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Exhibit R-2, RDT&E Budget Item Justification: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319: <i>Research, Development, Test & Evaluation, Navy / BA 4: Advanced Component Development & Prototypes (ACD&P)</i>	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>
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COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
Total Program Element	62.138	7.986	10.371	8.782	-	8.782	13.863	9.602	11.526	11.770	Continuing	Continuing
0770: <i>Adv Sub Supp Equip Prog</i>	16.378	3.320	4.103	4.429	-	4.429	4.143	4.403	4.725	4.828	Continuing	Continuing
1739: <i>Submarine Arctic W/F Development</i>	45.760	4.666	6.268	4.353	-	4.353	9.720	5.199	6.801	6.942	Continuing	Continuing

A. Mission Description and Budget Item Justification

The Submarine Tactical Warfare Systems program element is comprised of the Advanced Submarine Support Equipment Program (ASSEP) and the Submarine Special Operations Support Program. The objective is to improve submarine operational effectiveness through the development and implementation of advanced Research and Development (R&D). In order to provide improved operational effectiveness, R&D efforts are focused on Advanced Imaging Developments and Advanced Electronic Warfare Support (ES) Developments. A continuing need exists to improve these capabilities in view of the advancements in potential imaging counter detection, the need to support specialized missions, and the increasingly dense and sophisticated electronic environment caused by the proliferation of complex radar, communications, and navigation equipment of potential adversaries. Ongoing developments in 360 degree imaging systems and electro-optic infra-red vulnerability signature reduction technologies are supporting these needs.

The Submarine Arctic Warfare Development Project responds to the increased threat of naval activity in the Arctic regions while continuously supporting the Navy's strategic objective of Assured Access and Combat Credibility. The U.S. Navy Submarine Force (SUBFOR) demonstrates existing Arctic Warfare capabilities, operational and tactical proficiency while developing advanced submarine research and development technology in unique cold water environments, under-ice conditions, and ice-covered shallow water regions during Ice Exercises (ICEX). ICEXs are conducted biennially and require up front comprehensive planning and work-up training, as well as post exercise analysis and reporting. ICEXs provide the framework for various submarine research and development programs to conduct test and evaluation in Arctic regions or at periodic Ice Camps. Particular emphasis is placed on the areas of sonar operability, tactical surveillance, weapon utility, and other submarine support missions. Efforts include assessment of combat system effectiveness, development of Arctic specific improvements for existing sonar and weapons, development of class-specific Arctic operational guidelines, and the testing of ice-capable submarine support structures. This Project also provides SUBFOR a cadre of trained Arctic Operation Specialists (AOS) and an inventory of unique Arctic sensors to optimize submarine safety during under-ice operations.

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B. Program Change Summary (\$ in Millions)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Previous President's Budget	8.044	10.371	9.958	-	9.958
Current President's Budget	7.986	10.371	8.782	-	8.782
Total Adjustments	-0.058	0.000	-1.176	-	-1.176
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.058	0.000			
• Program Adjustments	0.000	0.000	-1.056	-	-1.056
• Rate/Misc Adjustments	0.000	0.000	-0.120	-	-0.120

Change Summary Explanation

Cost/Funding:

Decrease in Submarine Tactical Warfare Sys RDTE,N by \$369K as required for the Department of the Navy to comply with the Bipartisan Budget Act of 2015.

Project 0770: FY 2017 funding was added (\$+.540M) to procure the Submarine Launched Decoy Project.

Project 1739: FY 2017 funding was decreased (\$-1.000M) to realign Arctic Sub Lab funding to support Biennial Ice Exercises (ICEXs).

Project 1739: FY 2017 funding was reduced (\$-0.289M) to account for the availability of prior year execution balances.

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy										Date: February 2016		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>				Project (Number/Name) 0770 / <i>Adv Sub Supp Equip Prog</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
0770: <i>Adv Sub Supp Equip Prog</i>	16.378	3.320	4.103	4.429	-	4.429	4.143	4.403	4.725	4.828	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

A continuing need exists to improve Imaging and Electronic Warfare support (EW) capabilities in view of the advancements in potential imaging counter detection and the increasingly dense electromagnetic environment caused by the proliferation of complex radar, communications, and navigation equipment of potential adversaries. Improvements are necessary for submarine EW and Imaging to be operationally effective in the following mission areas: Joint Littoral Warfare, Joint Surveillance, Space and Electronic Warfare, Intelligence Collection, Maritime Protection, and Joint Strike. The program is divided into two project categories: Advanced Imaging Project Development and Advanced Electronic Warfare Support Project Development. Both of these categories will allow for the mitigation of submarine masts, periscopes, and sensors to visual, radar, and infrared detection. Evaluation of state of the art technology to implement periscope/mast improvements via EW electromagnetic and electro-optic sensors results in improved capability. Engineering Demonstration Models (EDMs) are developed, evaluated, and validated in the lab and through at-sea testing.

