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Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Navy										Date: February 2018		
Appropriation/Budget Activity 1319: Research, Development, Test & Evaluation, Navy I BA 4: Advanced Component Development & Prototypes (ACD&P)					R-1 Program Element (Number/Name) PE 0603562N I Submarine Tactical Warfare Sys							
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	75.297	8.603	13.834	9.374	-	9.374	11.314	11.551	13.365	12.031	Continuing	Continuing
0770: Adv Sub Supp Equip Prog	18.750	4.419	4.155	4.307	-	4.307	4.672	4.777	4.866	4.977	Continuing	Continuing
1739: Submarine Arctic W/F Development	56.547	4.184	9.679	5.067	-	5.067	6.642	6.774	8.499	7.054	Continuing	Continuing
A. Mission Description and Budget Item Justification												
<p>Project 0770 - The Advanced Submarine Support Equipment Program (ASSEP) objective is to improve submarine operational effectiveness through the development and implementation of advanced Research and Development (R&amp;D). In order to provide improved operational effectiveness, R&amp;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.</p>												
<p>Project 1739 - 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, and 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). Tactical Development (TACDEV) 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.</p>												
<p>Major ICEXs, occurring every four (4) years (FY 2018, FY 2022, etc) include a Fleet requirement to conduct exercise torpedo (EXTORP) firings in the Arctic. A Torpedo Exercise (TORPEX) requires significantly higher level of logistics, personnel, and infrastructure to account for the recovery and transportation efforts of the EXTORPs.</p>												
<p>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.</p>												

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<b>Appropriation/Budget Activity</b> 1319: <i>Research, Development, Test &amp; Evaluation, Navy I BA 4: Advanced Component Development &amp; Prototypes (ACD&amp;P)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0603562N / <i>Submarine Tactical Warfare Sys</i>
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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019 Base</b>	<b>FY 2019 OCO</b>	<b>FY 2019 Total</b>
Previous President's Budget	8.782	13.834	9.545	-	9.545
Current President's Budget	8.603	13.834	9.374	-	9.374
Total Adjustments	-0.179	0.000	-0.171	-	-0.171
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.178	0.000			
• Rate/Misc Adjustments	-0.001	0.000	-0.171	-	-0.171

**Change Summary Explanation**

Project 1739 Funding:

The FY 2018 to FY 2019 decrease is due to the completion of the major TORPEX/TACDEV event in FY 2018. There are no major ICEX events planned in FY 2019; efforts are directed at ICEX 2020 planning/work-up.

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy										Date: February 2018		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys				Project (Number/Name) 0770 / Adv Sub Supp Equip Prog			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
0770: Adv Sub Supp Equip Prog	18.750	4.419	4.155	4.307	-	4.307	4.672	4.777	4.866	4.977	Continuing	Continuing
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		
A. Mission Description and Budget Item Justification												
<p>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.</p> <p>The FY19 Advanced Imaging Project Development projects include Anti Reflective Coating Spherical Domes, Volumetric Atmospheric Modeling, Low Power Fiber Delivered Laser Range Finder, Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres, Vulnerability Improvement, Submarine Meteorological Sensors, System For Non-Acoustic Control of Signatures (SNACS), Imaging Buoy, Near Ocean Imaging through Atmospheric Turbulence and a Project Arrangement (PA) with Australia covering Electromagnetic Spectrum Sensor System Simulation &amp; Development for model-based mission planning.</p> <p>FY18 to FY19 cost growth is due to test events associated with Anti Reflective Coating Spherical Domes, Volumetric Atmospheric Modeling, and Low Power Fiber Delivered Laser Range Finder.</p> <p>The FY19 Advanced EW Project Development projects include the development of: Extremely Wideband Digital Receiver (NATO Nunn Project with NAVAIR and Australia), Multi-Functional Apertures, Disposable Decoy Buoys, ISR and Tethered Buoys and Antennas, Radio Frequency (RF) over Fiber (RfOF), Micro Adaptive Training, Mast Antenna Coupler, Ruggedized High speed Optical Fiber Network Connector Interfaces, Data Transmission Using Visible Light Communications (VLC), DISARMER, Digital Early Warning Receiver, Tunable Optic Filters for Radio Frequencies Photonic Signal Distribution Systems and Solid State RADAR Emitter Identification.</p> <p>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.</p>												
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)								FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Title: Advanced Imaging Project Development								3.242	2.360	2.561	0.000	2.561

