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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 I BA 5: System Development & Demonstration (SDD)</i>	R-1 Program Element (Number/Name) PE 0604580N I (U) <i>Virginia Payload Module (VPM)</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	57.282	106.223	167.719	97.920	-	97.920	72.165	0.000	0.000	0.000	0.000	501.309
4500: <i>VIRGINIA Payload Module</i>	57.282	106.223	167.719	97.920	-	97.920	72.165	0.000	0.000	0.000	0.000	501.309

Program MDAP/MAIS Code: 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)

	<u>FY 2015</u>	<u>FY 2016</u>	<u>FY 2017 Base</u>	<u>FY 2017 OCO</u>	<u>FY 2017 Total</u>
Previous President's Budget	120.602	167.719	100.234	-	100.234
Current President's Budget	106.223	167.719	97.920	-	97.920
Total Adjustments	-14.379	0.000	-2.314	-	-2.314
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-9.999	0.000			
• SBIR/STTR Transfer	-4.380	0.000			
• Program Adjustments	0.000	0.000	4.891	-	4.891
• Rate/Misc Adjustments	0.000	0.000	-7.205	-	-7.205

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<u>Change Summary Explanation</u> The FY 2015 congressional reduction was for SBIR. FY 2015 Reprogramming was an adjustment to the program due to under-execution. FY 2017 program adjustments include a reduction of \$2.109M for under-execution and a \$7M increase to account for rephasing of FY 2015 reprogramming.		

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

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
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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
4500: VIRGINIA Payload Module	57.282	106.223	167.719	97.920	-	97.920	72.165	0.000	0.000	0.000	0.000	501.309
Quantity of RDT&E Articles		-	-	-	-	-	-	-	-	-		

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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
Title: Non-Propulsion Electronics System (NPES) Engineering	18.978	25.200	15.123	0.000	15.123
Articles:	-	-	-	-	-
FY 2015 Accomplishments:					
Continue 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 design to support rapid, low cost integration and testing of payloads. Reduce overall launch electronics weight and footprint, and provide increased unit space for future payload electronics. Products include specifications, systems diagrams, arrangements, implementation of Advanced Message Queuing Protocol (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.					
FY 2016 Plans:					
Continue 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 design to support rapid, low cost integration and testing of payloads. Reduce overall launch electronics weight and footprint, and provide increased unit space for future payload electronics. Products include specifications, systems diagrams, arrangements, implementation of Advanced Message Queuing Protocol (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. EB will be assembling Functional Qualification Testing (FQT) and Software Qualification Testing (SQT) for Engineering Development Model (EDM). All EDM's will be delivered by FY2017. All PARMS (NUWC NPT, PMA280, 281, PMS425, EB) will be doing software					

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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 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total
<p>prototypes drops with fleet operators quarterly through FY16 and 17, in addition to an OPEX (operational exercise of the prototype) being completed every six month.</p> <p>FY 2017 Base Plans: Continue 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 design to support rapid, low cost integration and testing of payloads. Reduce overall launch electronics weight and footprint, and provide increased unit space for future payload electronics. Products include specifications, systems diagrams, arrangements, implementation of Advanced Message Queuing Protocol (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. EB will be assembling Functional Qualification Testing (FQT) and Software Qualification Testing (SQT) for Engineering Development Model (EDM). All EDM's will be delivered by FY2017. All PARMS (NUWC NPT, PMA280, 281, PMS425, EB) will be doing software prototypes drops with fleet operators quarterly through FY16 and 17, in addition to an OPEX (operational exercise of the prototype) being completed every six month.</p> <p>FY 2017 OCO Plans: N/A</p>					
<p>Title: Hull, Mechanical, and Electrical (HM&E) Systems Engineering</p> <p align="right">Articles:</p> <p>FY 2015 Accomplishments: 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. Update Integrated Master Schedule (IMS) and Manufacturing Plans. Design studies to assess all ship characteristics including maneuvering, signature levels, shock survivability, operational impacts, recoverability and life cycle support. Products include specifications, system diagrams, arrangements, technical trade studies, prototype plan, system description documents, develop long lead time components and update requirements matrix.</p> <p>FY 2016 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. Executing Integrated Master Schedule (IMS) and Manufacturing Plans. Design</p>	87.245	142.519	82.797	0.000	82.797
	-	-	-	-	-