The Advanced Imaging Project Development projects include the development of the Affordable Modular Panoramic Photonics Mast (AMPPM) which introduces several groundbreaking technologies such as individually replaceable capability modules (allowing a vast array of capability combinations without requiring redesign) as well as presenting live 360 degree High Definition video (greatly increasing situational awareness and reducing scope exposure time.) Also in support of the Advance Imaging Project Development are; Automatic Aircraft Cueing, RF Vulnerability Reduction (RAS), GPS Denied Navigation, Meteorological Sensors (METOC), Mast Test Vehicle (MTV) testing, Imaging Engineering Measurement Program, and a Project Arrangement (PA) with Australia covering Electromagnetic Spectrum Sensor System Simulation & Development for model-based mission planning and a Coalition Warfare Program (CWP) covering periscope vulnerability. The Advanced EW Development projects include the development of: EW Vulnerability Tool, Enhanced DeInterleavers, Low Probability of Intercept (LPI) Direction Finding (DF), High Speed Network, Embedded Built-in Test (BIT), EW on-Board Trainer (OBT), Multi-function Modular Mast (MMM) Payloads, Digital Precision Direction Finding, Multi-Functional Apertures, disposable decoy, ISR and tethered Buoys, Human Machine Interface (HMI)Improvements, and Next Generation EW Systems Algorithms and Applications. OPNAV direction provided for Next Generation EW in reference dated 17 June 12, SER N97/12U144401. New in FY17 is the acceleration of support for an EW Disposable Decoy Buoy capability addressing the U.S. Navy Submarine Force (SUBFOR) requirement to provide a Submarine Launched Decoy Buoy.

All programs funded in this project are non-Acquisition Category (ACAT) programs. The test articles identified consist of critical components that will be fully developed during Engineering Manufacturing and Development phase into EDMs.

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

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Advanced Imaging Project Development	1.887	2.464	2.756	0.000	2.756
Articles:	-	-	-	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy			Date: February 2016		
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 0770 / <i>Adv Sub Supp Equip Prog</i>			
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)					
	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p><i>FY 2015 Accomplishments:</i> 360 Imaging (ONR) - AMPPM - FNC Lab Demo Automatic Aircraft Cueing Continued Development GPS Denied Navigation Development Submarine METOC Development CWP Periscope Vulnerability - Development Imaging Engineering Measurement Program</p> <p><i>FY 2016 Plans:</i> 360 Imaging (ONR) - AMPPM - FNC Pierside Testing RF Vulnerability Reduction (RAS) - Lab Test Automatic Aircraft Cueing - Lab Test GPS Denied Navigation Continued Development Submarine METOC Continued Development CWP Periscope Vulnerability - Lab Test/At-Sea Test PA Electromagnetic Spectrum Sensor System Simulation - Development Low Power Fiber Delivered Laser Range Finder - Development Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres - Development Imaging Engineering Measurement Program Continuation</p> <p><i>FY 2017 Base Plans:</i> AMPPM Land Based ISIS Testing GPS Denied Navigation Test Meteorological Sensors Test Low Power Fiber Delivered Laser Range Finder - Continued development Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres - Continued development Imaging Engineering Measurement Program Continuation</p> <p><i>FY 2017 OCO Plans:</i> N/A</p>					
<i>Title:</i> Advanced Electronic Warfare Support (EW) Project Development	1.433	1.639	1.673	0.000	1.673
<i>Articles:</i>	-	-	-	-	-
<i>FY 2015 Accomplishments:</i>					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
ES Vulnerability Tool / Tactical Decision Aid Lab Demo ES Server (Valkyrie) Lab Demo Enhanced DeInterleavers Lab Demo #1 Low Probability of Intercept (LPI) Direction Finding (DF) / Localization Continued Development Embedded Built-in Test (BIT) Submarine EW Digital DF Development Human Machine Interface (HMI) Development ES On-Board Trainer (OBT) Development MMM Payload Coherent Electronic Attack for Submarines (CEAS) Development High Speed Backplane Lab Test <i>FY 2016 Plans:</i> Enhanced DeInterleavers Lab Demo #2 LPI DF / Localization Lab Test Submarine EW Digital DF Continued Development Human Machine Interface (HMI) Continued Development Precision DF Development Multi-Functional Aperture (FNC Substar) Development Digital Early Warning Receiver Development Extremely Wideband Digital Receiver Development Disposable Buoy - Submarine Launched Decoy baseline Lab Test Disposable Buoy - Modular Expendable Decoy enhancements Development Disposable Buoy - Modular Expendable Intelligence Surveillance and Reconnaissance (ISR) Development Tethered Buoy - Modular Tethered Antenna Development Tethered Buoy - Radio Frequency over Fiber (RFoF) development <i>FY 2017 Base Plans:</i> ES OBT Test Enhanced DeInterleavers Pierside/MTV Test LPI DF/Localization Pierside / MTV Test MMM (CEAS) Lab Test Precision DF Lab Test CWP LPI Direction Finding Development Commence SEA Dragon Mast Development					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Disposable Buoy - Submarine Launched Decoy Baseline Lab Test					
<i>FY 2017 OCO Plans:</i> N/A					
Accomplishments/Planned Programs Subtotals	3.320	4.103	4.429	0.000	4.429

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

Remarks

D. Acquisition Strategy

This project optimizes technology insertion using a build-test-build approach to support EW and Imaging operational needs. Operational needs have been based on the tactical requirements identified in CNO letters, Serial N77/3U629212, dated 04 Sep 03, CNO Itr Ser N772/5U936037 dtd 13 JUN 2005, CNO Itr Ser N776/4U786103 dtd 1 APR 2004, COMSUBLANT/ COMSUBPAC, Virginia Class SSN Operational Requirements Documentation objectives, ORD for Photonics (ORD #365-87-94) [dtd JUL 1994], Operational Requirements Document (ORD) for ES (ORD # 570-77-00) [dtd 20 DEC 2000], ORD for ISIS (ORD #663-77-05) [dtd MAR 2005], Capability Development Document (CDD) for Submarine EW Systems (Ver-DRAFT), Common Submarine Imaging System (CSIS) (CDD# 849-87-11) dtd 22 Dec 2011 for Submarine Imaging Systems and JOINT COMMAND SUBMARINE FORCE/COMMANDER SUBMARINE FORCE Itr Ser# N00/00621 dtd 24 Oct 2011. Project efforts develop submarine unique improvements to mast, periscope, and EW electromagnetic spectrum and electro-optic sensors based on emerging technologies that are available from DoD Exploratory Development Programs, industry Independent Research and Development, and other sources. Engineering Demonstration Models (EDMs) will be developed to provide a realistic method of evaluating the improvements, including deployment on submarines for testing.