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Appropriation/Budget Activity 1319 / 4		R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys		Project (Number/Name) 0770 / Adv Sub Supp Equip Prog	
B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)					
	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Articles:	-	-	-	-	-
FY 2018 Plans:					
Complete TOTIM Land Based ISIS System Architecture Design Development, Testing and Transition to Imaging					
Completed RF Vulnerability Reduction (RAS) Lab Test and Transitioned to Imaging					
Complete Automatic Aircraft Cueing Lab Test and Transition to Imaging					
Complete SBIR- Passive Ranging Development and Transition to Imaging					
Complete GPS Denied Navigation Lab Test and Transition to Imaging					
Complete Meteorological Sensors Test and Continue Development					
Complete Low Power Fiber Delivered Laser Range Finder Lab Test and continue Development					
Complete Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres Lab Test and Continue Development					
Continue Anti-reflective Coating Spherical Domes Development					
Continue Volumetric Atmospheric Modeling Development					
Continue PA Electromagnetic Spectrum Sensor System Simulation Development					
Start Vulnerability Improvement Development					
Complete RCS Test and Transition to Imaging					
Start System for Non-Acoustic Control of Signatures (SNACS) Development					
Start Near Ocean Imaging through Atmospheric Turbulence Development					
FY 2019 Base Plans:					
Complete Low Power Fiber Delivered Laser Range Finder Lab Test and Continue Development					
Complete Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres Lab Test and Continue Development					
Complete Anti-reflective Coating Spherical Domes Lab Test and Continue Development					
Complete Volumetric Atmospheric Modeling Lab Test and Continue Development					
Complete PA Electromagnetic Spectrum Sensor System Simulation Lab Test and Continue Development					
Continue SNACS Development					
Continue Vulnerability Improvement Development					
Continue Near Ocean Imaging through Atmospheric Turbulence Development					
Continue Meteorological Sensors Development					
FY 2019 OCO Plans:					

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B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)		FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
N/A						
FY 2018 to FY 2019 Increase/Decrease Statement: Increase of \$201 thousand in FY19 from FY18 is in support of a planned increase in Project Agreement Electromagnetic Spectrum Sensor System Simulation Development efforts in partnership with the Royal Australian Navy.						
Title: Advanced Electronic Warfare Support (EW) Project Development		1.177	1.795	1.746	0.000	1.746
Articles:		-	-	-	-	-
FY 2018 Plans: Complete Enhanced DeInterleavers Lab Test and Transition to EW Complete Human Machine Interface (HMI) Lab Demo and Transition to EW Continued Solid State RADAR Emitter Identification Development Complete LPI DF Lab Test and Transition to EW Complete EWR Phase II Development and Continue Development Complete Large Time Bandwidth Receiver Lab Test and transition to EW Continue Extremely Wideband Digital Receiver Development Complete EW Digital Direction Finding Lab Test and Transition to EW Complete RFOF Submarine Mast Integration Lab Test and Transition to EW Complete Next Generation SIGINT Processing Infrastructure High Speed Backbone Lab Test and Transition to EW Continue Disposable Buoy Modular Expendable Decoy enhancements - Development S&T Continue Disposable Buoy Modular Expendable Intelligence Surveillance and reconnaissance (ISR) Development S&T Continue Tethered Buoy Modular Tethered Antenna Development S&T Continue Tethered Buoy Radio Frequency over Fiber (RFoF) Development S&T Continue Precision DF Development Complete Multifunction Apertures (SUBSTAR FNC) Lab Test and Continue Development						
FY 2019 Base Plans: Complete EW Digital Direction Finding Lab Test and Continue Development Complete Extremely Wideband Digital Receiver Lab Test and Continue Development Complete Disposable Buoy Modular Expendable Decoy enhancements Lab Test and Continue Development						

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2019 Navy			<b>Date:</b> February 2018			
<b>Appropriation/Budget Activity</b> 1319 / 4		<b>R-1 Program Element (Number/Name)</b> PE 0603562N / <i>Submarine Tactical Warfare Sys</i>		<b>Project (Number/Name)</b> 0770 / <i>Adv Sub Supp Equip Prog</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>						
		<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019 Base</b>	<b>FY 2019 OCO</b>	<b>FY 2019 Total</b>
Complete Disposable Buoy Modular Expendable Intelligence Surveillance and reconnaissance (ISR) Lab Test and Continue Development Complete Tethered Buoy Modular Tethered Antenna Lab Test and Continue Development Complete Tethered Buoy Radio Frequency over Fiber (RFoF) Lab Test and Continue Development Complete Precision DF Lab Test and Transition to EW Complete Multifunction Apertures (SUBSTAR FNC) Lab Test and Transition to EW  <b>FY 2019 OCO Plans:</b> N/A  <b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> Decrease of \$49 thousand in FY19 from FY18 Advanced Electronic Warfare Development is due to planned increase in Advanced Imaging Development Project Agreement Electromagnetic Spectrum Sensor System Simulation Development efforts in partnership with the Royal Australian Navy.						
<b>Accomplishments/Planned Programs Subtotals</b>		4.419	4.155	4.307	0.000	4.307
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>Remarks</b>						
<b>D. Acquisition Strategy</b> 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 the Common Submarine Imaging System (CSIS) (CDD# 849-87-11) dtd 22 Dec 2011 for Submarine Imaging Systems, and the Common Submarine Electronic Warfare System (CSEWS) (CDD# 907-97-16) dtd 27 Sep 2016 for the Electronic Warfare Systems. 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.						
<b>E. Performance Metrics</b> The Research, Development and Demonstration (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 2019 Navy												Date: February 2018			
Appropriation/Budget Activity 1319 / 4						R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys				Project (Number/Name) 0770 / Adv Sub Supp Equip Prog					
Product Development (\$ in Millions)				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 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	16.996	3.378	Nov 2016	4.127	Nov 2017	4.279	Nov 2018	-		4.279	Continuing	Continuing	Continuing
Primary Software Deveopment	WR	SSC PAC : CA	1.278	0.163	May 2017	0.000		0.000		-		0.000	0.000	1.441	-
Primary Hardware Development	WR	NSWC CD : MD	0.175	0.260	May 2017	0.000		0.000		-		0.000	0.000	0.435	-
Primary Software and Hardware Development	MIPR	MIT/LL : MA	0.000	0.590	Jun 2017	0.000		0.000		-		0.000	0.000	0.590	-
Subtotal			18.449	4.391		4.127		4.279		-		4.279	Continuing	Continuing	N/A
Management Services (\$ in Millions)				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 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	0.301	0.028	Nov 2016	0.028	Nov 2017	0.028	Nov 2018	-		0.028	Continuing	Continuing	Continuing
Subtotal			0.301	0.028		0.028		0.028		-		0.028	Continuing	Continuing	N/A
			Prior Years	FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			18.750	4.419		4.155		4.307		-		4.307	Continuing	Continuing	N/A
Remarks															

