Exhibit R-2, RDT&E Budget Item Justification: FY 2018 Navy												Date: May 2017
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 5: *System Development & Demonstration (SDD)*					R-1 Program Element (Number/Name) PE 0604580N *I (U)Virginia Payload Module (VPM)*							
COST ($ in Millions)	**Prior Years**	**FY 2016**	**FY 2017**	**FY 2018 Base**	**FY 2018 OCO**	**FY 2018 Total**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**Cost To Complete**	**Total Cost**
Total Program Element	163.505	162.168	97.920	72.861	-	72.861	0.000	0.000	0.000	0.000	0.000	496.454
4500: *VIRGINIA Payload Module*	163.505	162.168	97.920	72.861	-	72.861	0.000	0.000	0.000	0.000	0.000	496.454
Program MDAP/MAIS Code: **Project MDAP/MAIS Code(s):** 516												

Note

1. Detailed design funding for this project transitions to SCN (BLI: 2013) beginning in FY17 to support VPM production beginning in FY19.

A. Mission Description and Budget Item Justification

The U.S. Navy must maintain a submarine fleet that is of sufficient capability and numbers to defend American interests. The VIRGINIA Class Submarine, formerly the New Attack Submarine (New SSN), is designed to fulfill this need. It will counter the potential threats of the next century in a multi- mission capable submarine that has the ability to provide covert, sustained combat presence in denied waters. The primary goal of the program is to develop an affordable yet capable submarine by evaluating a broad range of system and technology alternatives, and pursuing cost reduction, producibility improvement, and technical risk management. This Program Element (PE) provides the technology, prototype components, and systems engineering needed to design and construct the VIRGINIA Payload Module (VPM). VPM mitigates and will recapitalize the conventional TOMAHAWK Land Attack Missile (TLAM) gap created by the retirement of SSGNs in the late 2020s while maintaining current platform requirements. This PE directly supports the following VIRGINIA Class Submarine missions: (1) covert strike warfare; (2) anti-submarine warfare; (3) covert intelligence collection/surveillance, indication and warning, and electronic warfare; (4) anti-surface ship warfare; (5) special warfare; (6) mine warfare; and (7) battle group support.

B. Program Change Summary ($ in Millions)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Previous President's Budget	167.719	97.920	72.165	-	72.165
Current President's Budget	162.168	97.920	72.861	-	72.861
Total Adjustments	-5.551	0.000	0.696	-	0.696
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-5.551	0.000			
• Rate/Misc Adjustments	0.000	0.000	0.696	-	0.696

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy			Date: May 2017
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604580N / *(U)Virginia Payload Module (VPM)*	Project (Number/Name) 4500 / *VIRGINIA Payload Module*	

COST ($ in Millions)	Prior Years	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
4500: *VIRGINIA Payload Module*	163.505	162.168	97.920	72.861	-	72.861	0.000	0.000	0.000	0.000	0.000	496.454
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

Project MDAP/MAIS Code: 516

A. Mission Description and Budget Item Justification

This project encompasses Navy RDT&E efforts required to incorporate a modular design for future VIRGINIA Class Submarines (VCS) which integrates additional strike payload capacity for Tomahawk Land Attack and follow on missiles. The design is targeted for VCS Block V (FY19-23 ships).