E. Performance Metrics

The RDD program goal is to respond to urgent operational needs within 30 days and provide for rapid development and fielding of prototype solutions within 270 days.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy												Date: February 2016			
Appropriation/Budget Activity				R-1 Program Element (Number/Name)				Project (Number/Name)							
1319 / 4				PE 0603562N / Submarine Tactical Warfare Sys				0770 / Adv Sub Supp Equip Prog							
Product Development (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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
Systems Engineering	WR	NUWC : RI	11.909	2.174	Oct 2014	3.218	Nov 2015	4.164	Nov 2016	-		4.164	Continuing	Continuing	Continuing
Systems Engineering	SS/FFP	JHU/ARL : MD	1.096	0.000		0.192	Jul 2016	0.178	Mar 2017	-		0.178	Continuing	Continuing	Continuing
Primary Hardware Development	WR	NSWC Philadelphia : PA	0.630	0.000		0.000		0.059	Nov 2016	-		0.059	0.000	0.689	-
Primary Hardware Development	C/CPFF	3 Phoenix : VA	1.829	0.027	Dec 2014	0.000		0.000		-		0.000	0.000	1.856	-
Primary Software Deveopment	WR	SSC PAC : CA	0.310	0.492	Oct 2014	0.505	Oct 2015	0.000		-		0.000	0.000	1.307	-
Primary Software Development	C/CPFF	Reserach Associates of Syracuse : NY	0.173	0.030	Dec 2014	0.000		0.000		-		0.000	0.000	0.203	-
Primary Hardware Development	C/CPFF	Northrop Grumman : VA	0.186	0.297	Dec 2014	0.000		0.000		-		0.000	0.000	0.483	-
Primary Software and Hardware Development	C/CPFF	Accipiter : PA	0.000	0.000		0.160	Mar 2016	0.000		-		0.000	0.000	0.160	-
Primary Hardware Development	WR	Naval Reserach Lab : DC	0.000	0.133	May 2015	0.000		0.000		-		0.000	0.000	0.133	-
Hardware	WR	US Army Special Programs Office : VA	0.000	0.139	May 2015	0.000		0.000		-		0.000	0.000	0.139	-
Subtotal			16.133	3.292		4.075		4.401		-		4.401	-	-	-
Management Services (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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 : WNY	0.245	0.028	Oct 2014	0.028	Oct 2015	0.028	Nov 2016	-		0.028	Continuing	Continuing	Continuing
Subtotal			0.245	0.028		0.028		0.028		-		0.028	-	-	-
Project Cost Totals			16.378	3.320		4.103		4.429		-		4.429	-	-	-

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy	Date: February 2016
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Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 0770 / <i>Adv Sub Supp Equip Prog</i>
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	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
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Remarks	
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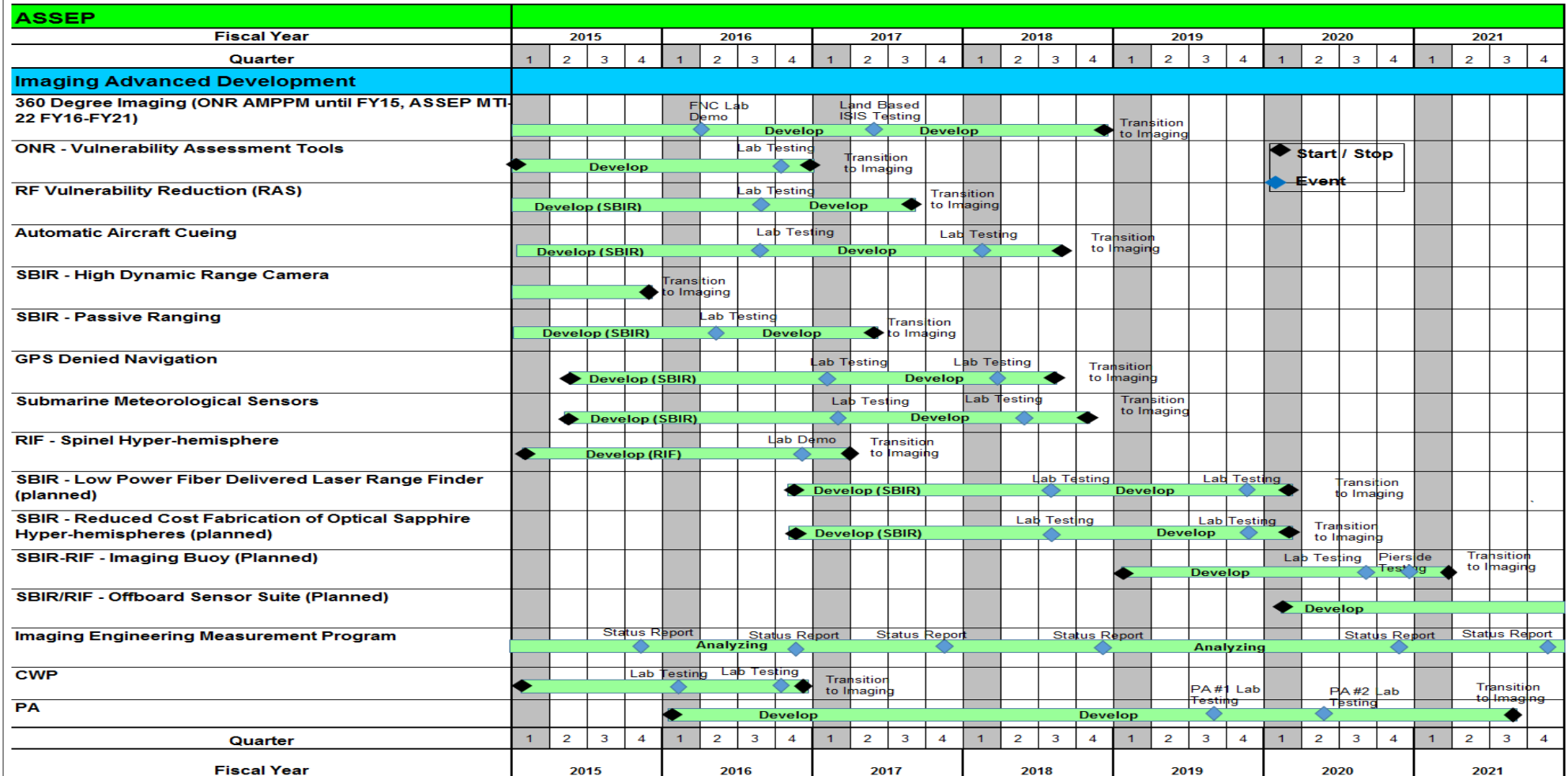
Exhibit R-4, RDT&E Schedule Profile: PB 2017 Navy