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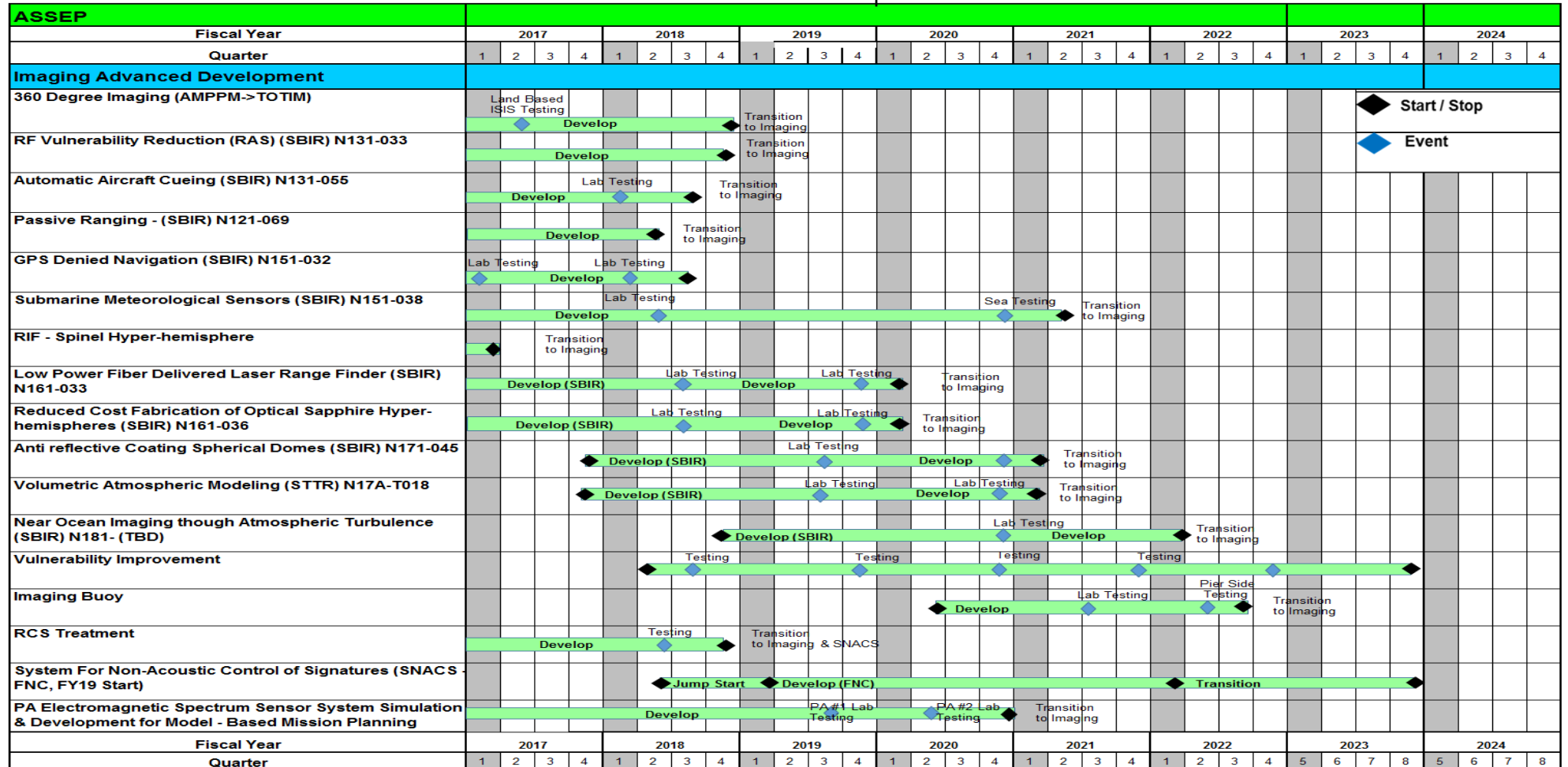
Exhibit R-4, RDT&E Schedule Profile: PB 2019 Navy