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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
Verification and validation Integrated Tube and Hull (ITH) pattern. Pour and destructively test ITH Castings. Develop final ITH pattern. Start payload tube proto-tactical construction. Complete ship specifications and diagrams. Begin development of plug design arrangements and base ship arrangements. Products include specifications, system diagrams, arrangements, system description documents, long lead time components. FY 2017 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. Executing Integrated Master Schedule (IMS) and Manufacturing Plans. Continue payload tube proto-tactical construction. Continue development of plug design arrangements and base ship arrangements. Products include specifications, system diagrams, arrangements, system description documents, long lead time components and payload tube prototype. FY 2017 OCO Plans: N/A					
Accomplishments/Planned Programs Subtotals	106.223	167.719	97.920	0.000	97.920

C. Other Program Funding Summary (\$ in Millions)											
<u>Line Item</u>	<u>FY 2015</u>	<u>FY 2016</u>	<u>FY 2017 Base</u>	<u>FY 2017 OCO</u>	<u>FY 2017 Total</u>	<u>FY 2018</u>	<u>FY 2019</u>	<u>FY 2020</u>	<u>FY 2021</u>	<u>Cost To Complete</u>	<u>Total Cost</u>
• SCN//2013: VIRGINIA Class Submarine	5,832.079	5,340.110	4,999.774	-	4,999.774	4,942.085	6,482.887	6,645.646	4,328.526	0.000	93,770.560
• OPN/0942: VA CL Support Equipment	70.094	35.747	79.412	-	79.412	46.283	71.231	44.390	45.279	Continuing	Continuing
• O&MN/0204283N: Sub Ops & Safety	33.938	31.355	23.828	-	23.828	25.738	27.175	27.731	29.305	Continuing	Continuing
• RDT&E/0604558N: New Design SSN*	85.786	122.556	137.126	-	137.126	149.218	84.132	79.429	89.178	Continuing	Continuing

Remarks
 *Note: RDT&E PE 0604558N contains project 3062: Submarine Multi-Mission Team Trainer which is not funding directly related to the VIRGINIA Class Program.

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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

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 three Multi-Year Procurement (MYP) contracts. The first and second contracts are for the Block II (FY04-08) and Block III (FY09-13) ships. The third contract is for 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 6 ships awarded and under construction. Developmental efforts began in FY13 and will be executed via current Lead Design Yard Agent contract with Electric Boat.

E. Performance Metrics

Preliminary Design Review
Critical Design Review

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

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Product Development (\$ 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			
Component Development	WR	NSWC : Carderock, MD	12.500	10.392	Jan 2015	15.674	Nov 2015	11.200	Nov 2016	-		11.200	15.815	65.581	-
Component Development	WR	NUWC : Newport, RI	11.250	3.384	Jan 2015	7.647	Nov 2015	7.500	Nov 2016	-		7.500	20.538	50.319	-
Component Development	C/CPFF	Electric Boat : Groton, CT	33.282	85.197	Nov 2014	137.148	Nov 2015	70.720	Nov 2016	-		70.720	132.370	458.717	-
Component Development	C/CPFF	GD-AIS : Pittsfield, MA	0.000	7.000	Feb 2015	7.000	Nov 2015	5.600	Jan 2017	-		5.600	0.000	19.600	-
Component Development	WR	PMA 280/281 : Pax River, MD	0.000	0.000		0.000		2.700	Jan 2017	-		2.700	0.000	2.700	-
Component Development	SS/CPFF	ARL/PSU : UNIVERSITY PARK, PA	0.000	0.000		0.000		0.200	Jan 2017	-		0.200	0.000	0.200	-
Subtotal			57.032	105.973		167.469		97.920		-		97.920	168.723	597.117	-

Support (\$ 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			
Contractor Engineering Support	C/CPAF	URS : Rockville, MD	0.250	0.250	Feb 2015	0.250	Nov 2015	0.000		-		0.000	0.500	1.250	-
Subtotal			0.250	0.250		0.250		0.000		-		0.000	0.500	1.250	-