Date: February 2016

Appropriation/Budget Activity
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PE 0603562N / Submarine Tactical Warfare
Sys

Project (Number/Name)
0770 / Adv Sub Supp Equip Prog



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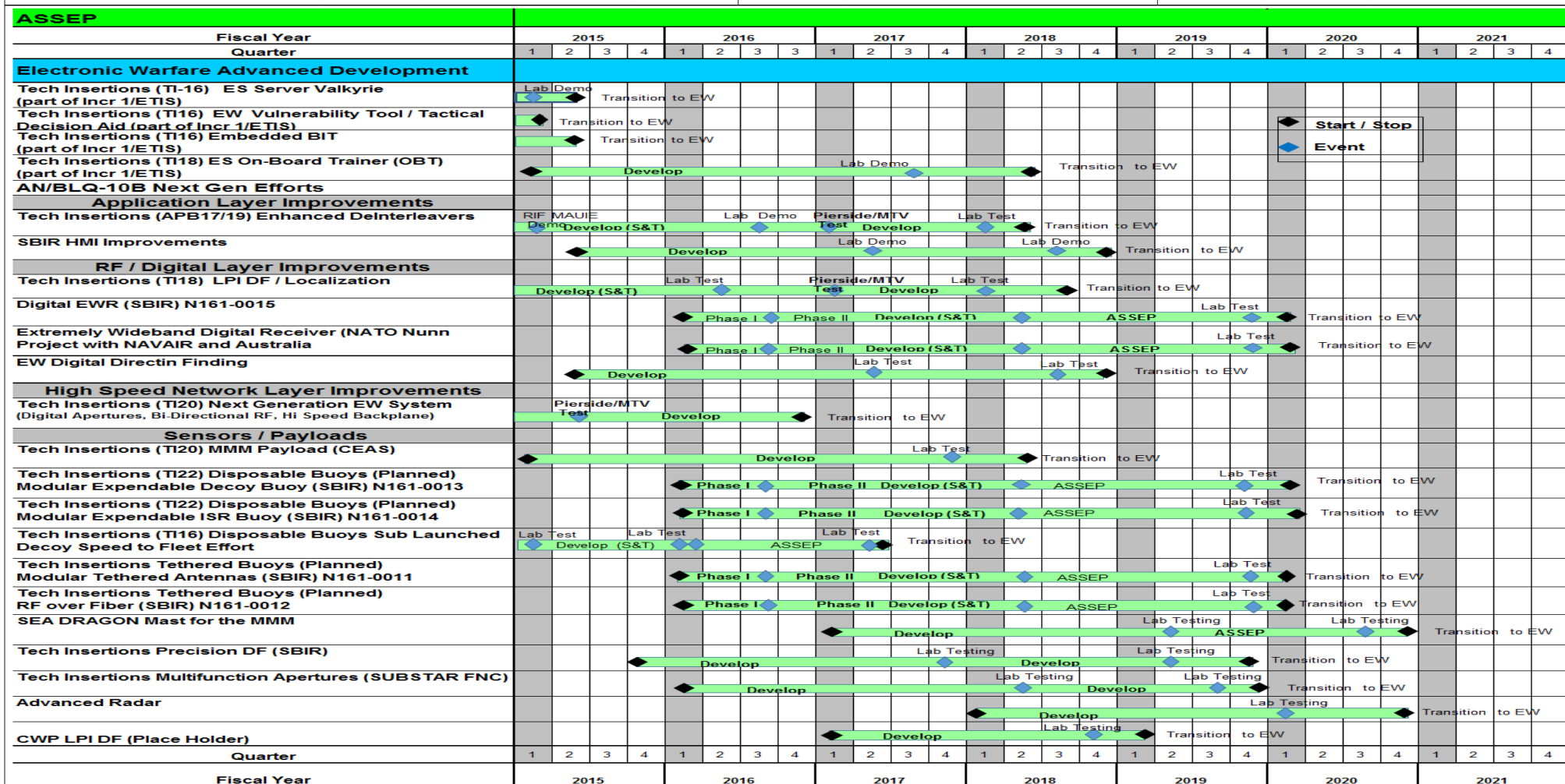
Exhibit R-4, RDT&E Schedule Profile: PB 2017 Navy