Date: February 2018

Appropriation/Budget Activity  
1319 / 4

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

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

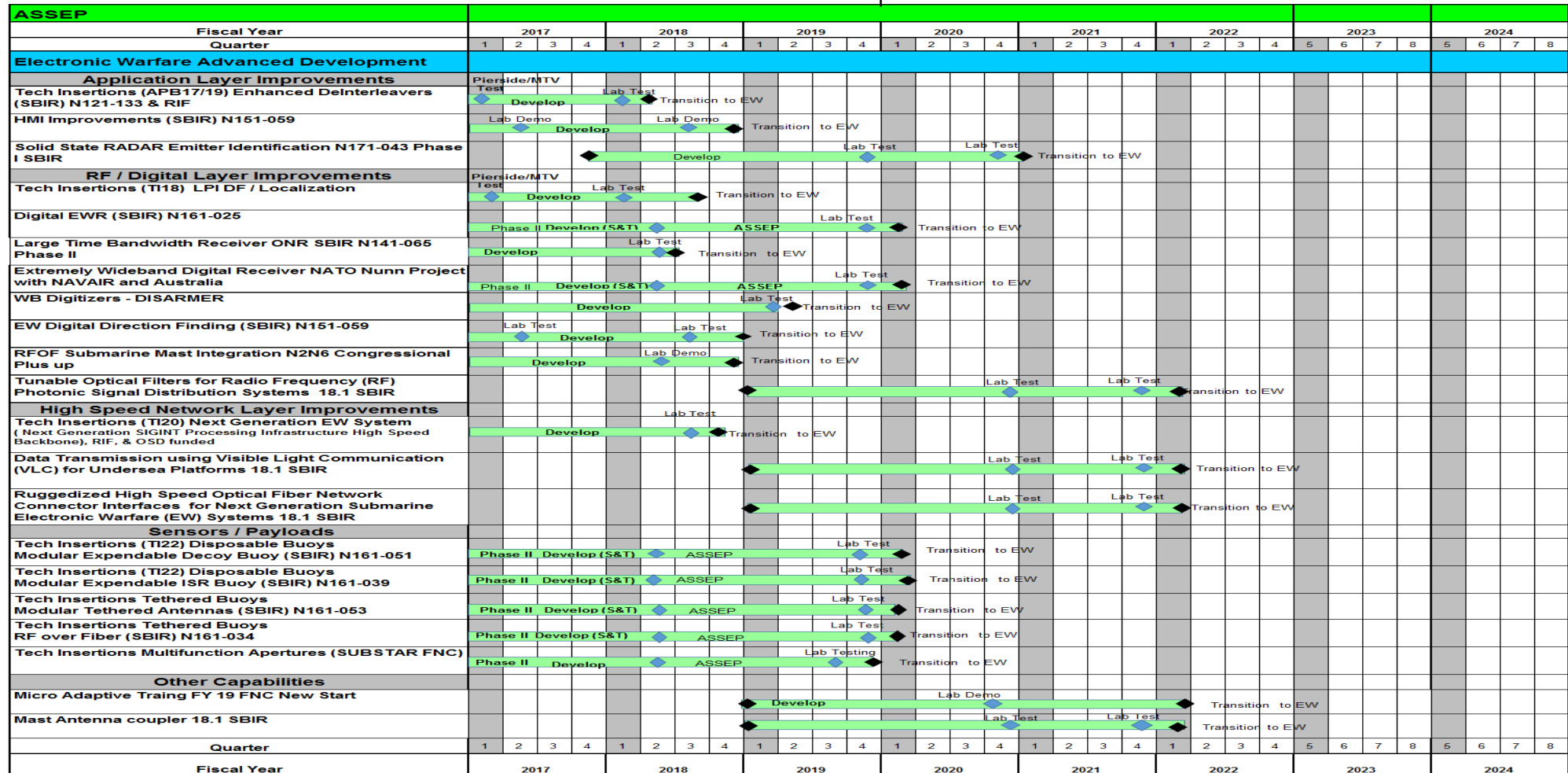




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Exhibit R-4, RDT&amp;E Schedule Profile: PB 2019 Navy

Date: February 2018

Appropriation/Budget Activity  
1319 / 4R-1 Program Element (Number/Name)  
PE 0603562N / Submarine Tactical Warfare  
SysProject (Number/Name)  
0770 / Adv Sub Supp Equip Prog

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2019 Navy			<b>Date:</b> February 2018
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	<b>Project (Number/Name)</b> 0770 / <i>Adv Sub Supp Equip Prog</i>	

**Schedule Details**

<b>Events by Sub Project</b>	<b>Start</b>		<b>End</b>	
	<b>Quarter</b>	<b>Year</b>	<b>Quarter</b>	<b>Year</b>
<b><i>Imaging Advanced Development</i></b>				
360 Degree Imaging (TOTIM) Land Based Integration Testing	2	2017	2	2017
360 Degree Imaging (TOTIM) Transition to Imaging	4	2018	4	2018
RF Vulnerability Reduction (RAS)	4	2018	4	2018
Automatic Aircraft Cueing Lab Test	1	2018	1	2018
Automatic Aircraft Cueing Transition to Imaging	3	2018	3	2018
Passive Ranging Transition to Imaging	2	2018	2	2018
GPS Denied Navigation Lab Test	1	2017	1	2017
GPS Denied Navigation Lab Test #2	1	2018	1	2018
GPS Denied Navigation Transition to Imaging	3	2018	3	2018
Submarine Meteorological Sensors Lab Test	2	2018	2	2018
Submarine Meteorological Sensors SeaTest #2	4	2020	4	2020
Submarine Meteorological Sensors Transition to Imaging	2	2021	2	2021
Spinel Hyper-hemisphere Transition to Imaging	1	2017	1	2017
Low Power Fiber Delivered Laser Range Finder Lab Test	3	2018	3	2018
Low Power Fiber Delivered Laser Range Finder Lab Test #2	4	2019	4	2019
Low Power Fiber Delivered Laser Range Finder Transition to Imaging	1	2020	1	2020
Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres Lab Test	3	2018	3	2018
Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres Lab Test #2	4	2019	4	2019
Reduced Cost Fabrication of Optical Sapphire Hyper-hemispheres Transition to Imaging	1	2020	1	2020
Anti reflective Coating Spherical Domes Development	4	2017	4	2017

