000	5.000
FY 2019 Accomplishments: N/A		
FY 2020 Plans: Continue development of prototype, testing and certification of Mode 5 Micro IFF transponder.		
Congressional Adds Subtotals	4.827	5.000

C. Other Program Funding Summary (\$ in Millions)

N/A

Remarks

D. Acquisition Strategy

The Acquisition Strategy is to develop and certify a micro IFF transponder solution through Small Business Innovation Research (SBIR) and other government development organizations and initiate development of a lightweight security IFF transmitter for manned and unmanned systems.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 9999 / Congressional Adds
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Product Development (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Product Development - SBIR	Various	R-Cubed Engineering LLC : Palmetto, FL	0.000	1.994	Mar 2019	1.500	Jul 2020	0.000		-		0.000	0.000	3.494	1.994
Product Development - SBIR	Various	Intelligent Automation : Rockville, MD	0.000	1.994	Apr 2019	1.500	Jul 2020	0.000		-		0.000	0.000	3.494	1.994
Product Development - Organic	WR	NAWCAD : Patuxent River, MD	0.000	0.527	Feb 2019	1.400	Apr 2020	0.000		-		0.000	0.000	1.927	-
Certification	TBD	Various : Various	0.000	0.312	Feb 2019	0.200	Aug 2020	0.000		-		0.000	0.000	0.512	-
Subtotal			0.000	4.827		4.600		0.000		-		0.000	0.000	9.427	N/A

Management Services (\$ in Millions)				FY 2019		FY 2020		FY 2021 Base		FY 2021 OCO		FY 2021 Total	Cost To Complete	Total Cost	Target Value of Contract
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost			
Program Management Support	WR	NAWCAD : Patuxent River	0.000	0.000		0.400	Mar 2020	0.000		-		0.000	0.000	0.400	-
Subtotal			0.000	0.000		0.400		0.000		-		0.000	0.000	0.400	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			0.000	4.827	5.000	0.000	-	0.000	0.000	9.827	N/A

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 9999 / Congressional Adds
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Micro IFF Component Development	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025							
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q				
Development			Critical Design Review (CDR) ◆																													
	Micro IFF Testing																															
					NSA Certification ◆				Final Prototype Delivery ◆																							

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Exhibit R-4, RDT&E Schedule Profile: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / Navigation/Id System	Project (Number/Name) 9999 / Congressional Adds
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Lightweight security Identification Friend or Foe transmitter	FY 2019				FY 2020				FY 2021				FY 2022				FY 2023				FY 2024				FY 2025							
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q				
Development								Contract Award ◆																								
								Micro IFF Development and Testing																								
									SRR/SFR ◆				PDR/CDR ◆																			

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Exhibit R-4A, RDT&E Schedule Details: PB 2021 Navy **Date:** February 2020

Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604777N / <i>Navigation/Id System</i>	Project (Number/Name) 9999 / <i>Congressional Adds</i>
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Micro IFF Component Development</i>				
Development: NSA Certification Critical Design Review (CDR)	3	2019	3	2019
Development: Micro IFF Testing	2	2019	3	2020
Development: Final Prototype Delivery	3	2020	3	2020
Development: NSA Certification	1	2020	1	2020
<i>Lightweight security Identification Friend or Foe transmitter</i>				
Development: Contract Award	4	2020	4	2020
Development: Micro IFF Testing	3	2020	4	2021
Development: Systems Requirement Reviews/Systems Functional Review	2	2021	2	2021
Development: Critical Design Review (CDR)	4	2021	4	2021