Date: February 2016

Appropriation/Budget Activity
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R-1 Program Element (Number/Name)
PE 0603562N / Submarine Tactical Warfare
Sys

Project (Number/Name)
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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy		Date: February 2016
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Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 0770				
Imaging Advanced Development: 360 Degree Imaging (ONR) - AMPPM - FNC Lab Demo	3	2015	3	2015
Imaging Advanced Development: 360 Degree Imaging (ONR) - AMPPM - FNC Pierside Testing	1	2016	1	2016
Imaging Advanced Development: 360 Degree Imaging (ONR) - AMPPM - Land Based ISIS Testing	2	2017	2	2017
Imaging Advanced Development: 360 Degree Imaging (ONR) - AMPPM - Transition to Imaging	4	2018	4	2018
Imaging Advanced Development: ONR Vulnerability Reduction (RAS) Development	1	2015	4	2016
Imaging Advanced Development: ONR Vulnerability Reduction (RAS) Lab Testing	4	2016	4	2016
Imaging Advanced Development: ONR Vulnerability Reduction (RAS) Transition to Imaging	1	2017	1	2021
Imaging Advanced Development: RF Vulnerability Reduction (RAS) Development	1	2015	3	2017
Imaging Advanced Development: RF Vulnerability Reduction (RAS) Lab Testing	3	2016	3	2016
Imaging Advanced Development: RF Vulnerability Reduction (RAS) Transition to Imaging	3	2017	3	2017
Imaging Advanced Development: Automatic Aircraft Cueing - Develop	1	2015	3	2018
Imaging Advanced Development: Automatic Aircraft Cueing - Lab Testing	3	2016	3	2016
Imaging Advanced Development: Automatic Aircraft Cueing - Lab Testing #2	1	2018	1	2018
Imaging Advanced Development: Automatic Aircraft Cueing - Transition to Imaging	3	2018	3	2018
Imaging Advanced Development: SBIR - Passive Ranging Development	1	2015	1	2017
Imaging Advanced Development: SBIR - Passive Ranging Lab Testing	2	2016	2	2016
Imaging Advanced Development: SBIR - Passive Ranging Transition to Imaging	2	2017	2	2017

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 0770 / <i>Adv Sub Supp Equip Prog</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Imaging Advanced Development: GPS Denied Navigation - Develop	2	2015	3	2018
Imaging Advanced Development: GPS Denied Navigation - Lab Testing	1	2017	1	2017
Imaging Advanced Development: GPS Denied Navigation - Lab Testing #2	1	2018	1	2018
Imaging Advanced Development: GPS Denied Navigation - Transition to Imaging	3	2018	3	2018
Imaging Advanced Development: Submarine Meteorological Sensors - Develop	2	2015	4	2018
Imaging Advanced Development: Submarine Meteorological Sensors - Lab Testing	1	2017	1	2017
Imaging Advanced Development: Submarine Meteorological Sensors - Lab Testing #2	2	2018	2	2018
Imaging Advanced Development: Submarine Meteorological Sensors - Transition to Imaging	4	2018	4	2018
Imaging Advanced Development: Spinel Hyper-Hemisphere Development	1	2015	1	2017
Imaging Advanced Development: Spinel Hyper-Hemisphere Lab Demo	4	2016	4	2016
Imaging Advanced Development: Spinel Hyper-Hemisphere Transition to Imaging	1	2017	1	2017
Imaging Advanced Development: Low Power Fiber Delivered Laser Range Finder Development	4	2016	1	2020
Imaging Advanced Development: Low Power Fiber Delivered Laser Range Finder Lab Testing	3	2018	3	2018
Imaging Advanced Development: Low Power Fiber Delivered Laser Range Finder Lab Testing #2	4	2019	4	2019
Imaging Advanced Development: Low Power Fiber Delivered Laser Range Finder Transition to Imaging	1	2020	1	2020
Imaging Advanced Development: Reduced Cost Fabrication of Optical Sapphire Hyper-Hemisphere Development	4	2016	1	2020
Imaging Advanced Development: Reduced Cost Fabrication of Optical Sapphire Hyper-Hemisphere Lab Testing	3	2018	3	2018
Imaging Advanced Development: Reduced Cost Fabrication of Optical Sapphire Hyper-Hemisphere Lab Testing #2	4	2019	4	2019

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy			Date: February 2016	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)	Project (Number/Name)		
1319 / 4	PE 0603562N / Submarine Tactical Warfare Sys	0770 / Adv Sub Supp Equip Prog		
Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Imaging Advanced Development: Reduced Cost Fabrication of Optical Sapphire Hyper-Hemisphere Transition to Imaging	1	2020	1	2020
Imaging Advanced Development: Imaging Buoy (Planned) - Develop	1	2019	1	2021
Imaging Advanced Development: Imaging Buoy (Planned) - Lab Demo	3	2020	3	2020
Imaging Advanced Development: Imaging Buoy (Planned) - Pierside Demo	4	2020	4	2020
Imaging Advanced Development: Offboard Sensor Suite (Planned) - Develop	1	2020	4	2020
Imaging Advanced Development: Imaging Engineering Measurement Program Analysis	1	2015	4	2020
Imaging Advanced Development: Imaging Engineering Measurement Program - Status Report #1	1	2015	1	2015
Imaging Advanced Development: Imaging Engineering Measurement Program - Status Report #2	4	2016	4	2016
Imaging Advanced Development: Imaging Engineering Measurement Program - Status Report #3	4	2017	4	2017
Imaging Advanced Development: Imaging Engineering Measurement Program - Status Report #4	4	2018	4	2018
Imaging Advanced Development: Imaging Engineering Measurement Program - Status Report #5	4	2019	4	2019
Imaging Advanced Development: Imaging Engineering Measurement Program - Status Report #6	4	2020	4	2020
Imaging Advanced Development: Imaging Engineering Measurement Program - Status Report #7	4	2021	4	2021
Imaging Advanced Development: CWP Periscope Vulnerability - Development	1	2015	4	2016
Imaging Advanced Development: CWP Periscope Vulnerability - Test	1	2016	1	2016
Imaging Advanced Development: CWP Periscope Vulnerability - Test #2	4	2016	4	2016
Imaging Advanced Development: CWP Periscope Vulnerability - Transition to Imaging	4	2016	4	2016
Imaging Advanced Development: PA Electromagnetic Spectrum Sensor System Simulation - Development	1	2016	3	2021