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Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy			Date: February 2018		
Appropriation/Budget Activity 1319 / 4		R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys		Project (Number/Name) 0770 / Adv Sub Supp Equip Prog	
		Start		End	
Events by Sub Project		Quarter	Year	Quarter	Year
Anti reflective Coating Spherical Domes Lab Test		3	2019	3	2019
Anti reflective Coating Spherical Domes Lab Test #2		4	2020	4	2020
Anti reflective Coating Spherical Domes Transition to Imaging		1	2021	1	2021
Volumetric Atmospheric Modeling Development		4	2017	4	2017
Volumetric Atmospheric Modeling Lab Test		3	2019	3	2019
Volumetric Atmospheric Modeling Lab Test #2		4	2020	4	2020
Volumetric Atmospheric Modeling Transition to Imaging		1	2021	1	2021
Near Ocean Imaging though Atmospheric Turbulence Development		4	2018	4	2018
Near Ocean Imaging though Atmospheric Turbulence Lab Test		4	2020	4	2020
Near Ocean Imaging though Atmospheric Turbulence Transition to Imaging		1	2022	1	2022
Vulnerability Improvement Development		2	2018	3	2023
Vulnerability Improvement Lab Test		3	2018	3	2018
Vulnerability Improvement Lab Test #2		4	2019	4	2019
Vulnerability Improvement Lab Test #3		4	2020	4	2020
Vulnerability Improvement Lab Test #4		4	2021	4	2021
Vulnerability Improvement Lab Test #5		4	2022	4	2022
Vulnerability Improvement Transition to Imaging		4	2023	4	2023
Imaging Buoy Development		2	2020	2	2020
Imaging Buoy Lab Test		3	2021	3	2021
Imaging Buoy PiersideTest		2	2022	2	2022
Imaging Buoy Transition to Imaging		3	2022	3	2022
RCS Treatment Development		1	2017	1	2017
RCS Treatment Testing		2	2018	2	2018
RCS Treatment Transition to Imaging		4	2018	4	2018
System For Non-Acoustic Control of Signatures (SNACS - FNC, FY18 Jump Start)		2	2018	2	2018

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	Start		End	
Events by Sub Project	Quarter	Year	Quarter	Year
SNACS FY19 FNC Start	1	2018	1	2018
SNACS transition to Imaging	4	2023	4	2023
PA Electromagnetic Spectrum Sensor System Simulation & Dev for Model - Based Mission Planning Test	3	2019	3	2019
PA Electromagnetic Spectrum Sensor System Simulation & Dev for Model - Based Mission Planning Test #2	2	2020	1	2023
PA Electromagnetic Spectrum Sensor System Simulation & Dev for Model - Based Mission Planning Transition to Imaging	4	2020	1	2023
Electronic Warfare Advanced Development: Tech Insertions (APB17/19) Enhanced DelInterleavers Pierside/MTV Test	1	2017	1	2017
Electronic Warfare Advanced Development: Tech Insertions (APB17/19) Enhanced DelInterleavers Lab Test	1	2018	1	2018
Electronic Warfare Advanced Development: Tech Insertions (APB17/19) Enhanced DelInterleavers - Transition to EW	2	2018	2	2018
Electronic Warfare Advanced Development: Digital Early Warning Receiver (EWR) Lab Test	4	2019	4	2019
Electronic Warfare Advanced Development: Digital Early Warning Receiver (EWR) Transition to EW	1	2020	1	2020
Electronic Warfare Advanced Development: Extremely Wideband Digital Receiver Lab Test	4	2019	4	2019
Electronic Warfare Advanced Development: Extremely Wideband Digital Receiver Transition to EW	1	2020	1	2020
Electronic Warfare Advanced Development: EW Digital Direction Finding Lab Test #1	2	2017	2	2017
Electronic Warfare Advanced Development: EW Digital Direction Finding Lab Test #2	3	2018	3	2018
Electronic Warfare Advanced Development: EW Digital Direction Finding Transition to EW	4	2018	4	2018
Electronic Warfare Advanced Development: HMI Lab Demo	2	2017	2	2017
Electronic Warfare Advanced Development: HMI Lab Demo #2	1	2018	1	2018