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
Title: Non-Propulsion Electronics System (NPES) Engineering	24.366	15.123	12.700	0.000	12.700
Articles:	-	-	-	-	-
FY 2016 Accomplishments: Continued development of VPM system launch control and integration with existing VIRGINIA Class combat systems. Integrated and automated launch processes to enable efficient launch of payloads. Assessed launcher electronics and software design to support rapid, low cost integration and testing of payloads. Reduced overall launch electronics weight and footprint, and provided increased unit space for future payload electronics. Products include specifications, systems diagrams, arrangements, implementation of Advanced Message Queuing Protocol (AMQP) to VPM network (Common Object Request Broker Architecture (CORBA) technology replacement), next generation TOMAHAWK (replaces TLAM BLK IV), implementation of new TOMAHAWK Control System (PMA280 software), implementation of TTWCS 5.6 supporting TOMAHAWK cell tasking vice tube tasking. Electric Boat (EB) will be assembling Functional Qualification Testing (FQT) and Software Qualification Testing (SQT) for Engineering Development Model (EDM). Software Readiness Review and Preliminary Design Review (TI16/APB15) completed to support EDM SQT. All EDM components have been ordered, all EDMs will be delivered by the end of CY2017. All Program Acquisition Resource Managers (PARM) (NUWC NPT, PMA280, 281, PMS425, and EB) will be conducting software prototype drops with fleet operators quarterly through FY16 and 17, in addition to an OPEX (operational exercise of the prototype) being completed every six months.					
FY 2017 Plans: Complete Critical Design Review for TI16/APB15 VPM SQT baseline to support continued development of VPM system launch control and integration with existing VIRGINIA Class combat systems. Integrate and automate launch processes to enable efficient launch of payloads. Assess launcher electronics and software					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604580N / *(U)Virginia Payload Module (VPM)*	**Project (Number/Name)** 4500 / *VIRGINIA Payload Module*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
design to support rapid, low cost integration and testing of payloads. Assemble and deliver all EDM units (April - December 2017), complete FQT and SQT at delivery. Complete initial VPM Common Weapon Launcher (CWL) FQT, VPM Network Input/Output Unit (NIOU) FQT, and Payload Tube Control Panel (PTCP) FQT. Complete integrated VPM weapon launch sysem SQT. Submit VPM CWL Shock and EQT Test Plan for NAVSEA approval to support FY18 test efforts. Complete Formal Weapon System Test Plans and Test Procedures to support FY18 test efforts. Products include specifications and systems diagrams. Continue with implementation of AMQP to VPM network (CORBA technology replacement), next generation TOMAHAWK (replaces TLAM BLK IV), implementation of new TOMAHAWK Control System (PMA280 software), implementation of TTWCS 5.6 supporting TOMAHAWK cell tasking vice tube tasking. All PARMS (NUWC NPT, PMA280, 281, PMS425, and EB) will be conducting software prototype drops (TTWCS Decision Aid, Multi-tube cell preparations/automation, automation of weapon casualties, Electronic OD44979 procedures, TTWCS Touch and Go Displays) with fleet operators quarterly through FY17 and FY18, in addition to an OPEX (operational exercise of the prototype) being completed every six months. ***FY 2018 Base Plans:*** Formal Environmental Qualification Test (EQT) of the new Common Weapons Launcher (CWL) electronics and support structure will take place, including full shock test. TOMAHAWK missile electrical characteristic and interface requirements verification testing will commence, necessary to validate accurate power and navigation data inputs. Combat system interface and fail-over modes will be tested to confirm proper SWFTS interoperability. And various fleet operator concept of operations demonstrations will take place to support development of operator training and maintenance procedures. ***FY 2018 OCO Plans:*** N/A					
Title: Hull, Mechanical, and Electrical (HM&E) Systems Engineering	137.802	82.797	60.161	0.000	60.161
Articles:	-	-	-	-	-
FY 2016 Accomplishments: Continued design efforts for the VPM including integration to existing hull structure, hydrodynamic assessments, hydraulic system design, tube control interface, and internal arrangements to accommodate hardware, electronics and personnel. Project executed VPM Integrated Master Schedule (IMS) and Manufacturing Plans, and designed the casting and forging prototype patterns for the Integrated Tube and Hull (ITH), and prototype forging pattern for the Integrated Tube and Keel (ITK) designs. Poured ITH Castings and began their destructive testing. Developed final ITH and ITK casting and forging patterns, and started payload tube proto-tactical					

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604580N / *(U)Virginia Payload Module (VPM)*	**Project (Number/Name)** 4500 / *VIRGINIA Payload Module*