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy **Date:** February 2016

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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Imaging Advanced Development: PA Electromagnetic Spectrum Sensor System Simulation - Lab Test #1	3	2019	3	2019
Imaging Advanced Development: PA Electromagnetic Spectrum Sensor System Simulation - Lab Test #2	2	2020	2	2020
Imaging Advanced Development: PA Electromagnetic Spectrum Sensor System Simulation - Transition to Imaging	3	2021	3	2021
Electronic Warfare Advance Development: TI-16 ES Server Valkyrie - Lab Demo	1	2015	1	2015
Electronic Warfare Advance Development: TI-16 ES Server Valkyrie - Transition to EW	2	2015	2	2015
Electronic Warfare Advance Development: TI-16 EW Vulnerability Tool/Tactical Decision Aid - Transition to EW	1	2015	1	2015
Electronic Warfare Advance Development: TI-16 Embedded BIT - Transition to EW	2	2015	2	2015
Electronic Warfare Advance Development: TI-18 ES On-Board Trainer - Develop	1	2015	2	2018
Electronic Warfare Advance Development: TI-18 ES On-Board Trainer - Lab Demo	3	2017	3	2017
Electronic Warfare Advance Development: TI-18 ES On-Board Trainer - Transition to EW	2	2018	2	2018
Electronic Warfare Advance Development: Technical Insertions (APB/17/19) Enhanced DeInterleavers Develop	1	2015	2	2018
Electronic Warfare Advance Development: Technical Insertions (APB/17/19) Enhanced DeInterleavers RIF MAUEI Demo	1	2015	1	2015
Electronic Warfare Advance Development: Technical Insertions (APB/17/19) Enhanced DeInterleavers Lab Test	3	2016	3	2016
Electronic Warfare Advance Development: Technical Insertions (APB/17/19) Enhanced DeInterleavers Pierside/MTV Test	1	2017	1	2017
Electronic Warfare Advance Development: Technical Insertions (APB/17/19) Enhanced DeInterleavers Lab Test #2	1	2018	1	2018
Electronic Warfare Advance Development: Technical Insertions (APB/17/19) Enhanced DeInterleavers Transition to EW	2	2018	2	2018

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 0770 / <i>Adv Sub Supp Equip Prog</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Electronic Warfare Advance Development: Human Machine Interface (HMI) Development	2	2015	4	2018
Electronic Warfare Advance Development: HMI Lab Demo	2	2017	2	2017
Electronic Warfare Advance Development: HMI Lab Demo #2	3	2018	3	2018
Electronic Warfare Advance Development: HMI Transition to EW	4	2018	4	2018
Electronic Warfare Advance Development: Technical Insertions (TI-18) LPI DF / Localization - Develop	1	2015	2	2018
Electronic Warfare Advance Development: Technical Insertions (TI-18) LPI DF / Localization - Lab Test	3	2016	3	2016
Electronic Warfare Advance Development: Technical Insertions (TI-18) LPI DF / Localization -Pierside/MTV Test	1	2017	1	2017
Electronic Warfare Advance Development: Technical Insertions (TI-18) LPI DF / Localization - Lab Test #2	1	2018	1	2018
Electronic Warfare Advance Development: Technical Insertions (TI-18) LPI DF / Localization - Transition to EW	2	2018	2	2018
Electronic Warfare Advance Development: Digital Early Warning Receiver (EWR) Phase 1 Development	1	2016	3	2016
Electronic Warfare Advance Development: Digital Early Warning Receiver (EWR) Phase 2 Development	3	2016	2	2018
Electronic Warfare Advance Development: Digital Early Warning Receiver (EWR) Lab Test	4	2019	4	2019
Electronic Warfare Advance Development: Digital Early Warning Receiver (EWR) Transition to EW	1	2020	1	2020
Electronic Warfare Advance Development: Extremely Wideband Digital Receiver Phase 1 Development	1	2016	3	2016
Electronic Warfare Advance Development: Extremely Wideband Digital Receiver Phase 2 Development	3	2016	2	2018

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy			Date: February 2016	
Appropriation/Budget Activity	R-1 Program Element (Number/Name)		Project (Number/Name)	
1319 / 4	PE 0603562N / Submarine Tactical Warfare Sys		0770 / Adv Sub Supp Equip Prog	
Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Electronic Warfare Advance Development: Extremely Wideband Digital Receiver Lab Test	4	2019	4	2019
Electronic Warfare Advance Development: Extremely Wideband Digital Receiver Transition to EW	1	2020	1	2020
Electronic Warfare Advance Development: EW Digital Direction Finding Development	2	2015	4	2018
Electronic Warfare Advance Development: EW Digital Direction Finding - Lab Test #1	2	2017	2	2017
Electronic Warfare Advance Development: EW Digital Direction Finding - Lab Test #2	3	2018	3	2018
Electronic Warfare Advance Development: EW Digital Direction Finding Transition to EW	4	2018	4	2018
Electronic Warfare Advance Development: TI-20 Next Generation EW System-Development	1	2015	3	2016
Electronic Warfare Advance Development: TI-20 Next Generation EW System-Pierside/MTV Test	2	2015	2	2015
Electronic Warfare Advance Development: TI-20 Next Generation EW System - Transition to EW	3	2016	3	2016
Electronic Warfare Advance Development: TI-20 MMM Payload - Development (CEAS)	1	2015	2	2018
Electronic Warfare Advance Development: TI-20 MMM Payload - Lab Test	4	2017	4	2017
Electronic Warfare Advance Development: TI-20 MMM Payload - Transition to EW	2	2018	2	2018
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable Decoy Buoy Enhancement Phase 1	1	2016	3	2016
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable Decoy Buoy Enhancement Phase 3	3	2016	4	2019
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable Decoy Buoy Enhancement - Lab Test	3	2019	3	2019
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable Decoy Buoy Enhancement - Transition to EW	4	2019	4	2019