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	Start		End	
Events by Sub Project	Quarter	Year	Quarter	Year
Electronic Warfare Advanced Development: HMI Transition to EW	2	2018	2	2018
Electronic Warfare Advanced Development: Technical Insertions (TI-18) LPI DF / Localization Pierside/MTV Test	1	2017	1	2017
Electronic Warfare Advanced Development: Technical Insertions (TI-18) LPI DF / Localization Lab Test #2	1	2018	1	2018
Electronic Warfare Advanced Development: Technical Insertions (TI-18) LPI DF / Localization Transition to EW	3	2018	3	2018
Electronic Warfare Advanced Development: Solid State RADAR Emitter Identification Development	4	2017	4	2017
Electronic Warfare Advanced Development: Solid State RADAR Emitter Identification Lab Test	4	2019	4	2019
Electronic Warfare Advanced Development: Solid State RADAR Emitter Identification Lab Test #2	4	2020	4	2020
Electronic Warfare Advanced Development: Solid State RADAR Emitter Identification - Transition to EW	1	2021	1	2021
Electronic Warfare Advanced Development: Large Time Bandwidth Receiver Lab Test	2	2018	2	2018
Electronic Warfare Advanced Development: Large Time Bandwidth Receiver - Transition to EW	3	2018	3	2018
Electronic Warfare Advanced Development: DISARMER Lab Test	1	2019	1	2019
Electronic Warfare Advanced Development: DISARMER - transition to EW	2	2019	2	2019
Electronic Warfare Advanced Development: RFOF Submarine Mast Integration Lab Demo	2	2018	2	2018
Electronic Warfare Advanced Development: RFOF Submarine Mast Integration - Transition to EW	4	2018	4	2018
Electronic Warfare Advanced Development: Tunable Optical Filters for Radio Frequency (RF) Photonic Signal Distribution Systems	1	2019	1	2019
Electronic Warfare Advanced Development: Tunable Optical Filters for Radio Frequency (RF) Photonic Signal Distributions System Lab Test	4	2020	4	2020

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	Start		End	
Events by Sub Project	Quarter	Year	Quarter	Year
Electronic Warfare Advanced Development: Tunable Optical Filters for Radio Frequency (RF) Photonic Signal Distribution Systems Lab Test #2	4	2021	4	2021
Electronic Warfare Advanced Development: Tunable Optical Filters for Radio Frequency (RF) Photonic Signal Distribution Systems - Transition to EW	1	2022	1	2022
Electronic Warfare Advanced Development: Next Generation SIGINT Processing Infrastructure High Speed Backbone Lab Test	3	2018	3	2018
Electronic Warfare Advanced Development: Next Generation SIGINT Processing Infrastructure High Speed Backbone - Transition to EW	4	2018	4	2018
Electronic Warfare Advanced Development: Data Transmission using Visible Light Comms(VLC) for Undersea Platforms	1	2019	1	2019
Electronic Warfare Advanced Development: Data Transmission using Visible Light Comms (VLC) for Undersea Platforms Lab Test	4	2020	1	2023
Electronic Warfare Advanced Development: Data Transmission using Visible Light Comms (VLC) for Undersea Platforms Lab Test #2	4	2021	4	2021
Electronic Warfare Advanced Development: Data Transmission using Visible Light Comms (VLC) for Undersea Platforms - Transition to EW	1	2022	1	2022
Electronic Warfare Advanced Development: Ruggedized High Speed Optical Fiber Network Connector Interfaces for NEXGEN EW	1	2019	1	2019
Electronic Warfare Advanced Development: Ruggedized High Speed Optical Fiber Network Connector Interfaces for NEXGEN EW Lab Test	4	2020	4	2020
Electronic Warfare Advanced Development: Ruggedized High Speed Optical Fiber Network Connector Interfaces for NEXGEN EW Lab Test #2	4	2021	4	2021
Electronic Warfare Advanced Development: Ruggedized High Speed Optical Fiber Network Connector Interfaces for NEXGEN EW - Transitions to EW	1	2022	1	2022
Electronic Warfare Advanced Development: TI-22 Disposable Buoys Modular Expendable Decoy Buoy Enhancement - Lab Test	4	2019	4	2019
Electronic Warfare Advanced Development: TI-22 Disposable Buoys Modular Expendable Decoy Buoy Enhancement - Transition to EW	1	2020	1	2020

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Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy			Date: February 2018	
Appropriation/Budget Activity 1319 / 4	R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys		Project (Number/Name) 0770 / Adv Sub Supp Equip Prog	
	Start		End	
Events by Sub Project	Quarter	Year	Quarter	Year
Electronic Warfare Advanced Development: TI-22 Disposable Buoys Modular Expendable ISR Buoy Lab Test	4	2019	4	2019
Electronic Warfare Advanced Development: TI-22 Disposable Buoys Modular Expendable ISR Buoy Transition to EW	1	2020	1	2020
Electronic Warfare Advanced Development: TI-22 Disposable Buoys Sub Launched Decoy Speed to Fleet Lab Test	4	2019	4	2019
Electronic Warfare Advanced Development: TI-22 Disposable Buoys Sub Launched Decoy Speed to Fleet Transition to EW	1	2020	1	2020
Electronic Warfare Advanced Development: TI Tethered Buoys Modular Tethered Antennas and RF Over Fiber Lab Test	4	2019	4	2019
Electronic Warfare Advanced Development: TI Tethered Buoys Modular Tethered Antennas and RF Over Fiber Transition to EW	1	2020	1	2020
Electronic Warfare Advanced Development: Technical Insertions Precision DF Lab Test	2	2017	2	2017
Electronic Warfare Advanced Development: Technical Insertions Precision DF Lab Test #2	3	2018	3	2018
Electronic Warfare Advanced Development: Technical Insertions Precision DF Transition to EW	4	2018	4	2018
Electronic Warfare Advanced Development: Technical Insertions Multifunction Apertures Lab Test	3	2019	3	2019
Electronic Warfare Advanced Development: Technical Insertions Multifunction Apertures Transition to EW	4	2019	4	2019
Electronic Warfare Advanced Development: Micro Adaptive Training	1	2019	1	2019
Electronic Warfare Advanced Development: Micro Adaptive Training Lab Test	4	2020	4	2020
Electronic Warfare Advanced Development: Micro Adaptive Training Transition to EW	1	2022	1	2022
Electronic Warfare Advanced Development: Mast Antenna Coupler	1	2019	1	2019
Electronic Warfare Advanced Development: Mast Antenna Coupler Lab Test	4	2020	4	2020
Electronic Warfare Advanced Development: Mast Antenna Coupler Lab Test #2	4	2021	4	2021