B. Accomplishments/Planned Programs ($ in Millions, Article Quantities in Each)	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total
construction. Began prototypical production of increased capacity air condition plant. Completed all VPM ship specifications and system description documents, and began the development of plug design arrangements and host ship arrangements. Type of products completed included specifications, requested diagram changes (RDC), system diagrams, arrangements, system description documents, design disclosures long lead time components and payload tube prototype. ***FY 2017 Plans:*** Continue design efforts for the VPM including integration to existing hull structure, hydrodynamic assessments, hydraulic system design, tube control interface, and internal arrangements to accommodate hardware, electronics and personnel. Forge the first tactical ITH and ITK through completion and cast first tactical ITH and begin machining. Continue production of prototypical increased capacity air conditioning plant. Continue executing VPM Integrated Master Schedule (IMS) and Manufacturing Plans. Continue payload tube proto-tactical construction. Complete system diagrams and continue development of technical products including design disclosures, requested diagram changes, and plug design arrangements and base ship arrangements. Continue design disclosures, RDCs, arrangements, long lead time components and payload tube prototype. ***FY 2018 Base Plans:*** Continue design efforts for the VPM including integration to existing hull structure, hydrodynamic assessments, hydraulic system design, tube control interface, and internal arrangements to accommodate hardware, electronics and personnel. Continue executing Integrated Master Schedule (IMS) and Manufacturing Plans. Continue payload tube proto-tactical construction and receipt of ITHs and ITKs. Complete prototypical larger capacity Air Conditioning plant and qualify plant for capacity and noise; begin production of first prototype unit Air Conditioning plant. Complete payload tube prototype. ***FY 2018 OCO Plans:*** N/A					
Accomplishments/Planned Programs Subtotals	162.168	97.920	72.861	0.000	72.861

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
• SCN/2013: *VIRGINIA Class Submarine*	5,318.210	4,955.219	5,225.911	-	5,225.911	7,181.369	7,209.343	6,534.775	5,263.896	48,161.837	150,856.478

Exhibit R-2A, RDT&E Project Justification: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604580N / *(U)Virginia Payload Module (VPM)*	**Project (Number/Name)** 4500 / *VIRGINIA Payload Module*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2016	FY 2017	FY 2018 Base	FY 2018 OCO	FY 2018 Total	FY 2019	FY 2020	FY 2021	FY 2022	Cost To Complete	Total Cost
• OPN/0942: *Virginia Class Support Equipment*	35.747	66.838	46.610	-	46.610	68.388	29.751	24.422	24.103	Continuing	Continuing
• OMN/1B2B: *Ship Operational Support and Training*	5,318.210	4,955.219	5,225.911	-	5,225.911	7,181.369	7,209.343	6,534.775	5,263.896	0.000	102,694.641
• RDT&E/0604558N/1947: *New Design SSN HM&E*	76.040	83.586	82.506	-	82.506	58.059	43.711	48.906	49.793	Continuing	Continuing
• RDT&E/0604558N/1950: *New Design SSN Combat Sys Dev*	30.667	26.977	34.913	-	34.913	39.342	36.348	37.088	37.823	Continuing	Continuing

Remarks

D. Acquisition Strategy

The VIRGINIA Class Submarine Program has implemented Integrated Product and Process Development (IPPD). The traditional distinct phasing of the design process has been replaced with the continuous concurrent engineering IPPD process. The IPPD approach has facilitated a smoother transition from design to manufacturing and has reduced the number of changes typically encountered during construction of the lead and early follow-on ships. In September 1997, Congress passed a law allowing Electric Boat (EB) and Northrop Grumman Newport News (NGNN), now Huntington Ingalls Industries (HII), to team for production of the first four VIRGINIA Class Submarines. Under the teaming agreement, EB remained the design yard for the VIRGINIA Class Submarine and HII became a part of the IPPD process. The Program Office is managing two Multi-Year Procurement (MYP) contracts. The first is for the Block III (FY09-13) ships. The second is for the Block IV (FY14-18) ships awarded April 2014. All Block I & II ships (SSNs 774-783) have been delivered. The first two Block III ships, SSN 784 and SSN 785, delivered in August 2014 and June 2015 respectively, with the remaining six ships awarded and under construction. The first six Block IV ships are awarded and under construction, with the remaining four to be authorized and appropriated in FY 2017 and FY 2018. Developmental efforts began in FY13 and will be executed via current Lead Design Yard Agent contract with Electric Boat. The program is currently planning for the fourth MYP (Block V) contract that will reflect 10 SSNs (FY19-23) and is anticipated to award in Early FY 2019.