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 0770 / <i>Adv Sub Supp Equip Prog</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable ISR Buoy- Phase 1	1	2016	3	2016
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable ISR Buoy- Phase 2	3	2016	1	2020
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable ISR Buoy - Lab Test	4	2019	4	2019
Electronic Warfare Advance Development: TI-22 Disposable Buoys Modular Expendable ISR Buoy - Transition to EW	1	2020	1	2020
Electronic Warfare Advance Development: TI-16 Disposable Buoys Sub Launched Decoy Speed to Fleet Development	1	2015	3	2017
Electronic Warfare Advance Development: TI-16 Disposable Buoys Sub Launched Decoy Speed to Fleet - Lab Test	1	2016	1	2016
Electronic Warfare Advance Development: TI-16 Disposable Buoys Sub Launched Decoy Speed to Fleet - Lab Test #2	2	2017	2	2017
Electronic Warfare Advance Development: TI-16 Disposable Buoys Sub Launched Decoy Speed to Fleet - Transition to EW	3	2017	3	2017
Electronic Warfare Advance Development: TI Tethered Buoys (Planned) Modular Tethered Antennas and RF Over Fiber- Phase 1	1	2016	3	2016
Electronic Warfare Advance Development: TI Tethered Buoys (Planned) Modular Tethered Antennas and RF Over Fiber- Phase 2	3	2016	1	2020
Electronic Warfare Advance Development: TI Tethered Buoys (Planned) Modular Tethered Antennas and RF Over Fiber - Lab Test	4	2019	4	2019
Electronic Warfare Advance Development: TI Tethered Buoys (Planned) Modular Tethered Antennas and RF Over Fiber - Transition to EW	1	2020	1	2020
Electronic Warfare Advance Development: SEA DRAGON Mast for MMM - Development	1	2017	4	2020
Electronic Warfare Advance Development: SEA DRAGON Mast for MMM - Lab Test	3	2020	3	2020
Electronic Warfare Advance Development: SEA DRAGON Mast for MMM - Transition to EW	4	2020	4	2020

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 0770 / <i>Adv Sub Supp Equip Prog</i>
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Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Electronic Warfare Advance Development: Technical Insertions Precision DF (Planned) - Develop	4	2015	4	2019
Electronic Warfare Advance Development: Technical Insertions Precision DF (Planned) - Lab Test	4	2017	4	2017
Electronic Warfare Advance Development: Technical Insertions Precision DF (Planned) - Lab Test #2	2	2019	2	2019
Electronic Warfare Advance Development: Technical Insertions Precision DF (Planned) - Transition to EW	4	2019	4	2019
Electronic Warfare Advance Development: Technical Insertions Multifunction Apertures (Planned) - Develop	1	2016	4	2019
Electronic Warfare Advance Development: Technical Insertions Multifunction Apertures (Planned) - Lab Test	2	2018	2	2018
Electronic Warfare Advance Development: Technical Insertions Multifunction Apertures (Planned) - Lab Test #2	4	2019	4	2019
Electronic Warfare Advance Development: Advanced Radar Development	1	2018	4	2020
Electronic Warfare Advance Development: Advanced Radar Lab Test	1	2020	1	2020
Electronic Warfare Advance Development: Advanced Radar Transition to EW	4	2020	4	2020
Electronic Warfare Advance Development: CWP LPI Direction Finding - Development	1	2017	1	2019
Electronic Warfare Advance Development: CWP LPI Direction Finding - Lab Test	4	2018	4	2018
Electronic Warfare Advance Development: CWP LPI Direction Finding - Transition to EW	1	2019	1	2019

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy										Date: February 2016		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>				Project (Number/Name) 1739 / <i>Submarine Arctic W/F Development</i>			
COST (\$ in Millions)	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	FY 2018	FY 2019	FY 2020	FY 2021	Cost To Complete	Total Cost
1739: <i>Submarine Arctic W/F Development</i>	45.760	4.666	6.268	4.353	-	4.353	9.720	5.199	6.801	6.942	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Submarine Arctic Warfare Development Project responds to the increased threat of submarine and surface ship activity in Arctic regions of the world through the development of advanced submarine concepts. It places particular emphasis on submarine operability and mission support in unique, cold, ice-covered environments. Efforts include assessment of combat system effectiveness, weapons testing, use of High Frequency (HF) sonars in Arctic regions, testing of ice-capable submarine structures, and development of class-specific Arctic operational guidelines. This project also provides the framework for various research and development programs to conduct test and evaluation in shallow water and Arctic regions.