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Exhibit R-4A, RDT&E Schedule Details: PB 2019 Navy			Date: February 2018	
Appropriation/Budget Activity 1319 / 4		R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys		Project (Number/Name) 0770 / Adv Sub Supp Equip Prog
		Start		End
Events by Sub Project		Quarter	Year	Quarter Year
Electronic Warfare Advanced Development: Mast Antenna Coupler Transition to EW		1	2022	1 2022



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Exhibit R-2A, RDT&E Project Justification: PB 2019 Navy										Date: February 2018		
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys				Project (Number/Name) 1739 / Submarine Arctic W/F Development			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
1739: Submarine Arctic W/F Development	56.547	4.184	9.679	5.067	-	5.067	6.642	6.774	8.499	7.054	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.

Increase in funding from FY 2017 to FY 2018 is driven by the requirement to fund the major TACDEV/TORPEX ICEX events planned in FY 2018, which necessitate additional aviation, personnel, logistics, and torpedo recovery resources than those required for a non-firing (TACDEV only) ICEX event. There are no major TACDEV/TORPEX ICEX events planned in FY 2019. Increase in funding in FY 2019, as compared to FY 2017, is driven by the additional need to conduct Arctic operations to support ice camp equipment evaluation, systems development, and extreme cold weather training, as well as the need to perform drifting sea ice analysis required to improve drifting sea ice camp Arctic operations.

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

	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
<b>Title:</b> Conduct ICEX and Arctic Transit Mission, ICEX Workup and Training, Ice Camps	4.184	9.679	5.067	0.000	5.067
<b>Articles:</b>	-	-	-	-	-
<b>FY 2018 Plans:</b> Conduct Arctic work-up training, ICEX mission 1-2018, and Ice Camp 1-2018.  Conduct ICEX 2018 as a TACDEV and TORPEX event. Operate a submarine and torpedo tracking range for approximately 14 days, conduct diver recovery of EXTORPs trapped under-ice, helicopter recover to Ice Camp, backhaul and conduct end or run analysis with on-ice support, return airlift EXTORPs from the Ice Camp back to shore for flushing and return ground transport from Alaska back to Naval Undersea Warfare Center (NUWC), Newport, RI. 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.					
<b>FY 2019 Base Plans:</b>					

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2019 Navy			<b>Date:</b> February 2018			
<b>Appropriation/Budget Activity</b> 1319 / 4		<b>R-1 Program Element (Number/Name)</b> PE 0603562N / <i>Submarine Tactical Warfare Sys</i>		<b>Project (Number/Name)</b> 1739 / <i>Submarine Arctic W/F Development</i>		
<b>B. Accomplishments/Planned Programs (\$ in Millions, Article Quantities in Each)</b>						
		<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019 Base</b>	<b>FY 2019 OCO</b>	<b>FY 2019 Total</b>
<p>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. Conduct Arctic operations to support ice camp equipment evaluation, systems development, and extreme cold weather training, and also perform drifting sea ice analysis required to improve drifting sea ice camp Arctic operations. Support testing and tactical development required to improve submarine Arctic operability and warfighting. Initiate planning, logistics support, procurement, and preparation for ICEX mission 2020 and Ice Camp 2020.</p> <p><b>FY 2019 OCO Plans:</b> N/A</p> <p><b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> The FY 2019 decrease is due to the completion of the major TORPEX/TACDEV event in FY 2018. ICEX is conducted on a biennial basis with the off year used to initiate planning, logistics support, procurement, and preparation for the following year's ICEX mission.</p>						
<b>Accomplishments/Planned Programs Subtotals</b>		4.184	9.679	5.067	0.000	5.067
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A						
<b>Remarks</b>						
<b>D. Acquisition Strategy</b>						
<ul style="list-style-type: none"> <li>- Use NAVSEA University Affiliated Research Center (UARC) omnibus contract for procurement of an acoustic tracking range service and equipment to support ICEX Ice Camps.</li> <li>- Use sole source and competitively awarded contracts through the U.S. Army Corps of Engineers (USACE) Alaska regional office for ICEX Ice Camp logistics, engineering, and operations support.</li> <li>- Use sole source and competitively awarded contracts through the Fleet Logistics Center (FLC) regional contracting office and Defense Logistics Agency (DLA) for equipment procurement and technical services.</li> </ul>						
<b>E. Performance Metrics</b>						
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 2019 Navy												Date: February 2018			
Appropriation/Budget Activity 1319 / 4						R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys				Project (Number/Name) 1739 / Submarine Arctic W/F Development					
Test and Evaluation (\$ in Millions)				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 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
Developmental Test & Evaluation	WR	COMSUBLANT : VA	2.563	2.694	Oct 2016	4.107	Oct 2017	2.856	Oct 2018	-		2.856	Continuing	Continuing	Continuing
Developmental Test & Evaluation	WR	COMSUBPAC : CA	36.101	0.000		0.000		0.000		-		0.000	0.000	36.101	-
Developmental Test & Evaluation	WR	NUWC/Newport : RI	0.235	0.000		1.570	Oct 2017	0.000		-		0.000	0.000	1.805	-
Developmental Test & Evaluation	C/CPFF	UT/ARL : TX	1.394	0.040	Jul 2017	0.000		0.050	Dec 2018	-		0.050	0.000	1.484	Continuing
Developmental Test & Evaluation	MIPR	USACE : AK	0.000	0.852	Dec 2016	1.198	Dec 2017	1.358	Dec 2018	-		1.358	0.000	3.408	-
Developmental Test & Evaluation	MIPR	USTRANSCOM : IL	0.000	0.110	Jan 2017	2.100	Dec 2017	0.247	Dec 2018	-		0.247	0.000	2.457	-
Developmental Test & Evaluation	C/CPFF	UW/APL : WA	14.755	0.428	Jul 2017	0.644	Dec 2017	0.496	Dec 2018	-		0.496	Continuing	Continuing	Continuing
Subtotal			55.048	4.124		9.619		5.007		-		5.007	Continuing	Continuing	N/A
Management Services (\$ in Millions)				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 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
Program Management Support	C/CPAF	EG&G : VA	0.311	0.000		0.000		0.000		-		0.000	0.000	0.311	-
Program Management Support	C/CPAF	BAE SYSTEMS : MD	1.088	0.000		0.000		0.000		-		0.000	0.000	1.088	-
Program Management Support	C/CPIF	TMB : DC	0.060	0.060	May 2017	0.060	Feb 2018	0.060	Dec 2018	-		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	-
Subtotal			1.499	0.060		0.060		0.060		-		0.060	Continuing	Continuing	N/A