E. Performance Metrics

Preliminary Design Review
Critical Design Review

Exhibit R-3, RDT&E Project Cost Analysis: FY 2018 Navy			Date: May 2017
Appropriation/Budget Activity 1319 / 5	R-1 Program Element (Number/Name) PE 0604580N / *(U)Virginia Payload Module (VPM)*	Project (Number/Name) 4500 / *VIRGINIA Payload Module*	

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Component Development	WR	NSWC : Carderock, MD	22.892	15.674	Nov 2015	11.200	Nov 2016	2.246	Nov 2017	-		2.246	15.815	67.827	-
Component Development	WR	NUWC : Newport, RI	14.634	7.647	Nov 2015	7.500	Nov 2016	1.853	Nov 2017	-		1.853	20.538	52.172	-
Component Development	C/CPFF	Electric Boat : Groton, CT	118.479	131.597	Nov 2015	70.720	Nov 2016	63.094	Nov 2017	-		63.094	132.370	516.260	-
Component Development	C/CPFF	GD-AIS : Pittsfield, MA	7.000	7.000	Nov 2015	5.600	Jan 2017	4.975	Jan 2018	-		4.975	0.000	24.575	-
Component Development	WR	PMA 280/281 : Pax River, MD	0.000	0.000		2.700	Jan 2017	0.000	Jan 2018	-		0.000	0.000	2.700	-
Component Development	SS/CPFF	ARL/PSU : UNIVERSITY PARK, PA	0.000	0.000		0.200	Jan 2017	0.000	Jan 2018	-		0.000	0.000	0.200	-
Component Development	WR	NSWC : Philadelphia, PA	0.000	0.000		0.000		0.287	Nov 2017	-		0.287	0.000	0.287	-
Component Development	C/CPFF	Raytheon : Tuscon, AZ	0.000	0.000		0.000		0.406	Jan 2018	-		0.406	0.000	0.406	-
		Subtotal	163.005	161.918		97.920		72.861		-		72.861	168.723	664.427	-

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2016 Cost	FY 2016 Award Date	FY 2017 Cost	FY 2017 Award Date	FY 2018 Base Cost	FY 2018 Base Award Date	FY 2018 OCO Cost	FY 2018 OCO Award Date	FY 2018 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Contractor Engineering Support	C/CPAF	SEAPORT : Rockville, MD	0.500	0.250	Nov 2015	0.000		0.000		-		0.000	0.500	1.250	-
		Subtotal	0.500	0.250		0.000		0.000		-		0.000	0.500	1.250	-

	Prior Years	FY 2016		FY 2017		FY 2018 Base		FY 2018 OCO		FY 2018 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	163.505	162.168		97.920		72.861		-		72.861	169.223	665.677	-

Remarks

Exhibit R-4, RDT&E Schedule Profile: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604580N / *(U)Virginia Payload Module (VPM)*	**Project (Number/Name)** 4500 / *VIRGINIA Payload Module*