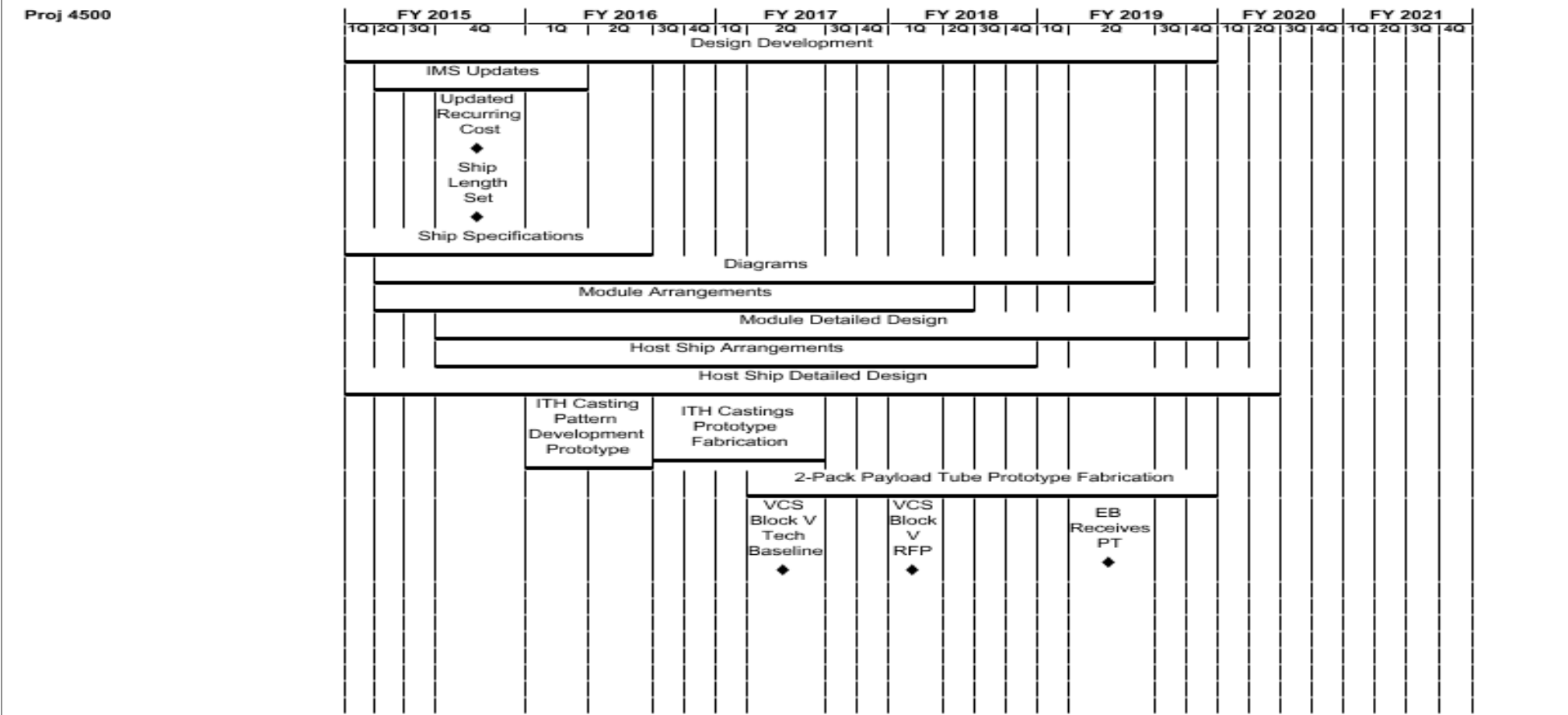
Prior Years	FY 2015	FY 2016	FY 2017 Base	FY 2017 OCO	FY 2017 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	57.282	106.223	167.719	97.920	97.920	169.223	598.367	-

Remarks

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

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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 4500				
Design Development	1	2015	4	2019
IMS Updates	2	2015	1	2016
Updated Recurring Cost	4	2015	4	2015
Ship Length Set	4	2015	4	2015
Ship Specifications	1	2015	2	2016
Diagrams	2	2015	2	2019
Module Arrangements	2	2015	2	2018
Module Design Development	4	2015	1	2020
Host Ship Arrangements	4	2015	4	2018
Host Ship Design Development	1	2015	2	2020
ITH Casting Pattern Development Prototype	1	2016	2	2016
ITH Castings Prototype Fabrication	3	2016	2	2017
2-Pack Payload Tube Prototype Fabrication	2	2017	4	2019
VCS Block V Tech Baseline	2	2017	2	2017
VCS Block V RFP	1	2018	1	2018
EB Receives PT	2	2019	2	2019

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