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Exhibit R-3, RDT&E Project Cost Analysis: PB 2019 Navy											Date: February 2018				
Appropriation/Budget Activity 1319 / 4					R-1 Program Element (Number/Name) PE 0603562N / Submarine Tactical Warfare Sys					Project (Number/Name) 1739 / Submarine Arctic W/F Development					
			Prior Years	FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals			56.547	4.184		9.679		5.067		-		5.067	Continuing	Continuing	N/A

Remarks

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

**Date:** February 2018

**Appropriation/Budget Activity**

1319 / 4

**R-1 Program Element (Number/Name)**

PE 0603562N / Submarine Tactical Warfare Sys

**Project (Number/Name)**

1739 / Submarine Arctic W/F Development

	FY 2017				FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023			
Project 1739	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
ICEX Missions	ICEX 2018 Planning				ICEX 2018 Analysis/ Reporting				ICEX 2020 Planning				ICEX 2020 Analysis/ Reporting				ICEX 2022 Planning				ICEX 2022 Analysis/ Reporting				ICEX 2024 Planning			
Ice Camps (Arctic Ocean)																												
Arctic Workup (at sea)																												
Arctic Training																												
Arctic Deployment (at sea)																												
Arctic Transit Mission (at sea)																												

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2019 Navy			<b>Date:</b> February 2018
<b>Appropriation/Budget Activity</b> 1319 / 4	<b>R-1 Program Element (Number/Name)</b> PE 0603562N / <i>Submarine Tactical Warfare Sys</i>	<b>Project (Number/Name)</b> 1739 / <i>Submarine Arctic W/F Development</i>	

**Schedule Details**

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b>Proj 1739</b>				
ICEX Missions: ICEX Mission 2018 (TACDEV / TORPEX) Planning/Logistics	1	2017	1	2018
ICEX Missions: ICEX Mission 2018 (TACDEV / TORPEX)	2	2018	2	2018
ICEX Missions: ICEX Mission 2018 (TACDEV / TORPEX) Post-ICEX Analysis/Reporting	3	2018	4	2018
ICEX Missions: ICEX Mission 2020 (TACDEV) Planning/Logistics	1	2019	1	2020
ICEX Missions: ICEX Mission 2020 (TACDEV)	2	2020	2	2020
ICEX Missions: ICEX Mission 2020 (TACDEV) Post-ICEX Analysis/Reporting	3	2020	4	2020
ICEX Missions: ICEX Mission 2022 (TACDEV / TORPEX) Planning/Logistics	1	2021	1	2022
ICEX Missions: ICEX Mission 2022 (TACDEV / TORPEX)	2	2022	2	2022
ICEX Missions: ICEX Mission 2022 (TACDEV / TORPEX) Post-ICEX Analysis/Reporting	3	2022	4	2022
ICEX Missions: ICEX Mission 2024 (TACDEV) Planning/Logistics	1	2023	4	2023
Ice Camps (Arctic Ocean): Ice Camp (Arctic Ocean) 2018	1	2018	3	2018
Ice Camps (Arctic Ocean): Ice Camp (Arctic Ocean) 2020	1	2020	3	2020
Ice Camps (Arctic Ocean): Ice Camp (Arctic Ocean) 2022	1	2022	3	2022
Arctic Workup (At Sea): Arctic Workup (At Sea)	1	2017	4	2023
Arctic Training: Arctic Training	1	2017	4	2023
Arctic Deployment (At Sea): Submarine Deployment as required by the Submarine Type Commander	1	2017	4	2023
Arctic Transit Mission (At Sea): Arctic Transit Mission (At Sea)	1	2017	4	2023