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

	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	4.666	6.268	4.353	0.000	4.353
Articles:	-	-	-	-	-
FY 2015 Accomplishments: Initiated planning and support for ICEX mission 1-2016 and Ice Camp 1-2016. Supported Arctic deployments, including inter-Fleet transfers, as required by the SUBFOR Commanders. Investigated, researched, developed and deployed new systems for Arctic submarine support. Supported testing and tactical development required to improve submarine Arctic operability and warfighting. Developed Temporary Alteration (TEMPALT) design for High Frequency (HF) sonar on SSN 21 Class Submarines.					
FY 2016 Plans: Conduct Arctic work-up training, ICEX mission 1-2016, and Ice Camp 1-2016. Support Arctic deployments, including inter-Fleet transfers, as required by the SUBFOR Commanders. Investigate, research, develop and deploy new systems for Arctic submarine support. Support testing and tactical development required to improve submarine Arctic operability and warfighting.					
FY 2017 Base Plans: Conduct Arctic work-up training. Support Arctic deployments, including inter-Fleet transfers, as required by the SUBFOR Commanders. Investigate, research, develop and deploy new systems for Arctic submarine support.					

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Exhibit R-2A, RDT&E Project Justification: PB 2017 Navy	Date: February 2016
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Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 1739 / <i>Submarine Arctic W/F Development</i>
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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Support testing and tactical development required to improve submarine Arctic operability and warfighting. Initiate planning for ICEX mission 1-2018 and Ice Camp 1-2018. FY 2017 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	4.666	6.268	4.353	0.000	4.353

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

Remarks

D. Acquisition Strategy
Use sole source and competitively awarded contracts through the Fleet Logistics Center (FLC) regional contracting office for equipment and technical services. The NAVSEA University Affiliated Research Center (UARC) omnibus contract is used for procurement of logistics support for Ice Camps.

E. Performance Metrics
Conduct and support Arctic deployments, including inter-Fleet transfers and biennial ICEXs, as required by the SUBFOR Commanders.

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 1739 / <i>Submarine Arctic W/F Development</i>
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Test and Evaluation (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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 Test & Evaluation	WR	COMSUBLANT : VA	0.000	0.000		2.372	Oct 2015	2.334	Nov 2016	-		2.334	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	COMSUBPAC : CA	33.724	2.377	Nov 2014	0.000		0.000		-		0.000	0.000	36.101	Continuing
Developmental Test & Evaluation	WR	NUWC/Newport : RI	0.235	0.000		0.000		0.000		-		0.000	0.000	0.235	0.235
Developmental Test & Evaluation	C/CPFF	UT/ARL : TX	0.894	0.500	Feb 2015	0.408	Mar 2016	0.463	Dec 2016	-		0.463	Continuing	Continuing	Continuing
Developmental Test & Evaluation	C/CPFF	UW/APL : WA	9.528	1.729	Jan 2015	3.428	Dec 2015	1.496	Dec 2016	-		1.496	Continuing	Continuing	Continuing
Subtotal			44.381	4.606		6.208		4.293		-		4.293	-	-	-

Management Services (\$ in Millions)				FY 2015		FY 2016		FY 2017 Base		FY 2017 OCO		FY 2017 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	EG&G : VA	0.311	0.000		0.000		0.000		-		0.000	0.000	0.311	0.311
Program Management Support	C/CPAF	BAE SYSTEMS : MD	1.028	0.060	Nov 2014	0.000		0.000		-		0.000	0.000	1.088	Continuing
Program Management Support	C/CPIF	TMB : DC	0.000	0.000		0.060	Dec 2015	0.060	Dec 2016	-		0.060	Continuing	Continuing	Continuing
Travel	Allot	NAVSEA PEO IWS 5 : DC	0.040	0.000		0.000		0.000		-		0.000	0.000	0.040	Continuing
Subtotal			1.379	0.060		0.060		0.060		-		0.060	-	-	-

	Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals		45.760	4.666	6.268	4.353	-	-	-	-

Remarks

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Exhibit R-4, RDT&E Schedule Profile: PB 2017 Navy **Date:** February 2016

Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 1739 / <i>Submarine Arctic W/F Development</i>
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Proj 1739	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019				FY 2020				FY 2021			
	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
Arctic Deployment (at Sea)	Arctic Deployment																											
ICEX Mission (at Sea)					ICEX 2016								ICEX 2018								ICEX 2020							
Arctic Transit Mission (at Sea)	Arctic Transit Mission																											
Arctic Workup (at Sea)	Arctic Workup																											
Arctic Training	Arctic Training																											
Ice Camp (Arctic Ocean)					Ice Camp 2016								Ice Camp 2018								Ice Camp 2020							

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Exhibit R-4A, RDT&E Schedule Details: PB 2017 Navy		Date: February 2016
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	Project (Number/Name) 1739 / <i>Submarine Arctic W/F Development</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
Proj 1739				
Arctic Deployment (at Sea): Submarine Deployment as required by the Submarine Type Commander	1	2015	4	2021
ICEX Mission (at Sea): ITEX Mission (at Sea) 2016	1	2016	4	2016
ICEX Mission (at Sea): ITEX Mission (at Sea) 2018	1	2018	4	2018
ICEX Mission (at Sea): ITEX Mission (at Sea) 2020	1	2020	4	2020
Arctic Transit Mission (at Sea): Arctic Transit Mission (at Sea)	1	2015	4	2021
Arctic Workup (at Sea): Arctic Workup (at Sea)	1	2015	4	2021
Arctic Training: Arctic Training	1	2015	4	2021
Ice Camp (Arctic Ocean): Ice Camp (Arctic Ocean) 2016	1	2016	4	2016
Ice Camp (Arctic Ocean): Ice Camp (Arctic Ocean) 2018	1	2018	4	2018
Ice Camp (Arctic Ocean): Ice Camp (Arctic Ocean) 2020	1	2020	4	2020

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