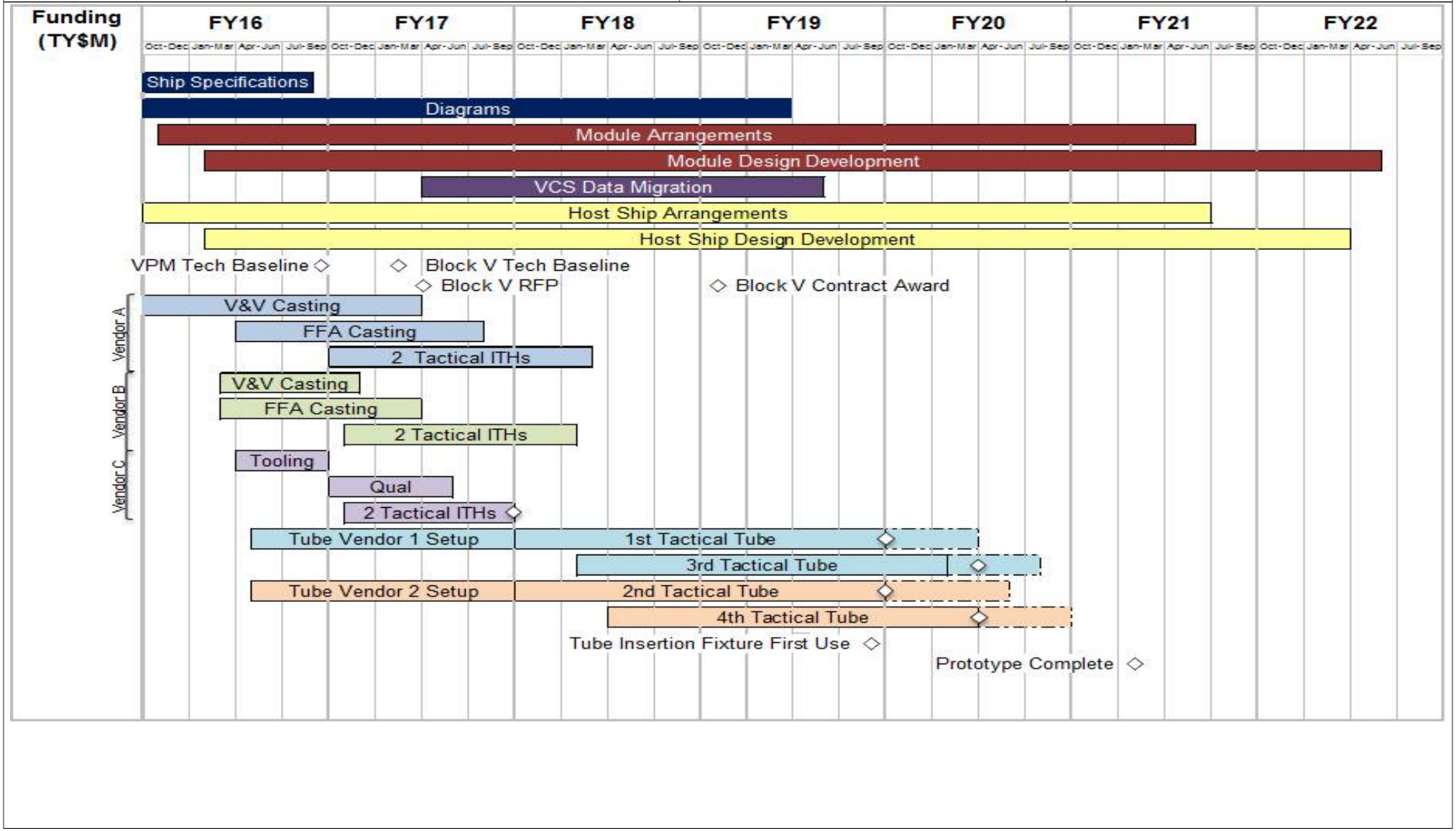

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604580N / *(U)Virginia Payload Module (VPM)*	**Project (Number/Name)** 4500 / *VIRGINIA Payload Module*

Schedule Details

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Proj 4500				
Ship Specifications	1	2016	4	2016
Diagrams	1	2016	2	2019
Module Arrangements	1	2016	3	2021
Module Design Development	2	2016	3	2022
VCS Data Migration	3	2017	3	2019
Host Ship Arrangements	1	2016	3	2021
Host Ship Design Development	2	2016	2	2022
VPM Tech Baseline	4	2016	4	2016
Block V Tech Baseline	2	2017	2	2017
Block V RFP	3	2017	3	2017
Block V Contract Award	1	2019	1	2019
Vendor A V&V Casting	1	2016	2	2017
Vendor A FFA Casting	3	2016	4	2017
Vendor A Two Tactical ITHs	1	2017	2	2018
Vendor B V&V Casting	2	2016	1	2017
Vendor B FFA Casting	2	2016	2	2017
Vendor B Two Tactical ITHs	1	2017	2	2018
Vendor C Tooling	3	2016	4	2022
Vendor C Qual	1	2017	3	2017
Tube Vendor 1 Setup	3	2016	4	2017
Vendor 1 First Tactical Tube	1	2018	2	2020

Exhibit R-4A, RDT&E Schedule Details: FY 2018 Navy		Date: May 2017
Appropriation/Budget Activity 1319 / 5	**R-1 Program Element (Number/Name)** PE 0604580N / *(U)Virginia Payload Module (VPM)*	**Project (Number/Name)** 4500 / *VIRGINIA Payload Module*

	Start		End	
Events by Sub Project	**Quarter**	**Year**	**Quarter**	**Year**
Vendor 1 Third Tactical Tube	2	2018	4	2020
Tube Vendor 2 Setup	3	2016	4	2017
Vendor 2 Second Tactical Tube	1	2018	3	2020
Vendor 2 Fourth Tactical Tube	3	2018	4	2020
Tube Insertion Fixture First Use	4	2019	4	2019
Prototype Complete	2	2021	2	2021